Watta Satta: Exchange Marriage and Women's Welfare in Rural Pakistan

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Abstract

This paper attempts to understand the pervasive marriage custom of *watta satta* in rural Pakistan, a bride exchange between families coupled with a mutual threat of reciprocity. In a setting where husbands wield considerable coercive power, forms of marriage should adapt to protect the interests of women and their families. We show that *watta satta* may be a mechanism to coordinate 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 support this view. The likelihood of marital inefficiency, as measured by estrangement, domestic abuse, and wife's mental health, is significantly lower in *watta satta* arrangements as compared to conventional marriages, but only after properly accounting for selection.

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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). In traditional societies, where women's formal legal rights are often weak and divorce is highly stigmatized, 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, its ex-ante provisions should 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 as *watta satta* (literally, 'give-take'), usually involves the simultaneous marriage of a brother-sister pair from two households. Remarkably, *watta satta* now accounts for about a third of all marriages in rural Pakistan, and is even more prevalent in parts of Sindh and southern Punjab province.[1] *Watta satta* is more than just an exchange of daughters, however; it also establishes the shadow of mutual threat across the marriages. In this arrangement, a husband who 'mistreats' his wife in certain ways 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; in particular, actions which harm the wife more than they benefit the husband. The idea is that husbands generally have coercive power over their wives, whether through emotional intimidation, the use or threatened use of violence, or the ability to expel her from the household. Actions such as these may, however, permanently destroy some of the marital surplus, either by limiting the gains to future cooperation between the spouses or by bringing disgrace upon the family or families involved. Family honor is particularly susceptible to publicly observable acts, like banishment of the wife to her natal home. Our theoretical argument uses the fact that, when one party in a negotiation can permanently destroy the surplus to be bargained over, and thereby extract a larger share for himself, inefficient equilibria can arise; in other words, threats might actually be carried out. Parents may be willing

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[1]Exchange marriage has also been documented in southern India (**ref?**) and in parts of China (Zhang, 2000), and, at least in the early 20th century, appears to have been common among Hindus in Punjab as well (Rose, 1908).

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. An exchange marriage essentially facilitates coordination between two sets of in-laws.

While our model is unique, there are several linkages to past work. La Ferrara (2003), in the context of credit transactions, shows how the family or kin-group fills the void left by the absence of legally enforceable contracts. Like us, La Ferrara explicitly models the way in which families punish deviations from a particular equilibrium, although the mechanisms are quite distinct in the two cases. 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. A crucial difference from our model, however, is that Zhang and Chan assume that the marital bargaining solution is efficient. By contrast, Bloch and Rao (2002) analyze a specific signalling game with an equilibrium featuring so-called dowry violence. In our model, which is more general, marital discord, including but not limited to domestic abuse, occurs even though there is perfect information about the husband's 'type'.[2] Our main concern is with the institutions that may emerge to deter such inefficiency. In this respect, our work fits into a broader program that seeks to rationalize institutional design in light of commitment failures (see, e.g., North and Weingast, 1989; Greif, 1993).

The key empirical implication of our theory is that, all else equal, surplus-destroying actions are less likely to occur in *watta satta* marriages than in conventional marriages. To test this implication, we have collected a large data set that provides unusual detail on marriage customs and the status of women in rural Pakistan, and, in particular, one which allows us to operationalize the notion of marital inefficiency. It is important to note that the allocation of goods or time within the household may not differ at all between conventional and exchange marriages. Instead, we examine measures of marital discord: estrangement, domestic violence, and the wife's mental health (depression and anxiety).

The main empirical challenge is to deal with systematic selection into exchange marriages. For example, *watta satta* arrangements may tend to be chosen by low status or traditional households, in which women may be treated more poorly on average irrespective of marriage type. If so, *watta satta* might spuriously appear to be detrimental to

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[2]Fernandez and Glazer (1991) were the first to demonstrate that labor strikes and other inefficient outcomes can emerge in bargaining games under complete information. To our knowledge, this idea has never been applied to spousal bargaining before.

women.[3] A similar effect may arise, as the theory itself will suggest, if men who are less averse to intimidation of women select into *watta satta* marriages. Yet, the very nature of the institution offers us a plausible instrument. Exchange marriage opportunities are limited by the presence of age and sex appropriate siblings. A *watta satta* bride normally must have an available brother (although *wattas* can be arranged with uncles and other relatives, brothers are strongly preferred). Moreover, given the preference for grooms to be older than brides, the likelihood that a woman is in a *watta satta* marriage is increasing in the number of older brothers she has relative to total older siblings.[4] The demographic composition of the wife's natal family, particularly the age pattern, is arguably uncorrelated with any of the unobservables that determine her treatment in her husband's family.

Our results indicate that women in *watta satta* marriages have substantially and significantly lower probabilities of marital estrangement and major depressive episodes. The likelihood of any domestic abuse in the marriage is also lower in the case of a *watta satta* arrangement, but this effect is statistically weaker. There is no difference across the forms of marriage in the prevalence of generalized anxiety disorder. None of these salutary effects of exchange marriage, however, emerge unless selection bias is taken into account. In short, we find that the peculiar institution of *watta satta* – a bride exchange coupled with a mutual threat of reciprocity – does appear to protect the welfare of women in rural Pakistan.

Section 2 of the paper begins by describing the incidence of exchange marriage and of marital discord in rural Pakistan. Section 3 presents a model illustrating the potential advantage of a *watta satta* arrangement. Our empirical strategy is described in section 4, followed by the results in section 5. Section 6 summarizes the findings and concludes.

2 Marriage and its Discontents in Rural Pakistan

2.1 Data

The data used throughout this paper are from the second round of the Pakistan Rural Household Survey (PRHS II) undertaken in 2004. The survey covers about 1800 randomly

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[3]Indeed, popular press accounts of *watta satta* in Pakistan often lump it together with other 'undesirable' practices like child-marriage and honor-killings.

[4]While an analogous argument applies to the siblings of the husband (since he must also have an available sister), using demographic composition of the husband's family as an instrument is more suspect, for reasons to be discussed.

sampled households in 94 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 married woman in the household age 15-40, including those divorced or separated from their husbands. The mental health module assesses major depression (MD) and Generalized Anxiety Disorder (GAD), using an instrument adapted from the CIDI-SF survey of the World Health Organization.[5] Given the sensitivity of these topics, women were interviewed in strict privacy by carefully trained female enumerators. As a consequence, response rates were extremely high.

For reasons that will become apparent, households containing sister-in-laws of all currently married women in the base sample were also tracked down and interviewed, provided that they resided in the same village. Given the high degree of village endogamy in rural Pakistan (see below), this is often the case. In total, then, 1649 women were interviewed, 17% of whom were sister-in-laws of other women in the sample.

2.2 *Watta Satta*

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 a *watta satta* marriage as one in which both of the counterpart couples are currently married; otherwise, the reciprocal threats may not yet be, or may be no longer, operative. Almost exactly half of our sample women report that their marriage involved a bride exchange, but in 12% of these cases the counterpart couple was not yet married. In 5% of the remaining *watta satta* cases, the counterpart couple were no longer living together, thus giving an incidence of *watta satta*, strictly defined, of 42%.[6]

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[5] **We thank Dr. xx at xx hospital/university for assistance with the development of the module and the training of the enumerators.**

[6] Even this figure may overstate the prevalence of exchange marriage in rural Pakistan, for two reasons. First, *watta satta* is much more common in Sindh and Punjab than in NWFP and Baluchistan, which are not covered in PRHS-II. According to the PRHS-I survey of 2001, which is nationally representative of rural areas, covering all four provinces, no more than 35% of women are in a *watta satta* marriage (questions about the current status of the counterpart couple's marriage were not asked in that survey).

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The vast majority of *watta satta* marriages (94%) involve at least one brother-sister pair, and most (68%) involve a brother-sister pair on both sides. The second most popular *watta satta* arrangement, but still much less prevalent than brother-sister (15 percent of *wattas* overall), is when at least one of the households contributes an uncle-niece pair. Various other combinations occur as well, but none is very common.

Marriage in rural Pakistan is characterized by a remarkable degree of endogamy. Sixty percent of women in our sample have married men from the same village, and most of the remainder have married within close proximity of their natal village. Even more striking is the extent of marriage within clan and caste. Eighty percent of women in our sample have married a blood relative, mostly first-cousins with a preference for the paternal side.[7] About 10% have married someone unrelated by blood but within the same caste (*zaat/biraderi*), leaving only 10% of marriages that are exogamous with respect to clan and caste. Exchange marriage clearly facilitates endogamy by forging a double union across the same two families, but this does not seem to be the sole motivation for the arrangement in rural Pakistan. In our sample, the incidence of *watta satta* is 47% among women married to a blood relative, 37% among those married to an unrelated member of the same caste, but is still 26% among those having no blood or caste affiliation to their husband.[8]

When asked in the survey whether they would favor their own daughters marrying into a *watta satta* arrangement, 70 percent of current *watta satt*a brides responded strongly in the affirmative, whereas 13 percent said they would strongly disfavor it (see Table 1). By contrast, only 32 percent of non-*watta satta* brides said they would strongly favor the institution for their own daughter, compared to the 41 percent who strongly disfavor. Thus, the majority of women who have actually experienced the institution seem to perceive some advantage to it. To be sure, these responses could reflect ex-post

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The figure for Punjab and Sindh alone in PRHS-I is 43%. Secondly, our sample includes sister-in-laws who would only have been tracked down if they live in the same village as a sampled women. *Watta satta* marriages are somewhat more likely to be village endogamous and hence will be overrepresented in the sister-in-law sub-sample. Among the 'non-sister-in-laws', the rate of *watta satta* marriage is 37%.

[7]Edlund (1999), for one, argues that cousin-marriage may be motivated by the desire to have in-laws of comparable status. Since land is usually divided equally among male heirs in Pakistan, and land confers status in a rural society, paternal cousins would be particularly well-matched in terms of both wealth and status.

[8]Exchange marriage might also serve as a mechanism for cancelling out dowry assets (from a son) and liabilities (from a daughter) in the parental 'balance sheet'. The advantage of marrying ones daughter into ones son's wife's family is that there is no need, in principle, to exchange dowry assets at all. However, in an analysis reported elsewhere (World Bank, 2005), we find no evidence that the value of dowries are lower in *watta satta* marriages, although we do find that the values of *bari* (the substantially smaller transfer from the groom's family to the bride) are significantly lower.

rationalization, although this is belied by other evidence from Table 1 presented in the next subsection.

2.3 Marital Discord

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.[9] Marital estrangement, whether directly initiated by the husband (i.e., banishment) or by the wife (an escape from abuse) is analogous to a labor strike, representing a failure to agree on an allocation of surplus that reduces the total value of the relationship; here due to the loss of family 'honor' more than from the delay in agreement. In our sample, 21% of women report that they had ever returned to their natal home due to an estrangement, yet only a small number of these women (8%) identify themselves as divorced or separated from their husbands. These periods of estrangement are generally short, the modal duration being less than a month.

How is an estrangement dealt with in the context of a *watta satta* arrangement? According to our field interviews, the convention is for the husband in the counterpart marriage to reciprocate by sending his wife back to her natal home [**need quote from qualitative work!**] . To verify that this is in fact the case, we make use of the sister-in-law data. We are able to match 205 sister-in-law pairs, for whom we can check the concordance in responses to the question about estrangement. We would expect a higher concordance among counterparts in a *watta satta* arrangement than among conventional sister-in-laws. Using a simple regression that controls for the difference in the number of years each sister-in-law has been married,[10] we find that estrangement is indeed significantly *more* correlated among *watta satta* sister-in-laws (p-value $= 0.0045$).

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[9]This contrasts with the Indian context studied by Bloch and Rao (2001), in which village exogamy is the norm and a return to the natal household is a much more drastic and, apparently, unlikely course of action.

[10]In particular, 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. Then, our regression is

$$y_i = \theta_0 + \theta_1 y_i^s + \theta_2 WS_i + \theta_3 WS_i y_i^s + \theta_4 \Delta m_i + \eta_i$$

where WS_i is an indicator for whether the sister-in-laws are linked in a *watta satta* arrangement and Δm_i is the difference in their number of years married. It is easy to show that the least-squares estimate

$$\widehat{\theta}_3 = \frac{Cov(y_i, y_i^s | WS_i = 1, \Delta m_i)}{Var(y_i^s | WS_i = 1, \Delta m_i)} - \frac{Cov(y_i, y_i^s | WS_i = 0, \Delta m_i)}{Var(y_i^s | WS_i = 0, \Delta m_i)}.$$

We thus reject equal concordance against the one-sided alternative of greater concordance among *watta satta* sister-in-laws if $\widehat{\theta}_3$ is significantly greater than zero.

While reciprocity thus appears to be an element in Pakistani exchange marriage, it is also a knife that cuts both ways. The upside, as will be demonstrated in the next section, is that the threat of reciprocity can deter a husband's malfeasance in equilibrium. The downside, however, is that when, a husband, 'out of equilibrium', banishes his wife, his *watta satta* counterpart comes under pressure to respond in kind. On the one hand, the banishment of the second wife seems wasteful, yet, in perpetuating the reciprocity, it may deter future discord in both marriages. The empirical question is whether, in the aggregate, *watta satta* arrangements avert more martial strife than they cause.

Table 1 gives an indication of this negative aspect of exchange marriage. Women in *watta satta* marriages who reported that they had ever been estranged from their husband are far more likely to hold a strongly unfavorable view of the institution compared to *watta satta* women who had never been estranged (25 versus 10 %). This difference is entirely absent among conventionally married women. One interpretation, which was also evinced in our field interviews, is that women who had been estranged blame their counterparts in the *watta satta* arrangement, and by implication the institution itself, for this bad outcome.

A sizeable fraction of women in our sample (21%) report that they had ever been physically hurt by their husbands, but this encompasses a wide range of intensity and frequency of violence. Arguably, domestic violence is a less direct measure of marital inefficiency than estrangement. Husbands can be physically abusive outside the context of marital bargaining, 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 from parents, in-laws, and society at large. In terms of *watta satta*, 'normal' levels of violence may not be brought to the attention of those who are in a position to initiate a reciprocal response in the counterpart marriage. This may be a reason why the concordance in the indicator for whether the woman has ever been abused between sister-in-laws is not significantly greater (*p*-value = 0.1174) among those in a *watta satta* arrangement than among those in conventional marriages. **[Need a better measure of intensity/frequency of violence].** Not surprisingly, though, there is strong correlation between domestic abuse and estrangement; 53% 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 13% for women who have never been abused.

Our final measures of marital discord are based on the mental health assessment in-

cluded in the PRHS-II. We use indicators of major depression and of Generalized Anxiety Disorder during the past 12 months. MD is much more prevalent in our sample (25%) than GAD (14%), although nearly 80% of those with GAD also reported symptoms of MD, as compared to 17% of those without GAD.[11] The argument for using these diagnostic-based measures of psychological disorders is that they are likely to capture the cumulative effects of the whole array of emotional and/or physical intimidation deployed against the women by her husband and his family. Physical abuse by the husband, to the extent that it is accurately recorded, may provide only an incomplete picture. Moreover, psychological states like major depression are likely to be less transitory than a specific episode of domestic abuse. The disadvantage is that MD and GAD could be triggered by stresses outside of marriage, or might be altogether unrelated to stress.

3 A Model of Exchange Marriage

3.1 Parental Transfers and Marital Bargaining

To understand the motives behind exchange marriage, we need to take into account the preferences of six actors: two husband-wife pairs and their two sets of parents. For ease of notation and analytical convenience, we assume that both couples and sets of parents are identical to each other in every respect. Parents are assumed to have exactly one married son and one married daughter and to make all marital arrangements, acting as a unitary decision-maker in so doing; i.e., we abstract from any conflicts between the father and mother over preferences toward their children. Parents have convex preferences over the utilities of their son and daughter, u^S and u^D, respectively, as well as over their own private consumption, c, of the form $V = v(u^S, u^D, c)$.[12] Children are assumed to display no altruism, neither toward their parents nor toward each other. Despite this assumption, we will show that brothers end up acting in the best interests of their sisters.[13]

Parents make monetary transfers to both their children, which may include bequests and dowries. Given a vector of transfers to the son and daughter $(t^S, t^D) \geqslant 0$, parents face the budget constraint $y = c + t^S + t^D$, where y is their wealth. The reason for giv-

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[11]**Consistency with other studies of women's mental health in south asia?**

[12]It is not necessary to ascribe altruistic motives to the parents. One could formulate a simpler, but narrower, model in which parents only care about their own consumption and about the 'stock' of family honor. In this case, parents would still have an incentive to jointly restrain their son-in-laws' honor-degrading actions.

[13]This will *not* be a consequence of the so-called Rotten Kid Theorem, Becker's (1981) argument that a child of an altruistic parent always acts to maximize family welfare.

ing parents unrestricted ability to make transfers in this model is to rationalize exchange marriage without resorting to limits on transfers. In particular, it would not be unreasonable to claim that, in rural Pakistan, where women typically move into their husband's intergenerationally extended family, it is more costly for parents to make transfers to their married daughters than to their married sons (perhaps because signalling a willingness to make such transfers opens them up to extortion). In this case, exchange marriage may serve to substitute for parents' financial support of their married daughters (more on this later). We want to argue, however, that exchange marriage potentially 'solves' a different problem.

The optimal allocation of transfers across siblings must satisfy

$$v_1/v_2 = (\partial u^D/\partial t^D)/(\partial u^S/\partial t^S) \tag{1}$$

which implies a tangency of the parents' indifference curve to the sibling utility possibility frontier. Parents, however, cannot directly control their children's utility through transfers. Rather, the slope of the utility possibility frontier depends on how resources are allocated within the respective marriages. We assume that marital utilities are the outcome of strategic bargaining, using the standard alternating-offer formulation of Rubinstein (1982). As is well known, the solution to this non-cooperative bargaining problem converges to the cooperative Nash equilibrium as the spouses' discount factors approaches one (and, by implication, the time between successive offers approaches zero). The advantage of the non-cooperative formulation is that it will allow us to incorporate husbands' threats and, most importantly, the possibility of inefficient equilibria.

Suppose, then, that a marriage yields an output in utility terms of m, which cannot be contracted upon ex-ante. Thus, once marriage has taken place, the output division is negotiated among the husband and wife through a series of offers and counteroffers. If agreement is not reached in any given round of negotiations, husband h and wife w receive disagreement payoffs d^h and d^w, respectively, where $m > d^h + d^w$ to ensure marital efficiency. As in Lundberg and Pollack (1993) and Bergstrom (1996), these payoffs or threatpoints can be interpreted as the maximized individual utilities from a non-cooperative equilibrium within the marriage ('perpetual burnt toast' to borrow Bergstrom's expression). In rural Pakistan, divorce is practically unheard of and, at any rate, is an unlikely threatpoint. In this set-up, the bargaining outcome yields marital utilities $(\overline{u}^h, \overline{u}^w) = (d^h + \pi/2, d^w + \pi/2)$, where $\pi = m - d^h - d^w$; in other words, each spouse obtains their threatpoint utility plus an equal share of the marital surplus .

The final step toward our benchmark model is to specify how parental transfers affect the parameters of the marriage; i.e., (m, d^h, d^w). An increase in transfers to a child can raise his or her marital utility through two channels: (i) a 'wealth' effect – a rise in the the value of the marriage itself, which is shared with the spouse; and (ii) a 'bargaining' effect due to the increase in the relative value of the marital threatpoint.[14] We make the following simplifying assumption:

A.1 Given a pre-transfer parameter vector (m_0, d_0^h, d_0^w), $m = m_0 + t^S + t^D$, $d^h = d_0^h + t^S$, and $d^w = d_0^w + t^D$.

In other words, marital output is increased one-for-one with an increase in transfers from either set of parents, whereas the disagreement payoff of each spouse is raised (one-for-one) only by an increase in transfers from own parents. This essentially captures the intuition that, in the event of disagreement, the wife consumes what she gets from her parents, but not what her husband gets from his parents, and vice-versa. An advantage of this formulation is that post-transfer marital utility is

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\begin{aligned}
(\overline{u}^h, \overline{u}^w) &= \left(\frac{1}{2}[m_0 + d_0^h - d_0^w] + t^S, \frac{1}{2}[m_0 - d_0^h + d_0^w] + t^D \right) \\
&= \left(\overline{u}_0^h + t^S, \overline{u}_0^w + t^D \right).
\end{aligned}
$$

Thus, a son's utility $u^S = \overline{u}^h$ is independent of t^D and a daughter's utility $u^D = \overline{u}^w$ is independent t^S. The important technical upshot of this is that there is no need to model the strategic interaction between the two sets of parents in their choice of transfers.[15]

Given the parents' budget constraint, the utility possibility frontier between the siblings, as illustrated in figure 1, has slope -1. The allocation of transfers is determined by the tangency of this line with the parents' indifference curve as per equation 1. For future reference, denote this highest level of parental utility by V_0. In this example, at the

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[14]Zhang and Chan's (1999) emphasize this bargaining effect in their explanation for dowry. Although divorce rather than non-cooperation within marriage is the threatpoint in their model, Suen et al. (2003) go on to show similar theoretical effects of intergenerational transfers on marital utilities for both types of threatpoints.

[15]Neither the model of Zhang and Chan (1999) nor of Suen, et al. (2003) takes into account the reaction of one set of parents to an increase in transfers by the other set of parents. Thus, in these models, it is not clear that increasing the daughter's dowry would, in equilibrium, actually lead to an increase in her marital bargaining power. This would seem to depend on the relative wealth and degree of altruism of both sets of parents.

pre-transfer utility vector $\left(\overline{u}_0^h, \overline{u}_0^w\right)$, the daughter is 'underprovided' for in her marriage relative to her brother, and is thus compensated by way of a reallocation of transfers.

3.2   Destructive Threats

Next consider the following modification of the marital bargaining game adapted from Busch, et al. (1998).

A.2 If a husband's offer of surplus division is rejected by the wife, then he can *permanently* destroy some proportion of the surplus before the wife can make a counter-offer.

We have already discussed examples of actions that could permanently destroy marital surplus. We assume that wives do not have this coercive power, which, though plausible, is not really essential to the argument. The husband's incentive to destroy surplus is also limited by the following tradeoff: By threatening greater destruction, the husband garners a larger share of the existing surplus, but then he has more to lose if he actually carries out his threat. There is thus an optimal amount of harm he will inflict on the marriage.

In a world of complete information, one might think that threats of surplus destruction would never be carried out in equilibrium, but this is not the case. As shown by Busch, et al. (1998), there are multiple equilibria in this bargaining game and not all of them are efficient. An alternative approach to obtaining marital inefficiency is to assume 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. Husband's may, therefore, destroy marital surplus as a way of signalling their type (see Bloch and Rao, 2002, for related model). A problem with this approach, besides technical complication, is that a husband's type is revealed as soon as he carries out a threat. Thus, for destructive behavior to persist in a marriage, one must arbitrarily assume that wives learn about their husbands very slowly.

Let (θ^h, θ^w) be the fraction of marital surplus appropriated by the husband and wife, respectively, so that any equilibrium to the marital bargaining game results in $(\overline{u}^h, \overline{u}^w) = \left(d^h + \theta^h \pi, d^w + \theta^w \pi\right)$. According to Busch, et al. (1998)

Proposition 1 *The surplus destruction bargaining game with unitary discount factors has two types of equilibria, efficient equilibria with $\theta^h + \theta^w = 1$, $\theta^h > 1/2$ and $\theta^w \geq 0$. and inefficient equilibria with $\theta^h + \theta^w < 1$, $\theta^h > 1/2$ and $\theta^w > 0$.*

In the efficient equilibria, the husband uses the destructive threat to extract up to the entire marital surplus, even though he never actually carries out the threat. In either type of equilibrium, the husband always gets at least half of the marital surplus, more than in the absence of a destructive threat (in which case, as shown above, $\theta^h = \theta^w = 1/2$).

Assuming that all husbands are willing and able to make destructive threats, the question we want to ask is whether parents prefer that their sons use this power. In fact, parents are better off when their son threatens, but only as long as their son-in-law does not threaten. To be precise, let $\sigma_i = 1$ when husband i employs destructive threats and $\sigma_i = 0$ when he does not make such threats and instead follows the conventional Rubinstein bargaining formula.[16] $E(\sigma_1, \sigma_2)$ will denote the marital utilities achieved by the son and daughter when the son plays σ_1 and the husband of the daughter plays σ_2 and both bargaining outcomes are efficient, which is to say that none of the threats that are made are ever acted upon. $I(\sigma_1, \sigma_2)$ has the same meaning in the case of inefficient equilibria, in which threats that are made are actually carried out. Clearly, we must have $I(0,0) = E(0,0)$, since when neither husband threatens there can be no inefficiency. After allocating transfers, parents obtain, using shorthand notation, either utility $v(E(\sigma_1, \sigma_2))$ or $v(I(\sigma_1, \sigma_2))$.

Figure 1 describes the utility payoffs to parents under alternative choices and equilibria. First, suppose that the equilibrium in the marital bargaining game is efficient. Clearly, $v(E(1,0)) > v(E(0,1))$. In either case, the daughter becomes worse off relative to her brother prior to the transfer decision, in the first instance because her brother is the beneficiary of his own destructive threats, and in the second because she herself is the victim. Parents will thus reallocate transfers toward the daughter. When both husbands use destructive threats and bargaining is efficient, the utility gain to the son exactly offsets the utility loss of the daughter. The ability to make transfers to both son and daughter consequently insures that $v(E(1,1)) = V_0$. In other words, parents can exactly compensate their daughter for her bargaining loss out of their son's bargaining gains.

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[16] We are treating the alternative modes of spousal bargaining as strategies subject to choice by the husband and, ultimately, by his parents. The wife, of course, only has the option of Rubinstein bargaining.
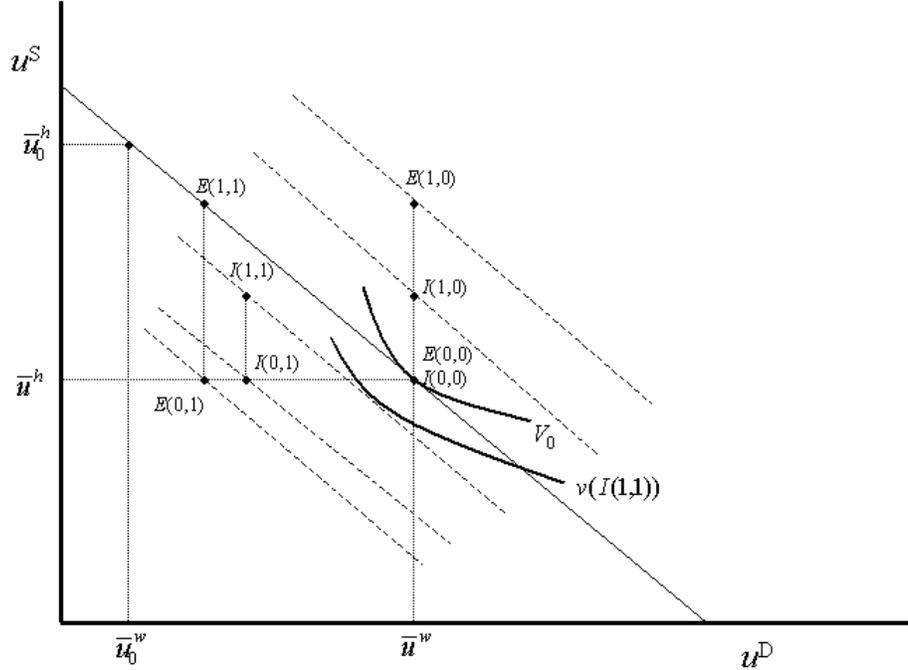
Figure 1. Parental Payoffs

This is, of course, a highly idealized situation. The point is merely to show that parents *could* be indifferent to whether husbands in general make destructive threats. The next step is to show that parents are *not* indifferent to whether husbands actually carry out destructive threats. To see this, consider the inefficient equilibrium payoffs in figure 1. As before, parents prefer that their own son, and only he, do the threatening (i.e., $v(I(1,0)) > V_0 > v(I(0,1))$). However, in the case where both sons threaten, parents must now be worse off. This is because, by definition of inefficient equilibria (and the presumed symmetry of the bargaining problem across the marriages of the two siblings), the utility loss to the daughter exceeds the utility gain to the son. The inefficiency – the fact that destructive threats are carried out – is reflected by the downward shift in the sibling utility possibility frontier. As a result, $v(I(1,1)) < V_0$.

3.3 Rationalizing Exchange Marriage

At this point, one might ask, whither Becker's Rotten Kid Theorem? If, indeed, destructive threats (that are ultimately carried out) lower the total resources available to the extended family, then why does the son's resulting loss in parental transfers not deter him from such behavior (see Becker, 1981, and Bergstrom, 1989, for other applications of the RKT). The reason is that, even if their son eschews threats, there is no guarantee that their son-in-law will do the same, and, if the son-in-law alone threatens their daughter, parents will be even worse off than before. In other words, there is a coordination failure. As we now show, this is exactly the type of problem that exchange marriage can potentially solve.

First note that the ability to implicitly bribe the son not to play the destructive threat game by withholding transfers effectively confers the strategic choice onto the parents. Thus, to evaluate alternative strategies of the husbands, it is sufficient to examine the implied parental utilities. Using subscripts to distinguish parents a and b, exchange marriage implies that $V_a = v(I(\sigma_1, \sigma_2))$ and $V_b = v(I(\sigma_2, \sigma_1))$; that is, the identity of the son and son-in-law of parents a are inverted for parents b. This leads to the following game between the two sets of parents in normal form (the first payoff is that to parent a)

	Parent a	
Parent b	$\sigma_1 = 1$	$\sigma_1 = 0$
$\sigma_2 = 1$	$v(I(1,1)), v(I(1,1))$	$v(I(0,1)), v(I(1,0))$
$\sigma_2 = 0$	$v(I(1,0)), v(I(0,1))$	V_0, V_0

Since, as already discussed, $v(I(0,1)) < v(I(1,1)) < V_0 < v(I(1,0))$, this game is none other than the Prisoner's Dilemma. Given that it is being played between the in-laws repeatedly and for an unknown duration, it is not unreasonable to suppose that they will achieve the cooperative solution $(\sigma_1, \sigma_2) = (0,0)$. 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 deploy, and hence possibly carry out, destructive threats against his wife. Bad behavior of a husband is thus deterred in equilibrium by the threat that his brother-in-law will do the same against his sister. Notice that this occurs even though brothers, by assumption, do not care directly about their sisters' welfare.

The advantage of exchanging brides should now be clear; simply put, it forges a strategic link between the two sets of in-laws. The fact that a son is married to a son-in-law's

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sister establishes reciprocity. In a non-exchange marriage, parents have no way to retaliate in-kind if their son-in-law uses destructive threats against their daughter, because their son is married to someone else's sister.

It is also instructive to compare intrahousehold allocations under the exchange marriage equilibrium $E(0,0)$ and the conventional marriage equilibrium $I(1,1)$. As seen in figure 1, provided that parents can make compensatory transfers between their sons and daughters, intrahousehold allocations across the two regimes will differ only by a wealth effect. If preferences over children's utility are homothetic, for example, then the ratio of husband's utility to wife's utility will be the same in both exchange and conventional marriages. Relative allocations of goods and time may, consequently, be indistinguishable across marriage forms and hence are uninformative with respect to the theory.

When parents can make transfers freely both to their son and to their daughter and when a husband's threats are never actually carried out (efficient bargaining), exchange marriage is no longer advantageous in the sense just described. However, as suggested earlier, even in a world of efficient bargaining, exchange marriage could still be useful if there are constraints on the ability to make transfers to married daughters. In the scenario pictured in figure 1, we would have $v(E(1,1)) < V_0$ in this case. In other words, allowing sons to use destructive threats shifts resources too much in their favor as far as their parents are concerned. Unable to allocate compensatory transfers to their daughters, parents' next best alternative may be to jointly restrain their sons in engaging in an aggressive mode of bargaining. Exchange marriage is one mechanism for achieving this end.

Lastly, consider the consequences of heterogeneity in the willingness of husbands to coerce. Imagine that husbands must incur a utility cost ϕ to play the destructive threat game instead of Rubinstein bargaining. In other words, high ϕ husbands are 'softies' and low ϕ husbands are 'tough-guys'. The interesting issues arise when parents, prior to marriage, can observe their son's ϕ, but not that of their prospective son-in-law. In this case, it may not make sense for the parents to enter their high ϕ son into an exchange marriage since they know he could not be convinced to play $\sigma_1 = 1$ if there was ever a deviation on the part of the son-in-law, whose propensity to play $\sigma_2 = 1$ is unknown to them. The upshot is that low ϕ men will be selected into exchange marriage and high ϕ men will be selected into conventional marriage. This has the effect of dampening the contrast across the two types of marriages, lowering the incidence of surplus-destroying actions in conventional marriages compared to what would prevail under random sorting.

Which is just one of the reasons why, in the empirical work, we need an instrumental variable; one that determines marriage type but that is uncorrelated with ϕ.

4   Empirical Strategy

In our model, marital discord – i.e., estrangement, domestic abuse, and other forms of intimidation detrimental to a wife's mental health – arise when the husband exercises a threat to destroy marital surplus.   In an efficient equilibrium, such destructive threats are never acted upon (or, alternatively, never made in the first place).   However, the bargaining game admits multiple equilibria, including those that are inefficient.   Since game theory generally cannot tell us which type of equilibrium will be chosen, the model yields no testable predictions for a *given* type of marriage, exchange or conventional.   The only empirical implication drawn from the theory concerns the contrast between the two marital arrangements.   In particular, under exchange marriage, destructive threats are less likely to be made (and thus carried out) than under conventional marriage.

Our empirical model consists of two equations

$$y_i = 1(\alpha WS_i + \beta\prime x_i + e_i > 0) \tag{2a}$$

$$WS_i = 1(\gamma\prime BR_i + \delta\prime x_i + u_i > 0) \tag{2b}$$

where y_i is the binary outcome indicator for woman i, WS_i is an indicator for whether she is in a *watta satta* arrangement, and x_i is a vector of exogenous controls.   Assuming that the error terms (e_i, u_i) are bivariate normal with $corr(e_i, u_i) = \rho$, the model may be estimated as a bivariate probit.   [**Later we will relax this assumption by estimating the joint distribution nonparametrically**].

The error term, e_i, reflects unobserved characteristics of the husband and wife, as well as of their joint household.   Any number of stories could be told as to why the unobserved determinants of marriage type, u_i, might be correlated with e_i.   Already mentioned is the possibility that more aggressive men are selected into *watta satta* arrangements.   Alternatively, traditional practices like *watta satta* may be more prevalent in households where women would otherwise have lower status.   Indeed, the same argument should apply to a whole range of features of the marriage: age at marriage (and, by implication, school attainment) of the women, the age difference and kinship relation between husband and wife, and so on.   For this reason, the variables included in x_i must be chosen with

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caution.

Above all, an instrument is needed for WS_i. This should be a variable that affects only the cost of entering into an exchange marriage. We propose to use information on the current sibling sex composition of the wife's family. The logic of the instrument is straightforward: the ability of a family to arrange a *watta satta* depends on the available supply of counterpart brides or grooms, as the case may be. The majority of exchange marriages in rural Pakistan occur among brothers and sisters. Among two-child families, only those with one boy and one girl can contemplate a brother-sister *watta satta*. 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 arranging a *watta satta* for a daughter is increasing in the ratio of boys to total children in her family, or the "total brother ratio" denoted by TBR_i. 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) will increase the likelihood of the woman entering *watta satta by* more than would having a younger brother. So, the "close older brother ratio", $COBR_i$ should explain *watta satta* conditional on TBR_i. In particular, let $TBR_i = B_i/(B_i + S_i + 1)$, where B_i and S_i are, respectively, the current number of brothers and sisters of woman i, and let $COBR_i = B_i^{5+}/(B_i^{5+} + S_i^{5+} + 1)$, where the superscript indicates that only the number of siblings 0-5 years older than woman i are taken into account. Our baseline instrument set is then $BR_i = (TBR_i, COBR_i)$.

The same instrument relevance arguments work, but in reverse, for the husband's brother ratios. That is, the probability that a women is in a *watta satta* marriage is *decreasing* in the ratio of boys to total children in her husband's family.[17] However, one concern in using the husband's brother ratio as an instrument is that family gender composition is subject to parental control. While the cohort of individuals we consider were all born well before sex-selective abortion became widespread in South Asia (albeit never in rural Pakistan), other forms of sex selection have long been available, notably underinvestment in girls' health care and nutrition.[18] In families that attach low status to women, not only may wives be treated badly, but girls may be less likely to survive. For this reason, the husband's brother ratio may be correlated with e_i and may thus be

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[17] In practice, however, the husband's family demographic variables do not work as well in explaining *watta satta* as the wife's, perhaps because of greater reporting errors in the former.

[18] See World Bank (2005) for a summary of the evidence on this issue. Note that stopping rules based on child gender do not affect sex ratios, only the total number of children (see Seidl, 1995).

an invalid instrument for WS_i.

To a large extent, the wife's brother ratio is immune from this critique because marriage is exclusively patrilocal in rural Pakistan. Thus, it is the attitudes and preferences of the woman's husband and his family that determine how she will be treated. On the other hand, families may match assortatively on precisely these attitudes and preferences. This opens the possibility that even the demographic composition of the woman's family is correlated with e_i. For example, in households that place a low value on women, fewer girls survive to adulthood and those that do survive are married off to husband's who treat them relatively poorly. Fortunately, we can gauge the importance of this endogeneity problem by including TBR_i directly into equation 2a. One can regard this as a test of a specific overidentifying restriction, while maintaining the hypothesis that $COBR_i$ is uncorrelated with e_i, conditional on TBR_i. The argument is that, even if parents control the family sex ratio by various subtle forms of female infanticide, there is no reason why, *net of the overall sibling sex ratio*, the incidence of female survival in an age band around a woman arbitrarily chosen in her family birth order should be systematically affected.[19]

5   Results

Tables 2-5 present the estimation results for the four indicators of marital inefficiency, respectively, estrangement, domestic abuse, MD, and GAD. The first column in each table reports a univariate probit specification that controls only for a woman's age quadratic and region of residence (northern Punjab, southern Punjab, or Sindh), both of which are undeniably exogenous. Based on these results, ignoring selection would lead us to conclude either that exchange marriage is unrelated to martial inefficiency or that, in the case of estrangement, it significantly *increases* the probability of inefficiency. As already pointed out, however, selection bias is likely to make outcomes in *watta satta* marriages seem relatively bad.

Specifications (1)-(4) in each of the tables take into account selection using a bivariate probit estimated by Full-Information Maximum Likelihood. The baseline excluded instrument set $(TBR_i, COBR_i)$ has high explanatory power in the first stage probits as reported at the foot of each table. Moreover, in all cases, except GAD, the cross-equation correlation ρ is significantly positive, indicating "negative" selection; i.e., *watta satta* is more likely in marriages that tend to be beset by inefficiency anyway. Consequently, the

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[19]Since it is impossible to prove a negative, we can only say that it is difficult to conceive of a model of child mortality with this particular feature.

selectivity corrected estimates reveal that women in *watta satta* arrangements are generally better off than their counterparts in conventional marriages. Particularly strong, statistically, are the results for estrangement and depression. Based on specification (1), being in a *watta satta* arrangement lowers the probability of ever returning to one's natal household on account of marital estrangement from 0.31 to 0.13, or by about 60%, and lowers the probability of MD from 0.41 to 0.12, or by almost 70%. The likelihood of domestic violence is 45% lower (from 0.27 to 0.15) in *watta satta* marriages, but this difference is only significant below the 10% level. Estimates for GAD are insignificant.

Expanding the set of covariates only strengthens our conclusions. Specifically, we control for the woman's school attainment (none, any primary, secondary and higher), her spouse's age, her relationship to her spouse (blood relative, unrelated but same *zaat/biraderi*, unrelated and different *zaat/biraderi*), and dummies for her (spousal) household's per capita consumption expenditure quartile. The latter set of dummies should be a reasonably good proxy for wealth. As indicated earlier, we do not claim that all of these controls are necessarily exogenous, nor does our theory make any predictions as to their effects on marital inefficiency. Including these covariates in specification (3), and comparing the resulting estimates of α to those from specification (1), constitutes a test of the null hypothesis of no omitted variable bias. However, this test has power only to the extent that correlation between the covariates and e_i is not too large in a particular direction; therefore, it must be interpreted with caution. Nevertheless, the results are encouraging. The estimate of α are quite similar across specifications; if anything, somewhat larger in magnitude and more precisely estimated in the less parsimonious specification (3).

Finally, we test the identifying restriction that the wife's brother ratio, TBR_i, is uncorrelated with the unobserved determinants of marital inefficiency. As discussed, this is done by relying exclusively on the age-sex pattern of the wife's siblings, specifically $COBR_i$, to identify α. Our claim is that, once the overall family sex ratio is held fixed, the proportion of brothers a woman has among her older siblings (within a five years age band) is, for all practical purposes, uncorrelated with household preferences. The results for the more and less parsimonious covariate sets are reported as specifications (2) and (4), respectively. Including TBR_i directly in the outcome equations generally reduces the significance of the estimated cross-equation correlation, which is not surprising given that the power of the instrument set is now considerably lower. But TBR_i never attracts a significant coefficient, so we cannot reject the hypothesis that it is uncorrelated with e_i. Moreover, all of the previous results remain intact, except that now the negative effect of

watta satta arrangements on domestic abuse becomes statistically significant at or above the 5% level, depending on the specification. These findings further support the causal interpretation of the effect of exchange marriage on marital inefficiency.

6   Conclusion

This paper attempts to understand the pervasive marriage custom of *watta satta* in rural Pakistan, an exchange marriage accompanied by a reciprocal threat. We began with the proposition that, in a setting where husbands wield considerable coercive power, against which wives have practically no legal recourse, forms of marriage may adapt to protect the interests of women and their families. In this light, we have shown that *watta satta* may be a mechanism to coordinate 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 appear to support this view. The likelihood of marital inefficiency is significantly lower in *watta satta* arrangements as compared to conventional marriages, but only after properly accounting for selection. Women thus appear to fair better under a customary practice that many enlightened laymen consider repugnant and retrogressive.

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Table 1: Women's Opinions on Watta Satta

Ever Been Estranged?	*Watta Satta* Marriage			Conventional Marriage		
	No	**Yes**	**All**	**No**	**Yes**	**All**
Strongly favor	74.1	58.8	70.5	32.1	32.0	32.1
Somewhat favor	6.4	4.7	6.0	8.2	8.6	8.3
No preference	7.6	9.4	8.0	15.2	17.1	15.5
Somewhat disfavor	2.4	1.8	2.2	3.4	0.6	2.8
Strongly disfavor	9.6	25.3	13.3	41.2	41.7	41.3
Total	100	100	100	100	100	100

Notes: Figures represent column percentages of responses to the following question:

"Would you favor your daughter marrying in a Watta Satta arrangement."

Table 2: Ever Been Estranged from Husband

	Univariate Probit	Bivariate Probit (1)	(2)	(3)	(4)
WS_i	0.209**	-0.657**	-0.993**	-0.731**	-0.994**
	(0.075)	(0.222)	(0.230)	(0.206)	(0.217)
[Marginal Prob.]	[0.060]	[-0.187]	[-0.290]	[-0.207]	[-0.286]
TBR_i (overid test)	—	—	0.370	—	0.328
			(0.241)		(0.235)
x_i (controls)[a]	A	A	A	B	B
$H_0 : \rho = 0$[b]	—	11.7**	9.0**	14.1**	10.6**
$H_0 : \gamma = 0$[c]	—	107.9**	31.3**	107.4**	30.8**

Notes: Standard errors in parentheses (* = p-value< 0.05; ** = p-value < 0.01)
[a]A={woman's age,age^2,region}, B={A,woman's school attainment,spouse's age, relationship between spouses,dummies for per cap. expend. quartile of household}
[b]Test of cross-equation correlation: $\chi^2_{(1)}$.
[c]Test of IV relevance: $\chi^2_{(k)}$ with $k=2$ in columns (1) and (3), $k=1$ in columns (2) and (4).

Table 3: Ever been Physically Abused by Husband

	Univariate Probit	Bivariate Probit (1)	(2)	(3)	(4)
WS_i	0.083	-0.430	-0.669	-0.540*	-0.910**
	(0.074)	(0.241)	(0.384)	(0.238)	(0.320)
[Marginal Prob.]	[0.024]	[-0.121]	[-0.188]	[-0.151]	[-0.258]
TBR_i (overid test)	—	—	0.218	—	0.356
			(0.304)		(0.283)
x_i (controls)	A	A	A	B	B
$H_0 : \rho = 0$	—	4.3*	3.0	6.2*	5.4*
$H_0 : \gamma = 0$	—	109.2**	23.7**	106.3**	21.1**

Notes: See notes to Table 2.

Table 4: Major Depressive Episode in Last 12 Months

| | Univariate | Bivariate Probit | | | |
	Probit	(1)	(2)	(3)	(4)
WS_i	-0.038	-0.940**	-1.250**	-0.994**	-1.270**
	(0.073)	(0.215)	(0.233)	(0.201)	(0.199)
[Marginal Prob.]	[-0.012]	[-0.287]	[-0.386]	[-0.302]	[-0.390]
TBR_i (overid test)	—	—	0.310	—	0.319
			(0.267)		(0.242)
x_i (controls)	A	A	A	B	B
$H_0 : \rho = 0$	—	12.9**	4.7*	16.0**	8.2**
$H_0 : \gamma = 0$	—	99.6**	13.9**	100.7**	16.5**

Notes: See notes to Table 2.

Table 5: General Anxiety Disorder in Last 12 Months

| | Univariate | Bivariate Probit | | | |
	Probit	(1)	(2)	(3)	(4)
WS_i	0.102	-0.006	0.094	-0.188	-.513
	(0.084)	(0.325)	(0.703)	(0.306)	(0.545)
[Marginal Prob.]	[0.022]	[-0.001]	[0.020]	[-0.267]	[-0.107]
TBR_i (overid test)	—	—	-0.068	—	0.252
			(0.428)		(0.368)
x_i (controls)	A	A	A	B	B
$H_0 : \rho = 0$	—	0.1	0.0	0.9	1.2
$H_0 : \gamma = 0$	—	108.0**	24.1**	106.2**	18.7**

Notes: See notes to Table 2.