# A Touch of Violence - Welfare Outcomes under Bride Exchange and Child Marriage

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**Abstract**

This paper investigates the impact of marital traditions on women's welfare. By controlling for cultural influences, it structurally estimates a husband's preferences to uncover the motivators for his decision to abuse his wife. The cultural customs considered are Pakistani exchange marriage - Watta Satta and the practice of child brides. The estimated preferences, after accounting for under-reporting of domestic abuse, reveal that an abusive husband negatively perceives the time and effort invested in home production. Under these preferences and customs, the policy takeaway from the causal experiment is that policies, such as initiatives aimed at promoting female financial independence, may not effectively reduce marital abuse within the context of the aforementioned customs and preferences. In contrast, male-centric policies, such as those that encourage fathers to view their daughters in a positive light and promote male education, have a significantly positive impact on female abuse outcomes. Regarding child marriage, the paper's results show that access to education does not affect the likelihood of becoming a child bride.

**JEL Classification: J12**

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# 1 Introduction

Marriage embodies intricate configurations of overlapping relations with a complex set of post-marriage outcomes. Within the realm of these outcomes, the persistent failure to provide women adequate protection against intimate partner violence and child marriage is a global challenge requiring urgent attention and comprehensive intervention. Marital outcomes extend beyond the interactions between spouses to include the intricate dynamics of extended family networks, regional heritage and social structures that collectively shape a wife's welfare (see Anderson 2007, Bloch & Rao 2002, Jacoby & Mansuri 2010, and Quisumbing & Maluccio 2003). In societies where women have lower bargaining power than men, the efficacy of women-centric welfare programs is clouded by uncertainty due to potential conflicts with entrenched cultural norms. Consequently, understanding how local traditions impact women's well-being and marital bargaining power becomes a paramount concern for policymakers grappling with the formidable task of addressing global issues of intimate partner violence and child marriage.

To address this concern, this paper investigates what contributes to the probability of women being in an abusive marriage, a form of marital power relations, in societies with solid marital traditions. Examples of such traditions include the Pakistani martial practice of *Watta Satta* bride exchange and female child brides.

The first tradition, *Watta Satta* is an implicit contract between two households to barter brides who are traditionally blood kin of the seeking spouse grooms. This practice is motivated by non-compliance with the Sharia Act of 1967 which entitles women to patrimony (Ahmad et al. 2016 and Rauf 1987) and protection for women against spousal violence (Jacoby & Mansuri 2010). The nature of *Watta Satta* ensures that a husband does not demand his wife's patrimony and is not physically abusive towards her because if he is, his *Watta* brother-in-law will reciprocate. The empirical estimates of this paper find that after controlling for child marriage and under-reporting of domestic abuse by women, there is an additional likelihood of spousal violence in a *Watta Satta* marriage than a benchmark one. Specifically, the underlying structural parameters representing a husband's preferences show that men in *Watta Satta* contracts have spousal violence-deterring empathy for their *Watta* blood kin and that they use abuse as a reaction to maltreatment of this *Watta* kin.

After accounting for the abuse censoring problem, the main contribution of this analysis lies in the role of male characteristics and preferences in reducing the incidence of spousal abuse. The resulting policy implication is that a lack of male education and societal prevalence of son bias increases the odds of women being victims of spousal abuse. The robustness of these policy implications is tested by conducting counterfactual exper-

iments using simulation and machine learning algorithms, to test how targeted policies impact abuse likelihood. The experiments find that returns to compulsory male education policy and social campaigns that alter male fertility preference reduce the likelihood of spousal abuse. The results argue that compared to conventional schemes that provide women with some form of financial independence, men receiving compulsory education and having altered perceptions about fertility can reduce the incidence of marital abuse.

For the second marital tradition, female child marriage, this paper finds that a groom's demographic profile and the cultural practice of *Watta Satta* influence the likelihood of being an underage bride. Furthermore, policy experiments show that neither education for boys nor any form of training which promises girls financial security impact the odds of child brides.

Moreover, the contributions of this paper are fourfold: (i) it provides insights into male preferences that lead to an abusive marriage; (ii) it clarifies motivators of child marriage; (iii) it improves the understanding of the type of households that opt for marriage exchange; and (iv) by using leading machine learning algorithms for causal inference (Laan & Rubin's targeted maximum likelihood and Bayesian analysis regression tree), it estimates the impact of popular policy prescription for domestic abuse and child marriage. This research addresses significant limitations in existing work: since gender-based violence is prone to under-reporting, most studies suffer from substantial biases. Additionally, due to the limited scope of survey data, papers that consider the censoring issue discount for significant confounding correlates to spousal violence. This paper addresses these limitations by first using the detail-rich survey data from Pakistan and by employing empirical techniques to address response censoring by the respondents and interviewers. The estimates using censorship bootstrap (Efron 1981) and misclassification indicator (Hausman et al. 1998) show that the conclusions remain robust after accounting for the under-reporting issue.

The organisation of the rest of the paper is as follows: Section 2 summarises the literature on household preferences about marriage, while Section 3 constructs a theoretical model based on these preferences. Section 4 summarises the data, and 5 describes the empirical strategy. Next, Section 6 presents the reduced form results, followed by Section 7 where the estimation robustness under abuse response censoring is checked. Structural estimates are reported in Section 8, with a counterfactual analysis in 9. Finally, Section 10 summarises and concludes the paper.

## 2 Background

Understanding the motivations for child brides and spousal abuse within the context of culture requires dissection of household and individual preferences and traditions. In this paper, *Watta Satta* bride exchange and child marriage are the two cultural considerations. This section summarises the underlying mechanisms of how *Watta Satta* and women being child brides influence domestic abuse as discussed in the literature. It also identifies and motivates causes for domestic abuse and child marriage, as they are used in Section 3 to construct the theoretical model and in Section 5 for the selection of observed covariates.

### 2.1 Watta Satta

*Watta Satta* is a marriage exchange tradition observed in Pakistan. It involves a barter of brides between two independent households via contracting a simultaneous marriage of related man-woman pairs. Since the *Watta* brides are kin of the spouse-seeking male, brother-sister and first-cousin pairs are frequently bartered. Variants of this custom also include "one-for-one" and "one-for-many" partner exchanges. That is, more than one bride can be offered for a groom and vice versa. Less prevalent forms include inter-generational pairs such as uncle-niece, daughter-father and granddaughter-grandfather.

Household selection into a *Watta Satta* contract is motivated by the protection it provides to women (Jacoby & Mansuri 2010). It gives households reciprocal leverage in controlling a husband's violent impulses. With virilocal residence, if a wife is mistreated, her natal family can sanction the punishment of her abuser's kin. As a result, *Watta Satta* contracts provide an incentive to household members (namely parents) to intrude in violent situations.

The effectiveness of *Watta Satta* protection is uncertain at best. First, the motivation disregards households where abuse is perceived to be a part of the matrimonial culture. Often spousal abuse is an inter-generational habit where future abusers and victims are child observers (Pollark 2004 and Ulbrich & Huber 1981). Second, repercussions of early age exposure result in under-reporting and censoring abuse in women and the perception of aggression as a marital norm in men (Palermo et al. 2014 and Chin et al. 2017). Overall, *Watta Satta* assumes that abusive men are empathetic towards the maltreatment of their *Watta* kin. This logic is counter-intuitive given that a man is willing to sanction violence for his wife but is critical of violence in his *Watta* kin's marriage. Lastly, based on Jacoby & Mansuri (2010) argument households selecting *Watta Satta* have to have perfect information about male violent behaviour ex-ante marriage, i.e., family members

can correctly predict if a man is going to be abusive towards his future wife prior to him getting married. This argument is disputable, especially for individuals who perceive abuse as a part of matrimonial duty.

Besides marital insurance, what else motivates *Watta Satta*? Ahmad et al. (2016) and Rauf (1987) observe that in rural Pakistan, there is resistance to compliance with Islamic law regarding women's inheritance (Muslim Personal Law (Shariat) Application Act of 1962). Under this law, women are entitled to a portion of a deceased's estate (men obtain twice the share). The practice of *Watta Satta* acts as a means to circumvent this legislation and ensures the maintenance of an agnatic kinship structure without legal repercussions. Moreover, it guarantees that a woman will forfeit her right to patrimony. In the case of failure, her *Watta* kin can claim on behalf of his wife. The threat of reciprocal patrimony claim reduces the expected size of the inheritance for both male *Watta Satta* participants. To avoid such uneconomic fallout, the family patriarch decides *Watta Satta* barters at the birth/young age of those concerned. He does this to ensure that his estate does not become fragmented or uneconomic for subsequent generations.

In Pakistan, a majority of rural households are either landless or owners of uneconomic holdings. Uneconomic holdings are unprofitable fragmented agricultural plots. According to the West Pakistan Land Revenue (Amendment) Ordinance 1978, land holdings of less than 200 kanals (10.117 hectares) are considered to be uneconomic and are not required to pay the land revenue tax.[1] It is hypothesised that landowners are more likely to practice *Watta Satta* to ensure that the estate does not become fragmented during the intergenerational transfer. For landless (or subsistence) households, the apparent motivation for *Watta Satta* is the demand for a discounted dowry/dower. However, Parsons et al. 2015 find that if the brides are less than 18 years of age, the dowers and dowry paid are lower in value than an adult bride. Section 2.2.1 further develops this argument in detail.

## 2.2 Ex-ante and Ex-post Marital Discontents

### 2.2.1 Child Brides

The legal definition of a "child bride" under the United Nations charter (2019) is a union of a female under 18 years of age. In Pakistan, the legal marriage age is 16, while in Islam, the age of marriage coincides with the age of menarche. Hence, since Pakistan is predominantly Muslim, it is not unusual to be married at 13 years old.

[1] In this paper, the average size of a holding is 110.6 kanals (5 hectares)

Traditional societies take elaborate steps to protect women because they view female identity as an honour concern (Fischer 1991). A notable component of honour is the protection of the chastity of an unmarried child/woman. Therefore, parents are motivated to marry their daughters off at the age of menarche as it reduces the effort required for her protection (Bettencourt 2000 and Lari 2011).

Additionally, delaying a daughter's marriage is viewed as an increased risk of female transgression, including a higher probability of refusing to marry a selected partner. In turn, a daughter's agency can lead to questions about a household's honour, resulting in damaging implications for households. For example, community and extended family members may hesitate to form new marriage alliances and avoid fulfilling prior marital promises. Moreover, unmarried household members will have problems finding partners.[2] In such situations, girls become victims of honour killing as they are perceived to have brought dishonour to the family.[3] To circumvent this, households offer child brides so that the betrothed's family shares the protection effort prior to marriage.

Men prefer child brides for two reasons: (i) increased years of fertility that lead to an increased likelihood of bearing sons; and (ii) reducing a bride's agency in selecting a mate. An extension of this preference is a consanguineous marriage where individuals demonstrate family solidarity by forming unions with household members or extended family (Charsley 2007 and Fricke et al. 1986).

Since *Watta Satta* is commonly transacted within the extended family, households select participating *Watta* pairs during childhood/infancy due to the threat of eligible mates being taken up by other household candidates. This competition causes *Watta Satta* to be one of the major contributors to child marriage in Pakistan (see Lane 2011, Nasrullah et al. 2014a and Nasrullah et al. 2014b).

Moreover, child marriage literature frequently identifies poverty, lesser valued dowry, religion and male education as significant motivators for child brides (Jain & Kurz 2007, Nour 2009 and Parsons et al. 2015).[4] The medical literature finds that intimate partner violence is positively correlated with the practice of child brides (Kidman 2016, Nasruallah et al. 2014c and Santhya et al. 2010) and negatively correlated with women's decisional independence (Klugman et al. 2014).

[2]This includes siblings, maternal and paternal uncles and aunts.

[3]In Pakistan, immediate family members like fathers, brothers, uncles and cousins are often participants and instigators of honour killings (Nasrullah et al. 2009).

[4]Parson et al. (2015) find that grooms demand lower-valued dowry for younger and less educated brides.

### 2.2.2 Spousal Abuse

Spousal abuse encompasses a range of behaviours and behavioural patterns. Riggs et al. (2000) state that two strategies to examine these behaviours are: (i) to directly examine aggression and (ii) to study correlates and consequences that control and entrap victims. He identifies household and individual demographics, socioeconomic status and culture as possible covariates to explain partner violence.

A recent development on domestic abuse motivators is based on the popular "bargaining theory" (Tauchen et al. 1991 and Farmer & Tiefenthaler 1991). This theory proposes that men have a preference to inflict violence on their spouses and that preference affects the intra-households bargaining process where a man bribes his wife into accepting some level of physical violence by offering her a form of compensation. This theory predicts that an increase in a woman's relative wage monotonically decreases levels of violence. An alternative to this explanation is Bloch & Rao (2002) "signalling theory". This theory posits that spousal violence is a signal to communicate a husband's marital dissatisfaction and is a means of extracting transfers from the wife's family.

In South Asia, prevalent abuse motivators are gender stratification via patrilineal descent, patrilocal residence, discounting women from inheritance and secession practices, and hierarchical relations in which the patriarch or his relatives have authority over household members (Jejeebhoy & Sathar 2001). In Pakistan, the culture of defending family honour is a significant motivator for partner violence, where violent actions redeem lost honour (Vandello & Cohen 2003). Spouses who face aggression in silence are considered loyal and honourable, while those who report bring disgrace to the family.

Patrilocal residence brings uncertain spillovers for women's welfare. Fernandaz (1997) finds that hostilities arise due to a conflict of loyalties between a wife and her inlaws. In extreme cases, this leads to spousal violence, where the husband's kin are often participants in the abuse.

As discussed in Section 2.1, it is ambiguous whether *Watta Satta* contracts protect women. Bhutta et al. (2015) explain that exchange marriages often lead to complicated physical abuse situations with one or more women involved. This abuse is sustained due to the notion that dissolution of a marriage contract due to abuse can result in retaliatory abuse or divorce of reciprocal *Watta* marriage. Moreover, there is a societal preference for avoiding divorce as it increases household costs due to the return of uneconomic/noncontributing member(s) (the divorced woman and her children). There is also a loss of social capital due to the cultural stigma associated with divorce.

National Institute of Population Studies and ICF International (2013) find that 40 per cent of Pakistani ever-married women aged between 15 and 49 years have suffered a form

of spousal violence. However, due to under-reporting and censoring by the victim, the actual incidence of spousal abuse ranges from 30 to 79 per cent (Khan et al. 2009). A common cause for this in Pakistan is visiting one's natal home without permission from one's husband or family (Sami & Ali 2006).

Lastly, in the later stages of marriage, women with abusive husbands lack reproductive agency. Literature finds that victims of domestic abuse are likely to experience pregnancy coercion and are less likely to adopt contraceptives (Miller et al. 2010 and Stephenson et al. 2008). The repercussion of this is that victims of domestic abuse have higher fertility rates, with many experiencing unwanted pregnancies (Gul et al. 2013 and Shaikh 2003).

## 3 Theoretical Model

This section develops a general equilibrium model where a man and a woman are in a relationship with spousal violence. The goal is to develop hypotheses that address the following questions theoretically: (i) what factors contribute to a violent marriage equilibrium; and (ii) under what conditions individuals select *Watta Satta* marriage. The empirical hypothesis taken to the data are *Watta Satta* selection is contingent on a husband's expectation of bequest; and that enforcement of *Watta Satta* contracts, and a change in male fertility and psychological preferences contributes to a changing incidence of marital abuse.

The model requires a husband ($i$ henceforth) to maximise utility subject to the constraint that his wife will remain in the marriage. If no equilibrium exists within this constraint, divorce will ensue. Individual $i$ obtains utility from private consumption, $c_i$, a home-produced household good, $Q_i$ (Anderberg & Rainer 2013), having $n_i$ children (McDonald & Zhang 2012) and bequests for children, $B_i$ (McDonald & Zhang 2012 and De la Croix & Gosseries 2012).

Besides basic preferences, $i$ values esteem and psychological gratification. Tauchen et al. (1991) and Farmer & Tiefenthaler (1997) model this by assuming that the assailant in the relationship, $i$, has expressive and instrumental motives for inflicting violence. This assumption is adopted by incorporating expressive levels of violence, $a_i$ into the utility function directly where utility is increasing in self-esteem, power, behaviour modification, or any other psychological factors present in a violent relationship. For instance, violence gives men a feeling of being in control, which in turn increases utility.

A standard utility function with additively separable preferences is assumed where there is no bargaining between spouses. Thus, in the initial specification, there is no external

violence intervention. However, once *Watta Satta* contracts are introduced in the specification, this restriction is relaxed.

Using logarithmic preferences (for analytical tractability), the utility function is:

$$V_i(c_i, n_i, B_i, q_i^H, a_{ii}) = \ln c_i + \rho \ln n_i + \tau \ln B_i + \alpha \ln Q_i + \ln a_i + \Psi_i, \quad \rho, \tau, \alpha > 0, \quad (1)$$

where the parameter $\rho$ weighs individual $i$'s preference for the number of children $n_i$, $\tau$ characterises inter-generational altruism, $\alpha$ is a measure of the relative importance of the household produced goods, and $\Psi_i$ encompasses psychological indicators such as general contentment and happiness. Since $i$ represents an individual from an agricultural household with a patriarchal kinship structure, $\rho$ is assumed to be strictly positive. Furthermore, agriculturist $i$ requires at least one male child as he needs a bearer of the family name and prefers to have more sons than daughters as they have a higher economic value in providing essential farm labour. Therefore, the model assumes that $n_i$ is the number of sons and that $i$ does not care about these sons' human capital. Furthermore, parents are indifferent to their children's adult utility, as in dynastic altruism.

Individuals are self-employed and face the following constraints. The first is a budget constraint that limits the amount spent on consumption, $c_i$:

$$c_i + B_i \leq y_i, \quad (2)$$

taken at a given level of household income, $y_i$ and aggregate bequests to children, $B_i$. To account for traditional gender roles, $i$ is the sole income earner and leaves child-rearing to his wife. Thus, individual $i$'s time is divided between income generation $h_i$ and household production, $q_i^H$:

$$h_i + q_i^H \leq 1. \quad (3)$$

Here $q_i^H$ is interpreted as time allocated to non-income generating activities that are essential for the household's survival. Such activities include household chores like household maintenance, cooking, cleaning and grocery shopping. In turn, income earned, $y_i$ is a function of bequests received, $k_i$ and time devoted to market-oriented labour, $h_i$:

$$y_i \leq h_i k_i. \quad (4)$$

Equation 4 has constant returns with respect to efficiency units $h_i k_i$. These efficiency units and hours worked are perfect substitutes. For simplicity, there are no monetary transfers between spouses.

To incorporate both domestic abuse's cooperative and non-cooperative aspects, home-produced household good, $Q_i$ is introduced in the utility function. Anderberg & Rainer

(2013) state that $Q_i$ introduces family decision-making into the model and the concept that spousal abuse may be part of a Pareto-improving trade between spouses. Under the cooperative frameworks, spousal abuse is a repercussion of spousal cooperation in family decision-making. Under the cooperative framework, the model assumes that men prefer violence and women tolerate it in return for higher transfers (Tauchen et al. 1991 and Farmer & Tiefenthaler 1991), while in a non-cooperative setup, spousal abuse is a consequence of spousal disagreement regarding economic roles. (Anderberg & Rainer 2013). Hence it is assumed that all active households have a family-specific household good, $Q_i$ that requires time contributions from spouses:

$$Q_i(q_i^H, q_i^W) = (q_i^H)^{\mu}(q_i^W)^{1-\mu}, \quad \mu \in (0,1) \tag{5}$$

where the superscripts $H$ and $W$ stand for husband and wife, while $\mu$ is the externality of a spouse's contribution to domestic production. $0 < \mu < 1$ implies that time contributed to household production by spouses can be both complements and substitutes, meaning that some jobs can only be done by the husband while others by the wife and some by both.

Anderberg & Rainer (2013) find that time allocation choice by spouses is associated with the Nash equilibrium point. That is, household behaviour implicitly appeals to folk theorems so that efficient resource allocations are sustained through repeated interaction. This argument ignores that results only apply if and only if individuals are infinitely patient (in the limit when the discount factor turns to one). By relaxing this assumption and allowing for heterogeneity of discount factor, families will sort endogenously into cooperative and non-cooperative allocation regimes. It is essential to permit behavioural non-cooperation, as couples can behave non-cooperatively as much as 25 per cent of the time (Del Boca & Flinn 2012). In the given context, the husband chooses whether or not he is going to engage in sabotaging his wife's productivity by abusing her. What is important here is this sabotage might give him direct utility but also will impact the utility indirectly as her contribution to the home production, economic labour and child-rearing activities will also be impacted by his abuse.

Hence composite measure for women's time allocated to home production and economic labour, $q_i^W$ introduces the non-cooperative aspect of domestic abuse into the model. This time allocation function is important as it implies that spouses simultaneously and non-cooperatively decide on how to allocate their unit time endowment between market work, child-rearing and the production of household goods. For women, the time allocation function includes time recovering from or being abused as well as child-rearing activities:

$$q_i^W = 1 - \kappa(N_i^H)^{\gamma} n_i - a_i. \tag{6}$$

Here, the distinction between home production and economic labour is unnecessary as it does not modify the result. Also, in Pakistan, a wife's monetary contribution (besides dowry) is frequently income from part-time positions. It is a function of time left over after child-rearing and other household responsibilities.[5]

Since the model assumes that parents are recipients and benefactors of ad-hoc altruism, the total bequests received, $k_i$, is a sum of his own and his wife's inheritances. Besides dowry, in a traditional marriage, $k_i$ includes a wife's share in patrimony. Hence the aggregate bequests received is given by:

$$k_i = \begin{cases} \frac{K^H}{N_i^H} + \frac{K^W}{N_i^W} & \text{for benchmark marriage;} \\ \frac{K^H}{N_i^H - 1} & \text{for } \textit{Watta Satta}; \end{cases} \tag{7}$$

where $K$ is the total parental estate and $N_i$ is the number of co-beneficiaries of that estate.

Bequests received, $k_i$ in a *Watta Satta* marriage represents the implicit contract between individuals $i$ and $j$, that both will forgo the claim on their respective wives' patrimony $\left(\frac{K^W}{N_i^W}\right)$. Thus, a woman's contribution, $K^W$ becomes zero, and the number of beneficiaries for $i$'s father's estate, $N_i^H$ is reduced by 1.[6]

Based on individual $i$'s utility, selection into *Watta Satta* marriage depends on aggregate bequests received $k_i$ and the efficiency of the *Watta Satta* patrimony punishment mechanism.[7] Considering that the efficiency of the punishment mechanism is observed ex-post marriage, the selection of *Watta Satta* will initially depend on bequests of $k_i$.

**Proposition 1** *(Watta Satta Selection) Individual i selects into a Watta Satta marriage if his wife's bequest, $K^W$ is such that:*

$$K^W < \frac{K^H N_i^W}{(N_i^H - 1)N_i^H}.$$

Proposition 1 motivates the selection of instruments and covariates for the empirical analysis; hence it is essential to the analysis. It shows that $i$'s selection of entering a

[5] According to Tanaka & Muzonones (2016), only 25 per cent of university-educated Pakistani women work outside the home. Reasons attributed to low participation are social, cultural and religious norms, safety, husband/family approval and availability of transport.

[6] For the sake of model tractability and because of negligible impact on empirical results, dowry and dower are not included in bequest received, $k_i$. This assumption is justified because summary statistics indicate that wedding contributions as a ratio of household wealth are minuscule.

[7] There are no household savings and interest rate is zero.

*Watta Satta* marriage depends on household estate size, $K$ for both $H$ and $W$, and the number of siblings, $N_i$ are observable ex-ante marriage. $i$ only select into the *Watta Satta* contract if the value of the expected inheritance is larger than a benchmark marriage where $\frac{N_i^W}{(N_i^H-1)N_i^H}$ is the weight for comparing the inheritance brought into the marriage by both spouses. For instance, if both $K_i^H$ and $K_i^W$ are equal, selection into *Watta Satta* will depend on the relative gap between the number of estate beneficiaries. This means that *Watta Satta* is preferable if the $i$'s number of sibling $N_i^H$ are less than his wife's, $N_i^W$ and less preferable if $N_i^W \geq N_i^H$.

For ex-post marriage outcomes, the abuse retaliation dynamic of *Watta Satta* is introduced in $i$'s utility by explicitly modelling reported abuse exercised by *Watta* counterpart $j$, $a_{jj}$. Hence, the aggregate level of domestic abuse in a marriage, $a_i$ will have the following functional form

$$a_i = a_{ii}^{\psi_i} a_{jj}^{1-\psi_i}. \tag{8}$$

Under *Watta Satta*, aggregate abuse in a marriage, $a_i$ depends on $i$'s own violent actions, $a_{ii}$ and reported abuse in the counterpart *Watta* marriage $j$, $a_{jj}$. Moreover, both $a_{ii}$ and $a_{jj}$ have a complementary nature. A parameter for reactive/proactive violent temperament, $\psi_i$ is introduced to account for the motivators under which $i$ exercises spousal violence: (i) his wife "deserves it" ($\psi_i > 0.5$); (ii) retaliation against $j$'s use of violence ($\psi_i < 0.5$); or (iii) both ($\psi_i = 0.5$).[8]

Equation 8 assumes concavity for domestic violence, i.e., $i$'s marginal utility from violence is decreasing in purchased good consumption. This introduces the correlation between financial stress and spousal violence into the model.[9] Setting up spousal abuse this way allows for household equilibrium to depend on relative abuse and not actual abuse level.

The psychological contentment parameter, $\Psi_i$ encompasses the disutility from $j$'s violent actions on $i$ emotional health under *Watta Satta* exchange and a constant,

$$\Psi_i = Constant - \theta \ln a_j = Constant - \theta \ln (a_{jj}^{\psi_j} a_{ii}^{1-\psi_j}), \quad \psi_j \in (0,1). \tag{9}$$

Here *Constant* accounts for other sources of general contentment and happiness. For the level of empathy, $\theta$ the sign is negative since $i$ is assumed to have disutility if his *Watta* kin experiences abuse $a_{jj}$. Correspondingly, $\psi_j$ is $i$'s perception of the reactive violent temperament of his *Watta* inlaw $j$.

By substituting saturated constraints equations (2 to 9) into the objective function, the

[8] Adopted from Gracia-Moreno et al. (2005).
[9] Violence is not necessarily decreasing in income.

individual $i$'s maximisation problem can be rewritten as:

$$\max_{n_i,b_i,q_i,a_{ii}} \ln\left((1-q_i)k_i - B_i\right) + \rho \ln n_i + \tau \ln B_i + \alpha \ln((q_i^H)^{\mu}(1-\kappa N_i^{H\gamma} n_i - a_i)^{1-\mu}) + \ln\left(a_{ii}^{\psi_i} a_{jj}^{1-\psi_i}\right) - \theta \ln\left(a_{jj}^{\psi_j} a_{ii}^{1-\psi_j}\right) + Constant.$$

Since the maximisation problem is strictly convex, the first-order conditions (henceforth FOCs) are necessary and sufficient. Assuming that $i$ has egotistic preferences so that the welfare of household members (wife and children) does not depend on his consumption, the FOCs theoretically prove Rao & Bolch (2002) "signalling theory". This theory hypothesises that $i$'s taste in his wife's productive contribution is negatively associated with domestic abuse - if $i$ perceives his wife to be lazy, he will resort to domestic abuse. Also, the parameter associated with female productive time, $q_i^W$, increases the marginal cost of having children, while the parameter associated with a bequest, $B_i$, increases the marginal utility of having children.

Solving for $c_i, B_i, q_i^H, n_i$ and $a_{ii}$ yields closed form solutions given by:

$$B_i = \begin{cases} \frac{\tau(K^W N_i^H + K^H N_i^W)}{N_i^H N_i^W (1+\alpha\mu+\tau)} & \text{for benchmark marriage;} \\ \frac{\tau K^H}{(N_i^H - 1)(1+\alpha\mu+\tau)} & \text{for } \textit{Watta Satta;} \end{cases} \tag{10}$$

$$q_i^H = \frac{\alpha\mu}{1+\alpha\mu+\tau}; \tag{11}$$

$$n_i = \frac{\rho\psi_i}{\kappa N_i^{H\gamma}((1+\alpha(1-\mu)+\rho)\psi_i - \theta(1-\psi_j))}; \tag{12}$$

$$a_{ii} = \begin{cases} \frac{1}{(1+\alpha(1-\mu)+\rho)} & \text{for benchmark marriage;} \\ \left(\frac{\psi_i - \theta(1-\psi_j)}{a_{jj}^{1-\psi_i}((1+\alpha(1-\mu)+\rho)\psi_i - \theta(1-\psi_j))}\right)^{\frac{1}{\psi_i}} & \text{for } \textit{Watta Satta.} \end{cases} \tag{13}$$

**Proposition 2** *(Determinants of Domestic Abuse) Individual i's equilibrium spousal abuse, $a_{ii}$ is a function of: (i) household production parameters $\alpha$ and $\mu$; (ii) fertility $\rho$; (iii) empathy for Watta kin $\theta$; and (iv) the reactive nature $\psi$ of $i$ and $j$.*

*Proof.* See Appendix A.

The partial derivative of abuse, $a_{ii}$ with respect to reactive nature $\psi$ for temperaments of $i$ and $j$ shows the abuse-deterrent motivation in the model. This derivative being positive implies that a recursive abuse cycle will be observed where both individuals use spousal abuse to respond to each other's actions. In the extreme, the limit of this game

is a spouse dying or becoming estranged (Jacoby & Mansuri 2010). Additionally, if both $i$ and $j$ use violence as a response to maltreatment of the *Watta* kin ($\psi_{\cdot} < 0.5$), the equilibrium abuse $a_{ii}$ will be lower compared to the case if they are both susceptive of violence ($\psi_{\cdot} > 0.5$). This mechanism translates into the following lemma:

**Lemma 1** *Equilibrium spousal abuse in a Watta Satta marriage, $a_{ii}$ for given level of $a_{jj} > 0$, is increasing in $\psi_i$ and $\psi_j$.*

*Proof.* See Appendix A.

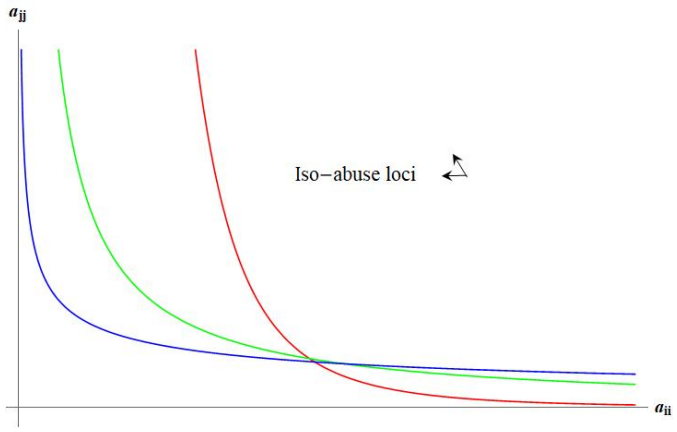
The dynamics of Lemma 1 are presented in Figure 1 , which displays maps of iso-abuse curves. Each curve in panels (a) and (b) represents a constant reactive temperament level in the plane the abuse level $a_{ii}$ x $a_{jj}$. As the iso-abuse curve follows toward the right, abuse by $j$, $a_{jj}$ decreases and abuse by $i$, $a_{ii}$ increases, with the reactive temperament $\psi_i$ remaining constant. The curve exhibits that $a_{ii}$ and $a_{jj}$ have a positive limit for a given level of $\psi$. This limit is interpreted as a minimum level of abuse tolerated/found acceptable in a marriage. Moreover, an increase in the reactive temperament of individual $i$, $\psi_i$ causes an inward upward move from one iso-abuse curve to another in panel (a), while an increase in the $i$'s perception about $j$'s reactive temperament, $\psi_j$ cause the curves to move outwards. This implies that husband $i$ in a *Watta Satta* marriage is less abusive if he exercises abuse as a reaction to $j$'s actions, while a recursive cycle of abuse is likely if he perceives $j$ to be highly reactive.

While panels (a) and (b) assume that $i$ has a fixed level of empathy for his *Watta* kin, panel (c) relaxes this assumption. Panel (c) shows the range of the iso-abuse curves for various levels of $\theta$. It shows that as $\theta$ increases, the level of abuse in both marriages decreases.

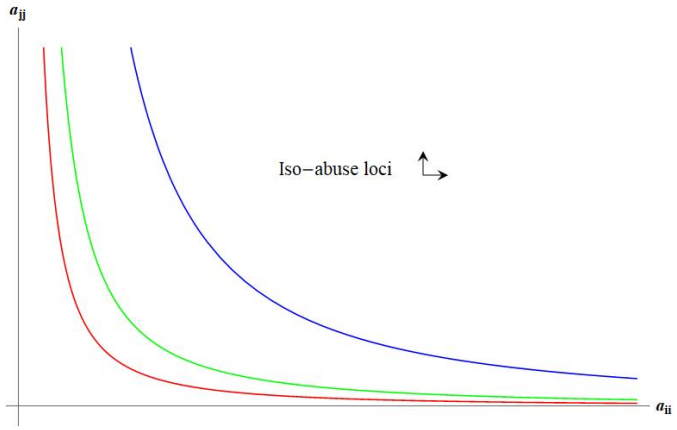
Additionally, Figure 1 also confirms the convexity of abuse for a reactive individual. Equations 12 and 13 show that the *Watta Satta* punishment mechanism affects equilibrium abuse, $a_{ii}$ and fertility decisions, $n_i$. Based on this, the following lemma is proposed:

**Lemma 2** *Equilibrium fertility under Watta Satta, $n_i$, is decreasing in the temperament parameter, $\psi$.*

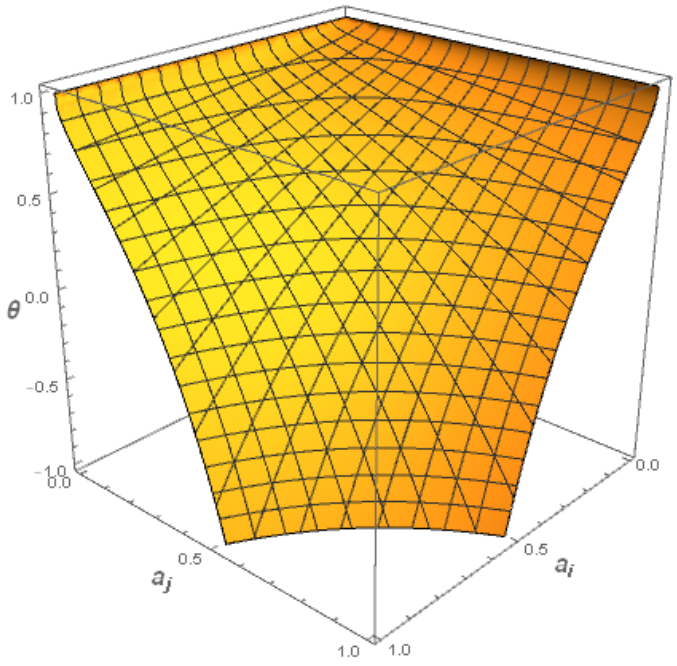
*Proof.* See Appendix A.




(a) Map for increasing $i$'s reactive temperament, $\psi_i$




(b) Map for increasing $i$'s perception of $j$'s reactive temperament, $\psi_j$




(c) Empathy

Figure 1: Map of iso-abuse curves under *Watta Satta*.

The following second-order condition reinforces this conclusion:

$$\frac{\partial^2 a_{ii}}{\partial \psi_i^2} < 0, \quad \frac{\partial^2 a_{ii}}{\partial \psi_j^2} < 0.$$

Individuals, who use spousal violence for reasons beyond the response to the *Watta* kin maltreatment, have a lower number of children compared to individuals who exercise violence just because of maltreatment. A potential reason for this might be that highly abused victims are more likely to develop long-term health problems, hence are more likely to miscarry a child.

# 4 Data

This paper uses cross-sectional data from the Pakistan Rural Household Survey (henceforth PRHS) undertaken in 2004-2005 to test the propositions developed in Section 3. The sample consists of 1,342 married couples from 967 households, with women aged between 15 and 53 years. These randomly sampled households are from 94 villages in 10 districts of the provinces of Sindh and Punjab. The survey has detailed modules on marital history, marriage-related transfers and women's welfare. Table 1 summarises the key characteristics of the sample.

The outcomes, women, being child brides and being victims of spousal abuse, are dichotomous indicators, where 1 means experiencing these outcomes once. Panel 2(a) show the spacial distribution of the domestic abuse reporting in the sampled districts, where the darkest gradient indicates that more than 30 percent of the sample reported being domestically abused by their husbands.
For the indicator child marriage, in the sample being a child bride depends on *Ruqsati* age - an age when a woman moves in with her husband. The sample mean age of *Ruqsati* is 17.58 years. On average, *Watta* brides move in with their husband 1.32 years before a conventional bride.[10] Under the United Nations (2019) definition of child marriage, the summary statistics indicate that, on average, a woman in the sample is a child bride. Panel 2(b) shows that child marriage is more dominant in southern Pakistan, compared to the norther part of the country.

The abuse indicator is constructed by asking women if their husband has exercised extensive margin of physical violence in the past year.[11] Note that this indicator is restricted

[10] *Watta* brides leave natal house at 16.92 years while conventional brides at 18.25.

[11] In this paper, spousal abuse means violent physical actions that include slapping, pushing, being thrown, kicking, choking, burning or being attacked with a weapon and excludes sexual violence (non-

Table 1: DESCRIPTIVE STATISTICS

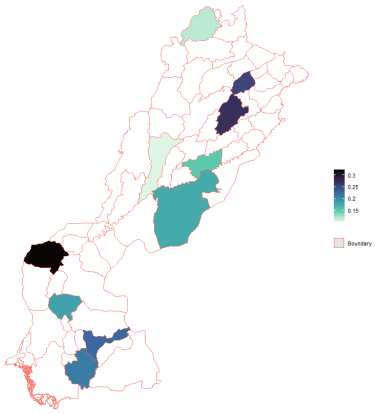
| Variable definition | All women (1) | *WattaSatta* (2) | Non-*WattaSatta* (3) |
|---|---|---|---|
| Woman age of marriage$\leq$ 18 | 0.576 | 0.652 | 0.499 |
| Ever been physically abused by husband | 0.209 | 0.223 | 0.194 |
| Number of brothers $\leq$ 5 years | 0.951 | 1.223 | 0.677 |
| Number of sisters $\leq$ 5 years | 0.826 | 0.829 | 0.824 |
| Number of female cousins related to woman $\leq$ 5 years | 4.487 | 5.406 | 3.562 |
| Endogamy- cousin marriage | 0.700 | 0.753 | 0.646 |
| Husband attended secondary school | 0.159 | 0.123 | 0.196 |
| Age of the woman | 28.28 | 28.130 | 28.42 |
| 0 $<$ Father's holding $\leq$ 100 kanals | 0.362 | 0.327 | 0.398 |
| 100 $<$ Father's holding $\leq$ 200 kanals | 0.042 | 0.048 | 0.037 |
| Father's holding $>$ 200 | 0.049 | 0.043 | 0.055 |
| Received dower | 0.666 | 0.637 | 0.695 |
| Natal family resides locally | 0.590 | 0.669 | 0.511 |
| Number of brother-in-laws | 2.576 | 2.756 | 2.746 |
| 0 $<$ brother-in-law's holding $\leq$ 100 kanals | 0.388 | 0.360 | 0.417 |
| Father-in-law's holding $\geq$ 100 and $<$ 200 kanals of land | 0.064 | 0.064 | 0.064 |
| Father-in-law's holding $>$ 200 kanals | 0.066 | 0.046 | 0.085 |
| Patrilocal residence | 0.583 | 0.568 | 0.598 |
| Number of living daughters | 1.422 | 1.456 | 1.387 |
| Number of living sons | 1.440 | 1.456 | 1.423 |
| Paid worker | 0.200 | 0.199 | 0.200 |
| Relative Autonomy Index | 3.534 | 3.548 | 3.521 |
| Number of observations | 1,342 | 673 | 669 |

in the sense that it does not indicate actual spousal violence, but rather represents self-reported spousal assault rates. The initial analysis of Section 6 does not account for this limitation, though it is formally addressed in Section 7.

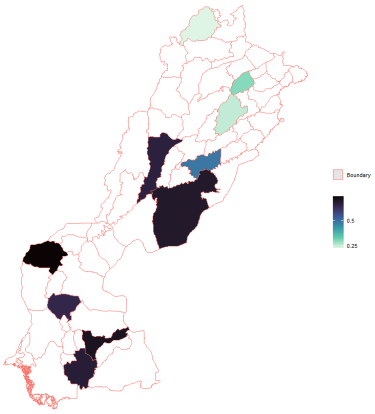
To incorporate husband-related attributes into the analysis, a composite of covariates is employed. These encompass indicators related to the husband's familial background, his kinship ties, and educational attainment. In parallel, the power dynamics within the household are factored in, with the inclusion of covariates encompassing extended family sex composition, dowry exchanges, contributions to domestic production, patterns of fertility, and the configuration of land ownership.

The classification of land ownership, as defined by three binary indicators, holds particular significance due to its implication on wealth-related factors. According to classifications derived from sources such as the State Bank of Pakistan (2003) and Saquib et al. (2016), households with land holdings less than one hundred kanals are categorized as

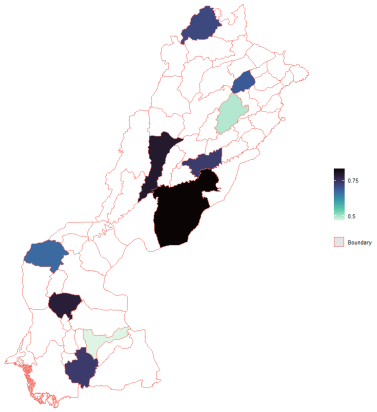
consensual sex), verbal threats, and coercive psychological acts.



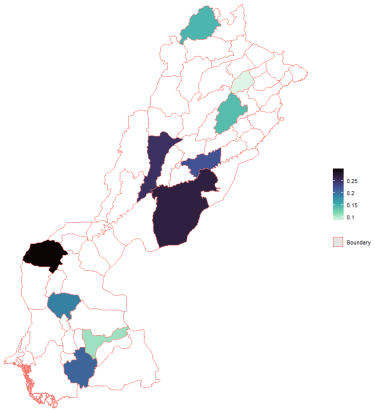
((a)) Domestic Abuse



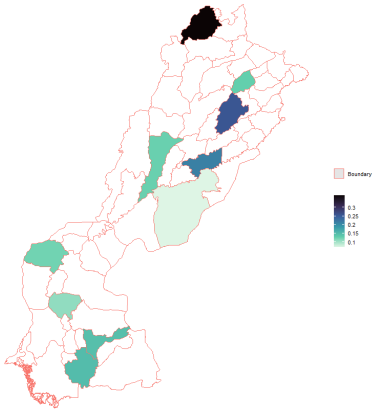
((b)) Child Marriage



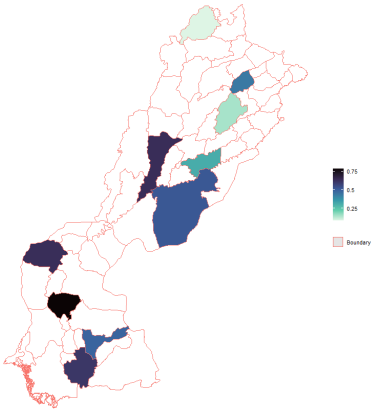
((c)) Endogamy- First Cousin



((d)) Paid Worker



((e)) Husband has secondary education



((f)) Watta Satta

Figure 2: Spacial Maps of the Survey Districts

lower-subsistence, while those with holdings ranging from one hundred to two hundred kanals fall within the upper-subsistence category. Non-subsistence holdings are defined as those exceeding two hundred kanals. Throughout the analysis, these three categories are juxtaposed with the baseline scenario of landless households for comparative evaluation.

*Watta Satta* categorisation is directly observed in the PRHS where 50.15 per cent of respondents categorised themselves as *Watta* brides while 49.85 per cent were "conventional". The spatial distribution map panel 2(f) shows that *Watta Satta* is a relatively more dominant practice in central Sindh than compared to Punjab. For the variable "endogamy", this paper only considers maternal or paternal first cousin as a blood relative. Literacy indicators show that only 15.9 per cent of men have a secondary education or higher while 17.1 per cent of women have ever attended school. Out of the school-going women, 74.63 per cent have some primary and 97.43 have both secondary and primary education. Only 12.79 per cent of *Watta* brides have some form of school attendance.

The number of wife's siblings and father's landownership profile accounts for natal family attributes. Since there is a direct correlation between wedding transfers and outcomes of child brides and spousal abuse, the analysis also incorporates dowry and dower. The marital transfers section of the PRHS details that all women received a type of dowry. For example, 61.70 per cent of women report having received gold, while 17.92, 98.62 and 4.60 per cent received silver, household goods and cash, respectively. Besides dowry, at the time of marriage, the dower is also exchanged.[12] Table 1 reports that 66.6 per cent of women in the sample received some dower in the form of either gold, silver, household goods or cash.

Ex-post marriage covariates relevant to the analysis include household structure indicated by virilocity and matrilocality. The number of living sons and daughters represents fertility behaviour. A woman's decision-making autonomy is controlled by constructing an index from the decision-making section of PRHS. To gauge autonomy, women score decision agency for fertility, consumption and socialising decisions on a scale of 1 to 5, where 1 means complete autonomy. The index used in the estimation is a log sum of these responses as it responds to the distributional skewness towards large values; i.e., cases in which one or more women's total scores are much larger than the bulk of the respondent.

The binary indicator of women being able to partake in the paid labour market indicates women's productive contributions. Summary statistics show that 20 per cent of the sampled women participate in paid labour activities with no difference between *Watta*

[12]Typical to traditional Islamic marriages, the dower is insurance paid to the bride in case of divorce or death of the husband (Anderson 2007).

*Satta* and non *Watta Satta* women. On average, the surveyed women earned less than 0.261 US Dollars (based on the 2004 US dollar exchange rate) per day, with *Watta Satta* brides earning 0.227 US Dollars a day. Panel 2(d) shows that from the sampled districts the regions located in the central part of Pakistan have a higher percentage of women involved in paid labour activities.

# 5 Empirical Strategy

## 5.1 Econometric Strategy

Following Jacoby & Mansuri's (2010) notation, let $\zeta$ represent the unobserved statehood in a marriage. The latent variables - child bride *(c)* and spousal abuse $(a)$ are denoted by binary indicators $y_o$, where $o = c$ and $a$. A system of equations is estimated, with the $o$th equation being of form

$$y_o = 1(\beta_o \zeta + \mathbf{X}\xi_o + u_o > 0), \tag{14}$$

where $\beta_o > 0$, $\mathbf{X}$ is a matrix of exogenous characteristics. Here the error term $u_o$ is i.i.d and is uncorrelated with the diagonal of a covariance matrix. The variable of interest is *Watta Satta*, which has the following indicator function

$$\zeta = \eta WS + \epsilon. \tag{15}$$

Here $\epsilon$ is the error terms with variance $\sigma^2_\epsilon$.[13] Proposition 1 and empirical content is embodied in parameter $\eta$. Substituting 15 into 14 leads to

$$y_o = 1(\eta_o WS + \mathbf{X}\xi_o + \nu_o > 0), \tag{16}$$

where $y_o$ is a vector of the dependent variable, $\eta_o = \beta_o \eta$ and $\nu_o = \beta_o \epsilon + u_o$. Since the magnitude of $\eta$ is not of direct interest, the null hypothesis $(\eta = 0)$ is tested against $\eta < 0$, by looking at each of the $\eta_o$ (since $\beta_o > 0$) for the two structural equations.

An individual's ability and willingness to participate in this custom also depend on the latent variables' personal and cultural factors. Jacoby & Mansuri (2010) conclude that *Watta Satta* is prevalent in households where women have low status, and thus are more likely to be poorly treated. This conclusion is applied to the likelihood of being a child bride and hypothesised that a lower status of women also implies that parents view

[13] Without loss of generality $\mathbf{X}$ has been left out from equation 15.

unmarried daughters as a liability and uneconomic consumers. Therefore, households are motivated to marry daughters closer to menarche age than the legal age. Having child brides means natal families can divert resources to a more profitable agent (namely sons and their spouses), as the daughter/bride is no longer their financial responsibility.

The direction of violence in a *Watta Satta* contract compared to a baseline marriage is uncertain from the theoretical model. In this instance, Proposition 2 is insightful as it suggests that domestic abuse, $a_i$ is impacted by the type of reactive nature, $\psi$ for $i$ and $j$, and level of male empathy, $\theta$. Hence, it is reasonable to believe Jacoby & Mansuri (2010) conclusion that a selection into *Watta Satta* is based on some latent variable that also affects marital discord and age of marriage.

To address the endogeneity or selection problem, *Watta Satta* is governed by a 'first stage' equation given by

$$WS = 1(\mathbf{Z}\pi + \omega > 0), \tag{17}$$

where $\mathbf{Z}$ are the instruments and $\omega = \beta_w \epsilon + \Upsilon$ is the disturbance term.[14] The instruments and disturbance for the two reduced form equations $o$ are uncorrelated.

For these estimations, $\nu_o$ and $\omega$ are assumed to be normally distributed, with equations 16 and 17 being simple probit conditional on $\epsilon$. Tantamount to Jacoby & Mansuri (2010), $\epsilon$ is modelled nonparametrically using discrete factor approximation where coefficients are estimated jointly by maximum likelihood.[15] Benefits of using discrete factor approximation with maximum likelihood are: (i) that it controls for sample selection biases (see Keane et al. 1988); and (ii) when disturbances are not normally distributed, discrete factor approximations perform better than regular maximum likelihood estimators that assume joint normality (Moroz 1999).

### 5.2 Identification

Jacoby & Mansuri (pg. 1817, 2010) build their first stage on the argument that

> "... having an older brother ... increases the likelihood of the woman's entering *Watta Satta* (bride exchange). Likewise, a woman's sisters, particularly older

[14] The disturbance terms $\Upsilon$ and $u_o$ are assumed to be mutually uncorrelated.

[15] Since gradient-based algorithms fit probit estimation better (see Zheng & Liu 2012), the maximum likelihood estimation uses the Broyden, Fletcher, Goldfarb & Shanno (henceforth BFGS) algorithm. This algorithm is a class of quasi-Newton optimisation methods with the added benefit of being simple and less computationally expensive than Newton-Rap. Additionally, to avoid getting trapped in local minima or maxima, the estimates are also confirmed using Kirkpatrick et al.'s (1983), Simulated Annealing algorithm (henceforth SANN). The estimates under SANN and BFGS are identical and are reported in Table 2.

ones not too far away in age will be competing with her for an available brother to form a *Watta* so that the probability declines as the number of close older sisters increases."

Section 2.1 establishes that this argument is valid for only "one-for-one" brother-sister exchange, but it fails to account for other combinations of *Watta Satta* pairs such as cousin-cousin. This paper accounts for this variation by incorporating extended household members like maternal and paternal first cousins as additional instruments. The intuition of this remains the same as the likelihood of a woman/girl entering *Watta Satta* contract is increasing in the number of older but not too far away in age female cousins. This number positively increases *Watta Satta* selections due to the consanguineous marriage culture and that these female cousins can act as potential counterpart brides for the *Watta* contract. The female cousin instrument does not distinguish between maternal and paternal cousins; instead is based on an aggregate number reported.[16]

The estimated system of equations has uniform specifications with a uniform set of instruments- wife's number of brothers$\geq$ 5 years, wife's number of sisters $\geq$ 5 years and wife's number of female cousins $\geq$ 5 years. Based on the preferences presented in Section 2 and the model developed in Section 3, the first-stage equation for *Watta Satta* (equation 17) controls for husband characteristics like being kin, education level, number of brothers and household landholding categorisation. The natal family living locally and being from a patrilocal residence indicate residential dynamics. Dower accounts for marital transfers. For women's natal family characteristics, the categorisation of the father's landholding is included in the specification.

# 6 Results

## 6.1 First Stage

Columns (1) and (4) of Table 2 report the determinants of *Watta Satta*. Diagnostic tests show that the instruments - number of brothers, sisters and female cousins $\leq$ 5 years are not weak. The Wald test reports a $\chi^2$ value of 22.105 with a $p$-value $\leq$ 0.000.[17] The results are estimated by nonparametric full information maximum likelihood with three-point support for finite mixture distribution. The difference between the two models is

[16]Total number of male cousins and male cousins who are less than five years older than a woman, both are not significantly correlated with *Watta Satta* in the sample. Hence it is not a considered instrument.

[17]Wald test is conducted in a linear probability specification.

that Model I assumes no selection bias while Model II accounts for it. The selection bias is ignored by restricting the correlation between first stage *Watta Satta* residuals with residuals from $y_a$ and $y_c$, to zero ($\beta_o = 0 \Rightarrow corr(\nu_o, \omega) = 0$). The log-likelihood test confirms that there is indeed a selection bias ($\chi^2 = 27.273$ with $p < 0.000$), hence Model II is preferable to I. With the inclusion of the two error correlations in Model II, the precision of the estimates improves, especially for three instruments for *Watta Satta*. Additionally, the coefficients are estimated in a probit, hence the magnitude is not straightforward to interpret. The purpose of this section's estimates is to identify and understand significant covariates, which will be used in Section 10 to propose and test policy recommendations. Hence, the significance and sign of the coefficient in table 2 are only of interest.

The estimates indicate that having brothers, sisters and female cousins $\leq 5$ years increases the likelihood of a woman entering a *Watta Satta* marriage. The estimate about brothers has a consistent positive sign in the two specifications and confirms the Proposition 1. In the case of sisters, the increasing *Watta Satta* likelihood is attributed to "one-groom- to- many- brides" *Watta Satta* contracts. It also corresponds to a natural sex ratio in children. That is since post-natal sex selection (both infanticide and abortions) is religiously condemned, couples use fertility-stopping rules as a means to implement son partiality. To obtain the desired number of male heirs, households will have higher fertility without the distorting natural sex ratio (Almond et al. 2013). A repercussion of children's sex composition being close to the natural sex ratios is that more daughters will be available for an exchange marriage. In other words, sisters in a similar age cohort do not compete for a given marriage contract but rather can be part of the same *Watta Satta* contract. Additionally, this argument is also true for female cousins $\leq 5$ years. Having more female cousins in a similar age cohort increases the likelihood of a woman entering a *Watta Satta* marriage is attributed to a patrilocal residence where extended family members cohabit. With increased household membership, female cousins residing in the same residence act as complimentary brides for consanguineous and non-consanguineous *Watta Satta* contracts.

Additionally, a woman's father having a holding larger than 200 kanals reduces her likelihood for exchange marriage selection, while men being members of economically landed households increases it. These results further confirm Proposition 1, in the sense that the size of a man's expected bequests, $k_i$ motivates exchange marriage. Furthermore, it indicates a presence of income effects in men's marriage type selection - wealthier households opt for exchange marriage to prevent estate fragmentation during inter-generational transfer.[18] The magnitude, sign and significance of the dower indicator also support this

[18]To partial out the impact of income, all estimations have district dummies.

hypothesis, that men who can afford to pay religiously sanctioned dower to their wives are more likely to select a *Watta Satta* marriage.

### 6.2 Main Results

The remainder of Table 2 summarises estimation results of the outcomes given by being a child bride ($c$) and ever abused ($a$) under the two econometric restrictions. Since there is a presence of selection bias, all interpretations are of model II estimates.

The coefficients associated with the odds of being in a child marriage indicate that a husband's demographic profile significantly influences the likelihood of being a child bride. Men who are educated, not residing with their parents, and from economically landed households opt for adult brides. The negative correlation between a natal family residing locally and being a child bride signals a preference for adult brides in local emigrants and men from non-subsistence households.

In support of Lane 2011, Nasrullah et al. 2014a and Nasrullah et al. 2014b, the estimates confirm that *Watta Satta* increases the likelihood of being a child bride. Since *Watta Satta* contract is based on a bride's demand for an older male relative, early marriage is a consequence of (i) a man's desire for marriage because he is of age; (ii) households' preference for cost-saving via single marriage ceremony for all *Watta* participants; and (iii) increased likelihood to bear son as the number of fertile years in women increases.

Estimates show that child brides have more daughters, which is caused by an increased fertile time in women and a wife's lack of agency in fertility decisions. This conclusion is further supported by the magnitude and the sign of the relative autonomy index, where a third of the questions in the survey concern fertility decisions.

For the abuse outcome, columns (3) and (6) show the likelihood of acknowledging spousal abuse under the two specifications. Here it is assumed that there is no censoring by the respondent, nor there is misclassification of the abuse outcome and that non-acknowledgement of abuse is the absolute truth.

Overall, there is a strong indication that women from and married into highly subsist households are more prone to domestic abuse than landless and non-subsistence households (land holdings $>$ 200 kanals). Likewise, the significance and magnitude of the dower also give credence to this hypothesis - men, who can afford to pay the dower, are less likely to abuse their wives. Alternatively, the dower-abuse correlation also means that men who fulfil dower religious obligations are less likely to abuse their wives.

Moreover with the exception of latent psychological parameters ($\theta, \psi_i$ and $\psi_j$), Proposition 2 is confirmed by Table 2. Irrespective of the selection bias, domestic production

Table 2: RESULTS

| | Model I | | | Model II | | |
|---|---|---|---|---|---|---|
| Variable | *WS* | *c* | *a* | *WS* | *c* | *a* |
| Endogamy- cousin marriage | -0.015 | -0.071 | 0.038 | -0.002 | -0.072 | 0.04 |
| | ( 0.084 ) | ( 0.094 ) | ( 0.032 ) | (0.094) | (0.095) | (0.032) |
| Husband has secondary education | 0.078 | $-0.293^{**}$ | -0.14 | 0.077 | $-0.289^{**}$ | -0.146 |
| | ( 0.098 ) | ( 0.128 ) | ( 0.091 ) | (0.102) | (0.13) | (0.094) |
| Natal family resides locally | $-0.426^{*}$ | $-0.256^{***}$ | -0.123 | $-0.423^{*}$ | $-0.271^{***}$ | -0.104 |
| | ( 0.228 ) | ( 0.092 ) | ( 0.175 ) | (0.229) | (0.093) | (0.182) |
| Patrilocal residence | -0.163 | $-0.205^{**}$ | $-0.379^{**}$ | -0.194 | $-0.211^{**}$ | $-0.399^{**}$ |
| | ( 0.180 ) | ( 0.089 ) | ( 0.182 ) | (0.171) | (0.091) | (0.184) |
| 0 < Father's holding ≤ 100 kanals | $-0.500^{**}$ | -0.036 | 0.204 | $-0.523^{**}$ | -0.046 | $0.211^{*}$ |
| | ( 0.211 ) | ( 0.096 ) | ( 0.138 ) | (0.204) | (0.099) | (0.114) |
| 100 < Father's holding ≤ 200 kanals | $-0.741^{***}$ | 0.380 | $0.234^{***}$ | $-0.781^{***}$ | 0.353 | $0.261^{***}$ |
| | ( 0.245 ) | ( 0.206 ) | ( 0.036 ) | (0.242) | (0.22) | (0.045) |
| Father's holding > 200 kanals | $-0.433^{**}$ | 0.122 | $-0.127^{***}$ | $-0.481^{**}$ | 0.133 | $-0.13^{***}$ |
| | ( 0.207 ) | ( 0.216 ) | ( 0.038 ) | (0.201) | (0.225) | (0.039) |
| Number of sons | −0.300 | 0.026 | $0.028^{***}$ | $-0.342^{*}$ | 0.029 | $0.027^{***}$ |
| | ( 0.197 ) | ( 0.034 ) | ( 0.008 ) | (0.191) | (0.035) | (0.009) |
| Number of daughters | -0.179 | $0.065^{**}$ | -0.043 | -0.202 | $0.065^{*}$ | -0.033 |
| | ( 0.202 ) | ( 0.033 ) | ( 0.082 ) | (0.19) | (0.033) | (0.084) |
| Watta Satta | | 0.109 | −0.120 | | $0.184^{*}$ | -0.121 |
| | | ( 0.088 ) | ( 0.095 ) | | (0.099) | (0.098) |
| 0 < Father-in-law's holding ≤ 100 kanals | 0.084 | 0.085 | $4.497^{***}$ | 0.046 | 0.09 | $4.53^{***}$ |
| | ( 0.188 ) | ( 0.095 ) | ( 0.875 ) | (0.18) | (0.097) | (1.182) |
| 100 < Father-in-law's holding ≤ 200 kanals | 0.013 | -0.308 | $0.228^{**}$ | 0.002 | -0.347 | $0.235^{**}$ |
| | ( 0.214 ) | ( 0.201 ) | ( 0.090 ) | (0.23) | (0.216) | (0.1) |
| Father-in-law's holding > 200 kanals | $1.149^{***}$ | $-0.385^{*}$ | $-0.226^{**}$ | $1.207^{***}$ | $-0.379^{*}$ | $-0.237^{**}$ |
| | ( 0.181 ) | ( 0.211 ) | ( 0.110 ) | (0.282) | (0.226) | (0.115) |
| Number of brothers-inlaws | 0.066 | -0.011 | 0.098 | 0.088 | -0.014 | 0.114 |
| | ( 0.217 ) | ( 0.024 ) | ( 0.086 ) | (0.239) | (0.025) | (0.096) |
| Relative Autonomy Index | $0.681^{***}$ | $0.396^{***}$ | -0.058 | $0.707^{***}$ | $0.401^{***}$ | -0.053 |
| | ( 0.198 ) | ( 0.146 ) | ( 0.086 ) | (0.23) | (0.148) | (0.092) |
| Dower | $0.836^{***}$ | $-0.024^{*}$ | $-2.048^{***}$ | $1.034^{***}$ | -0.032 | $-2.078^{***}$ |
| | ( 0.224 ) | ( 0.088 ) | ( 0.220 ) | (0.282) | (0.089) | (0.254) |
| Paid worker | $0.967^{***}$ | 0.179 | $-0.175^{*}$ | $0.879^{***}$ | $0.186^{*}$ | $-0.17^{*}$ |
| | ( 0.201 ) | ( 0.100 ) | ( 0.091 ) | (0.291) | (0.104) | (0.094) |
| Number of brothers ≤ 5 years | $1.008^{***}$ | | | $1.076^{***}$ | | |
| | ( 0.200 ) | | | (0.295) | | |
| Number of sisters ≤ 5 years | $1.189^{***}$ | | | $1.238^{***}$ | | |
| | ( 0.206 ) | | | (0.316) | | |
| Number of female cousins ≤ 5 years | $1.091^{***}$ | | | $1.170^{***}$ | | |
| | ( 0.197 ) | | | (0.306) | | |
| Corr($\eta, \nu_o$), $o = c, a$) | | | | | $0.005^{***}$ | 0.001 |
| | | | | | -0.002 | (0.003) |
| Corr($\nu_c, \nu_a$) | | | $0.002^{***}$ | | | $0.028^{***}$ |
| | | | (0.000) | | | (0.001) |
| Log Likelihood | | -2113.079 | | | -2110.889 | |
| AIC | | 4408.158 | | | 4405.778 | |

Notes:

[a] Standard errors in parentheses. Significant codes: *p<0.1; **p<0.05; ***p<0.01.

[b] Estimation sample is 1,342 women. All reported specifications control for log age of women and include district dummies.

[c] Model I and Model II are joint estimates of the two marital discord indicator equations- child marriage ($c$) and domestic abuse ($a$) is by nonparametric FIML with three points support for the finite mixture distribution.

[d] In Model I, residual correlations between first-stage *Watta Satta* and second-stage ($y_c$ and $y_a$) is restricted to zero, while Model II allows them to be free.

and fertility influence abuse outcomes. The sign of women being paid workers supports the "bargaining theory" to domestic abuse (see Tauchen et al. 1991 and Farmer & Tiefenthaler 1991), where a husband bribes his wife into accepting some level of physical violence by offering her payments as compensation. The estimate shows that a woman having an income reduces the likelihood of abuse; hence by not accepting a husband's abuse-related bribe, women will experience lower abuse.

Another interpretation of this result is that women receive better treatment in households where they have a measured productivity contribution via wages. In a household where women earn wages, abuse is less likely due to the higher bargaining power of the wife due to her financial independence. However, given the gender wage gap and women being part-time rural workers, a woman's contribution is marginal if not minuscule compared to a husband's.[19] The large wage gap between spouses is a potential explanation for the negative correlation between the likelihood of abuse and women's paid labour. That is, the Pakistani rural spousal wage differential is so significant that a husband is not insecure about his wife's financial contribution and independence.

Additionally, the likelihood of an abused woman is positively correlated to her having more sons. This correlation is interpreted as: (i) for a given level of natural sex ratios, more sons mean higher fertility (total number of children is high); and (ii) more son implies that the household has a son preference, i.e., keep on having children until the desired number of son are achieved.

The estimates also indicate that the likelihood of domestic abuse decreases in patrilocal households. A possible explanation of the negative correlation is censoring abuse response by the victim due to a lack of trust or inlaws' arbitrating marital discord. Overall, the role of inlaws in spousal altercations is not clear as inlaws either can be peacekeepers or disciplinarians on behalf of the spouse. Niaz (2004) finds that 70 per cent of respondents never acknowledge abuse in metropolitan areas and 43 per cent of suicidal women have a conflict with inlaws. These numbers identify a standard problem within this literature, hence Section 7 attempts to account for under-reporting and checks for the robustness of these conclusions.

Lastly, households, where women have a lower status, are likely to opt for child brides and have a higher likelihood of abuse after marriage. The point estimates suggest this as the underlying residual correlations, $corr(\nu_a, \nu_c)$ are positively significant. Additionally, $corr(\epsilon, \nu_c)$ is estimated to be positively significant.

[19] Even though the proportion of women's financial contribution in aggregate household income is unknown, on average working women earn 0.261 USD per day. A husband's income is calculated in this instance as a majority work on family farms.

# 7 Under reporting and Censoring of Abuse

Marital violence literature is frequently limited by the issue of under-reporting and censoring by the victim. (see Chin et al. 2017 and Palermo et al. 2014). The reasons attributed to this include shame, stigma, retaliation, loss of children (Gracia-Moreno et al. 2005), cultural beliefs (Wolf et al. 2003) and/or perception of the normalcy of marital violence (Fugate et al. 2005). It is reasonable to assume that the aforementioned motivators are applicable to Pakistan's case as well.

Response under-reporting and censoring is an important consideration for policy evaluation as it leads to biased results via the following mechanisms: (i) self-censoring by respondents; and (ii) censoring by the interviewer during the interview and/or data entry. This section accounts for these biases and checks for the robustness of Section 6.2 conclusions by running Efron's (1981) censoring bootstrap to account for the respondent self-censoring and by introducing Hausman misclassification indicator (see Hausman et al. 1998) to address censoring and misclassification by the interviewer.

## 7.1 Self-Censoring by the Respondents

Using the Efron (1981) empirical bootstrap technique for right-censored data, the system of equations under Model II is replicated 1400 times. Figure 4 shows the stability of the estimates at a 95 per cent confidence level. Overall, all estimates of Model II fall between the 95 per cent confidence bands irrespective of their significance in the initial estimates.

The confidence intervals indicate that after correcting for self-censoring, women who received a dower, live with their inlaws, earn wages and have husbands from landed families (father-in-law's holding $\geq$ 200 kanals) are less likely to be victims of domestic abuse. Additionally, the small confidence range for the number of sons shows that sons' impact on the probability of spousal abuse remains consistent with a stable magnitude.

The 1400 bootstrap replications can also be used to check the robustness of the outcomes *Watta Satta* and being a child bride. The three instruments for *Watta Satta* are found to be consistent in significance and direction of correlation, i.e., the number of brothers, sisters and female cousins $\leq$ 5 years increases the likelihood of entering a *Watta Satta* contract. Additionally, the estimate for father-in-law's holding $>$ 200 kanals having a positive confidence interval reinforces the plausibility of Proposition 1 pertaining *Watta Satta* selection criteria. For the negative correlation between the father's holding size and *Watta Satta*, 1400 replications with replacement do not change the direction of this correlation.

For odds of being a child bride, the results are within 95 per cent confidence bands, with the sign being similar to the estimates of Table 2. The strictly negative interval range of a father-in-law's holding $> 200$ kanals indicates the presence of strong wealth effects. Also, the result of a husband having an education and being an internal migrant reduces his selection of a child bride and remains robust after 1400 replications.

### 7.2 Response Censoring by the Interviewer

To assess the empirical implication of response censoring by the interviewer, the Hausman et al. (1998) estimator is used to correct misclassified 1s of domestic abuse recorded as 0s. Here, the probability of misclassification, $\iota$ depends on the domestic abuse indicator, $\widetilde{y}_i^a$ and is independent of the covariates $\mathbf{X}_i$. This translates into a probability function

$$\iota_1 = Pr(y_i^a = 0 | \widetilde{y}_i^a = 1),$$

where $\iota_1$ is the probability of a 1 being misclassified as a 0. Given that misclassification of 0s being reported as 1s is ignored, the probability of domestic abuse becomes

$$Pr(y_i^a = 1 | \mathbf{X}_i) = (1 - \iota_1) F(\mathbf{X}_i' \xi_a), \tag{18}$$

which collapses into a reduced form expression $F(\mathbf{X}_i' \xi_a)$ when there is no misclassification. Identification conditions for $(\iota_1, \xi_a)$ are similar to those for the traditional binary choice model with $\iota$ being monotonic ($\iota_1 < 1$) (Hausman et al. 1998).

Equation 18 is substituted into the system of equation and estimated in a maximum likelihood setup similar to that of Model II in Section 6. Table 3 shows that there is no misclassification in the data as the $\iota_1$ is insignificant. Furthermore, the significance and sign of the estimates of Model II do not change with the addition of the Hausman indicator (refer to Table 6 for more details).

Table 3: MISCLASSIFICATION OF DOMESTIC ABUSE

| | |
|---|---|
| Misclassification indicator, $\iota_1$ | 0.150 |
| Standard Error | (0.571) |
| Log-likelihood | -2109.059 |

# 8 Structural Estimation

Since the results of the previous sections are rigorously robust, the data is used to estimate $i$'s latent preferences as outlined in Proposition 2. This section does this by re-estimating Model II with the preference parameters to identify the correlation of $i$'s latent preferences to the abuse outcome. These estimates are essential to the remaining analysis as they aid in assessing the viability of abuse prevention policy interventions.

## 8.1 Maximum Likelihood Function

Amount of spousal violence, $DA_i$ exercised by $i$ is correlated with all the model II covariates estimated in Section 6.2 and has the functional form

$$DA_i = \mathbf{X}_i\xi + \nu_i. \tag{19}$$

Using equation 13, the equilibrium level of spousal violence depends on $i$'s preferences which are unobserved by the econometrician. A woman reports spousal abuse ($y_i^a = 1$) if the amount of violence exercised by her husband is equal or greater than the equilibrium level $a_{ii}$,

$$y_i^a = \mathbb{1}\{DA_i \geq a_i\},$$

where $\mathbb{1}\{\cdot\}$ is the indicator function for reporting spousal abuse that equals 1 if its argument is true and 0 otherwise. As Section 7.2 finds that the estimates do not suffer from misclassification and censoring, it is assumed that reporting abuse is monotonic to actual abuse. This implies that a woman experiences/tolerates some form of abuse in a marriage where she will report if a husband is more violent than her tolerance level. Here tolerance level of minimum marital abuse is given by equation 13.

$$\begin{aligned} Pr(y_i^a = 1) =& Pr(DA_i \geq a_{ii}) \\ =& Pr(DA_i \geq a_{ii}|WS_i = 1) + Pr(DA_i \geq a_{ii}|WS_i = 0), \end{aligned} \tag{20}$$

where the latter follows from the law of total probability. Substituting $a_{ii}|WS_i = 0$ and $a_{ii}|WS_i = 1$ from equation 13 into equation 20 yields

$$\begin{aligned} Pr(y_i^a = 1) =& Pr\{\mathbf{X}_i\xi \geq \left(\frac{(\psi_i - \theta(1-\psi_j))a_{jj}^{\psi_i - 1}}{(1+\alpha(1-\mu)+\rho)\psi_i - \theta(1-\psi_j)}\right)^{\frac{1}{\psi_i}}\} Pr(WS = 1) \\ &+ Pr\left(\mathbf{X}_i\xi \geq \frac{1}{1+\alpha(1-\mu)+\rho}\right)(1 - Pr(WS = 1)). \end{aligned} \tag{21}$$

By plugging in a distributional specification of $DA_i$ into equation 21, the following probability of a wife reporting abuse is obtained

$$Pr(y_i^a = 1) = \Phi(h_1(\delta, X))\Phi(h_3(\pi, Z)) + \Phi(h_2(\delta, X))(1 - \Phi(h_3(\pi, Z))) = H(\delta, \pi, X, Z), \tag{22}$$

where $X$ and $Z$ are vector of covariates for domestic abuse and *Watta Satta* from Section 6.2 respectively, $\delta = [\alpha, \xi, \mu, \psi_i, \psi_j, \rho, \theta, \sigma]$ and $\pi$ are set of parameters and $\Phi(\cdot)$ is a cumulative distribution of the standard normal. The function $h_\ell(\cdot)$, $\ell = 1, 2, 3$ appearing in equation 22 are defined by

$$\begin{aligned} h_1(\delta, X) = &\ \tfrac{1}{\sigma}(\mathbf{X}_i\xi - \left(\tfrac{(\psi_i - \theta(1-\psi_j))a_{jj}^{\psi_i - 1}}{(1+\alpha(1-\mu)+\rho)\psi_i - \theta(1-\psi_j)}\right)^{\frac{1}{\psi_i}}), \\ h_2(\delta, X) = &\ \tfrac{1}{\sigma}(\mathbf{X}_i\xi - \tfrac{1}{1+\alpha(1-\mu)+\rho}), \\ h_3(\pi, Z) = &\ \mathbf{Z}_i\pi. \end{aligned}$$

Equation 22 is jointly estimated as a part of a system of equations in a maximum likelihood.[20] The estimated structural parameters are the relative importance of the household produced good, $\alpha$; externality strength of spouses' contribution to domestic production, $\mu$; preference in children, $\rho$; empathy for *Watta Satta* sister, $\theta$ and reactive measure for exercising violence by *Watta* inlaws $\psi_i$ and $\psi_j$; and the standard deviation of spousal abuse, $\sigma$.

### 8.2 Results

Table 4 reports maximum likelihood estimates where parameters, the standard deviation for abuse $\sigma$ and $\psi_j$ are fixed to get meaningful estimates.[21] The parameter $\alpha$ is regarded as individual $i$'s "perception" of household goods, $Q_i$. Overall, the likelihood of domestic abuse declines as $\alpha$ increases, implying that improved perception about household goods/contributions leads to a reduced likelihood of abused wives. Since that $Q_i$ is a composite function of time allocated to unpaid labour by $i$, $q_i^H$ and a wife's productive time spent for paid labour and housework, $q_i^W$, it is ambiguous to say whether $i$'s use of violence is a repercussion of him not wanting to contribute to housework or his perception of his wife is being unproductive.

Moreover, estimated negative $\alpha$ shows evidence supporting the "signalling theory" devel-

[20] The number of observations reduces to 922 from 1342 due to the additional parameter of $a_{jj}$. In PRHS (2004), abuse outcomes for matched *Watta Satta* pairs are available. The loss of observations is due to missing data concerning *Watta* counterpart, $j$.

[21] The value is iteratively determined with the highest log-likelihood value.

oped by Bloch & Rao (2003). The estimates show that an average abusive husband $i$ has a negative perception/ disutility associated with home-produced household goods, $Q_i$ and uses violent acts as a signal to communicate dissatisfaction to his wife. This result, in conjunction with the negative correlation between a woman being a paid worker and abuse likelihood (see Table 2), also signals that the source of $i$'s dissatisfaction is from the time invested in home-produced household good $q_i^H$ and not from his wife's time allocation for home production and economic labour $q_i^w$. Thus, it remains unclear if an abusive $i$'s dissatisfaction is due to him not wanting to contribute to domestic production or just having a negative perception about his unpaid contribution.

Furthermore, the externality of a husband's domestic production contribution $\mu$ further clarifies this abuse as a repercussion of a husband's dissatisfaction with housework. The positive significance and marginal effects of $\mu$ suggest that, on average, an abusive $i$'s wife's contribution to household production has a higher relative externality than his contributions. This indicates that $i$ perceives his wife to have a natural disposition and temperament for housework, making her more efficient at home production. However, further investigation is required to conceptually disentangle the nature of marital household contributions as it is outside the scope of this paper. In the context of domestic abuse, $\mu$ combined with a negative $\alpha$ imply that an average abusive man has a strict view about his wife's marital role, i.e., a woman's contribution to a marriage fulfils household responsibilities and bears children. The stronger this perception is, the more likely a husband is abusive.

Table 4: Structural FIML estimates

| Parameter | Name | Estimate | Marginal Effect |
|---|---|---|---|
| St. Dev for abuse | $\sigma$ | 3.341 | 1.333 |
| Importance of home-produced production | $\alpha$ | $-0.652^{***}$ | -0.260 |
| | | (0.034) | |
| Externatlity of a man's contribution to domestic production | $\mu$ | $0.074^{**}$ | 0.030 |
| | | (0.032) | |
| Empathy | $\theta$ | $0.383^{***}$ | 0.153 |
| | | (0.142) | |
| Preference for children | $\rho$ | $0.500^{**}$ | 0.195 |
| | | (0.247) | |
| Reactive temperament to violence of $i$ | $\psi_i$ | $0.294^{***}$ | 0.117 |
| | | (0.497) | |
| Perception about $j$'s reactive temperament to violence | $\psi_j$ | $-0.028$ | $-0.284$ |
| Log Likelihood | | -861.999 | |
| Number of observations | | 922 | |

Asymptotic standard errors in parenthesis. Significant codes: $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01.

The psychological parameter for sibling empathy, $\theta$ is positively significant in the abuse likelihood. The positive $\theta$ implicates dis-utility and emotional dissonance $i$ feels if his *Watta* kin gets abused and hence is a deterrent to being abusive to his wife. Even though Table 2 estimates fail to establish a correlation between *Watta Satta* and the likelihood of spousal abuse, the significance and magnitude of $\theta$ is aligned with the conclusions of Jacoby & Mansuri (2010) of *Watta Satta* having a negative effect on the likelihood of spousal abuse.

Individual $i$'s reactive temperament to violence $\psi_i$ confirms that he uses spousal abuse as a reaction to maltreatment of his *Watta* kin. The magnitude of the marginal effects of $\psi_i$ indicates that $i$'s use of violence is contingent on $j$ use of violence. Under the criteria discussed in Section 3, $\psi_i$ being less than 0.5 suggests that $i$ mostly uses violence as a response to $j$'s use of violence. Additionally, the magnitude of $\psi_i$ partially confirms Lemma 2, and indicates that perceived reactive violence increases the likelihood of domestic abuse.

Lastly, the fertility preference parameter, $\rho$ is estimated to be positive, suggesting that abusive husbands have a positive fertility preference and affection for their children. With the positive returns to having children in an agricultural household and women with sons having a higher abuse likelihood, it is hypothesised that men's preference for children is predominantly for sons rather than daughters. Here the estimated $\rho$ is the benchmark affection men feel for their sons and an increase implies that $i$ starts to have affection for daughters. This hypothesis is tested in the following section, with a counterfactual policy experiment conducted to investigate how abuse outcomes change with a policy aimed at changing $i$'s child preference.

## 9 Counterfactual Policy Experiment

This section uses the estimates from Section 6 and 8 to evaluate the impact of targeted policies on $i$'s decision to engage in spousal abuse and child marriage. Since the previous sections suggest that a woman's productive role and a husband's demographic profile and fertility preferences influence the likelihood of a woman being a child bride and a victim of spousal abuse, this section tests policy prescriptions that can remedy and reduce the likelihood of these outcomes. It examines how the following policies affect the odds of women being child brides and being in an abusive relationship change with (i) women's employment schemes; (ii) compulsory education for boys; and (iii) social awareness schemes aimed at changing male preferences about fertility and domestic roles.

### 9.1 Compulsory education for boys and women's employment schemes

Until now, the welfare analysis only considered monetary transfers (land and dower) as the inter-generational inheritance, $k_i$. This section relaxes this restriction and includes parental investment in human capital to examine the effect of inheritance on women's marital outcomes. Here the parental investment is an altruistic expenditure that enables children to become financially independent adults. This investment is in skill development either through formal schooling or informal skill development via family members teaching children vocational skills (for instance, skills like sewing, farming and growing crops). For these two investments, a comparative policy experiment is conducted to understand how the odds of child brides and domestic abuse change with the implementation of human capital improvement policies. Since individuals perceive sons to have higher returns than daughters, sons are more likely to receive formal education. (Purewal & Hashmi, 2015). Based on this preference, gender-specific policy experiments are conducted. The first experiment examines the impact of male schooling on the likelihood of abuse and of marrying a child bride, while the second measures how girls receiving training from family members change abuse and child bride odds.

The first experiment, schooling for boys, assumes that all respondents have secondary schooling attendance. Specifically, since only 15.9 per cent of the sampled husbands have ever attended secondary school, the experiment examines how domestic abuse and marital age are impacted if all men had attended.

Since parents are less motivated to send their daughters to school, the definition of parental non-monetary investment in daughters is not as straightforward for the gyno-centric experiment. Since, on average, only 17 per cent of women have ever attended school, altruistic human capital investment is proxied by a woman's financial independence in marital life, i.e., women earning wages. This indicates that the woman has received some vocational training.[22] Given the negative correlation between a wife working and abuse likelihood, the second experiment examines how abuse odds are impacted by programs that help circumvent cultural and religious barriers preventing women from working.[23]

The policy impact of the two experiments is quantified in the form of the causal treatment effects for both policy interventions. The technique selected for the estimation is based on the winners of the 2016 Causal Inference Data Analysis Challenge.[24] The following

[22] These skills include expertise in animal husbandry, horticulture and the art of handicrafts.

[23] Such programs include micro-finance schemes, promotion and organisation of women-centric cottage industries.

[24] A detailed description of the challenge motivation, development, and results is provided by Dorie et al. (2019).

techniques were found to be most efficient and are hence used in this paper: (i) targeted maximum likelihood with a machine learning algorithm (henceforth TMLE-SL); and (ii) Bayesian analysis regression tree (henceforth BART). These methods address a unique set of biases and, therefore, act as a robustness check for the policy recommendation.

The first technique, TMLE-SL, is a doubly robust, asymptotically efficient, maximum likelihood-based estimation. Introduced by van der Laan & Rubin (2006), TMLE relaxes the assumption of similarity between exposure groups by statistically adjusting the confounders. This adjustment addresses biases (i) that conflate the actual effect with baseline group differences; and (ii) arising from a finite sample, outliers and sparsity. In case of a misspecified regression, TMLE can be used for bias correction via implementing the machine learning algorithm "Superlearner".[25] Lastly, in case there is a non-linear response surface or uncertainty concerning nonessential variables and functional form, BART is used to check the robustness of the estimates.

Table 5 summarises the average treatment effect (henceforth ATE), average treatment on the treated (henceforth ATT) and average treatment on the untreated (henceforth ATC). Using the same sample and covariates as used in Section 6, the estimates show that neither of the two policy interventions significantly impacts that child marriage. The precision in the estimation of heterogeneous effects is higher under BART compared to TMLE-SL (see Dorie et al. 2019). Even though TMLE-SL is superior in predicting interval length and coverage, a policy is considered robust only if it is significant under TMLE-SL and BART. The policy failure is potentially attributed to the prevailing religious and cultural doctrines ingrained in the household marriage decision. Due to marital decisions being taken at a household level (where the patriarch approves the bride-groom match), policies that are parent centric in nature fail. Here, "parent centric" means that parents have more autonomy in deciding the quality and quantity of human capital investment for their children compared to agency in who and when that child can marry. Moreover, Table 5 confirms this hypothesis, as it implies that female marriage age and male education investment are not correlated and are mutually exclusive decisions. This decisional exclusivity comes from parents wanting approval from their extended family for marital decisions and solely relying on themselves for human capital investments.

In contrast, the experiments for domestic abuse show a precise reduction in abuse if men are exposed to secondary education. Table 5 indicates that, on average, there is a 9 per cent decline in the likelihood of abuse likelihood. The significant ATC indicates that a decline in spousal abuse odds by 8 per cent under TMLE-SL and 6 per cent under BART

[25]This is an ensemble learner with a heterogeneous base learner using V-fold cross-validation to ascertain an optimal convex combination of estimates obtained from the application of each algorithm in a user-specified library of prediction algorithms (van der Laan, Polley & Hubbard 2007).

is observed if all uneducated individuals receive secondary schooling. Furthermore, the insignificance of ATT shows no change in spousal abuse likelihood if secondary educated husbands had not gone to school. This lack of significance can be attributed to the small sample of educated husbands (only 15.9 per cent of husbands have secondary education).

For the second experiment, there is no significant evidence of reduced abuse due to women's participation in a paid work scheme. A potential reason for the lack of significance is that the estimation fails to gauge women's productive contribution. In addition, the binary intensity of the treatment-work scheme for women is limiting as (i) heterogeneity of wages due to differences in skill level is discounted from the analysis; and (ii) there is no adjustment for wage differential between sexes.

Table 5: Impact of schooling for boys and women's work schemes

| | ATE | | ATT | | ATC | |
|---|---|---|---|---|---|---|
| | *TMLE-SL* | *BART* | *TMLE-SL* | *BART* | *TMLE-SL* | *BART* |
| *Child Marriage* | | | | | | |
| Compulsory schooling for boys | $-0.092^{***}$ | -0.069 | $-0.090^{***}$ | -0.067 | -0.75 | -0.068 |
| | (0.039) | (0.040) | (0.033) | (0.054) | (0.039) | (0.039) |
| Women work schemes | 0.010 | 0.013 | 0.012 | 0.012 | 0.013 | 0.012 |
| | (0.031) | (0.032) | (0.030) | (0.046) | (0.031) | (0.033) |
| *Spousal Abuse* | | | | | | |
| Compulsory schooling for boys | $-0.086^{***}$ | $-0.078^{***}$ | -0.087 | -0.056 | $-0.080^{***}$ | $-0.061^{***}$ |
| | (0.031) | (0.029) | (0.251) | (0.045) | (0.032) | (0.031) |
| Women work schemes | 0.050 | 0.040 | 0.049 | 0.041 | 0.051 | 0.038 |
| | (0.029) | (0.030) | (0.082) | (0.044) | (0.029) | (0.031) |

Standard errors in parentheses. Significant codes: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

### 9.2 Attitude

Anderberg & Rainer (2013) find that spousal abuse is a repercussion of non-cooperation in household decision-making. This experiment tests this argument by examining how a change in $i$'s perceptions about a wife's role impacts the odds of marital discord. In this context, the change in men's perceptions is an altered attitude about household production and fertility preferences.

The experiment uses the structural estimates of Section 8 to evaluate the impact of awareness campaigns targeted toward altering $i$'s attitudes and behaviours. The evaluations of this experiment are vital as they give empirical insights about the awareness programs on abuse probability and hopefully urge decision-makers.

Social awareness campaigns are assumed to be initiated by the Pakistani government,

non-governmental or international organisations. Examples of such schemes include programs by MenEngage Alliance in India, Tostan in Senegal, the White Ribbon Campaign in Canada and UNFPA programs in Turkey. These programs involve community-level outreach, media campaigns, education and engagement to encourage their target groups to evaluate and alter their perceptions concerning fertility and gender.

It is assumed that all the sample respondents are exposed to the scheme and that the exposure increases the absolute numerical value of household duties perception, $\alpha'$ and fertility, $\rho'$ by allowing the individuals' perception to become positive. Here, high $\rho$ and $\alpha$ magnitude means "favorable" perception and a more emotionally "happier" $i$. The resulting equations for the two policy exposures are,

$$\alpha' = \alpha + A,$$

$$\rho' = \rho + P,$$

where $\alpha$ is the estimated structural value of perception about the domestic good, and $\rho$ is the baseline fertility preference. Here $A$ and $P$ represent the additional positive reinforcement after each program exposure. In this setting, the positive reinforcements, $A$ and $P$ assumed to benefit from a perfect take-up rate. Therefore the results reflect the maximum gain in absolute utility for the social intervention. The impact of these programs on reported abuse is depicted in Figure 3, where the horizontal axis is the total magnitude of home-produced production perception, $\alpha'$ and fertility preference, $\rho'$ and the vertical axis represents variation in the ratio of abuse reporting women ex-ante campaign exposure.

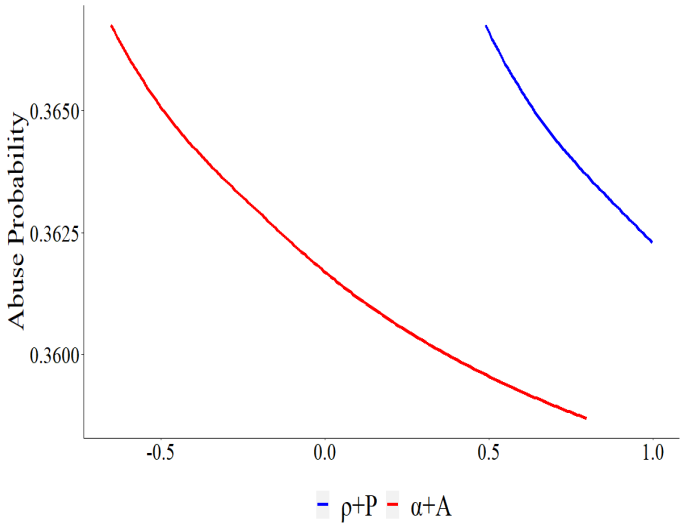



Figure 3: Counterfactual experiment: change in household duties perception and fertility preference in men

The initial value of $\alpha$ and $\rho$ is the estimated structural value of $-0.652$ and 0.074. This means that the starting value of reinforcements $A$ and $P$ is 0, the current state, corresponding to the situation where no program is initiated. When $A > 0$ and $P > 0$, Figure 3 shows that the fraction of abuse decreases. Two messages emerge from this pattern. First, reported abuse declines marginally with a large increase (negative to positive) in domestic production perception, $\alpha'$. There is a 50 percentage points decline in abuse when $\alpha'$ increases from -0.652 to 0, and when $\alpha' > 0$, abuse probability only improves by 0.3 per cent. Moreover, this result conveys that a husband's perception of domestic production needs to become positive for him to be less abusive toward his wife.

Second, compared to home production, a slight change in fertility preference, $\rho'$ yields a more significant decline in domestic abuse probability. The blue line in Figure 3 shows that a 0.5 unit increase in $\rho'$ yields a reduction of 0.4 per cent in abuse. The simulations require that $\rho'$ is always positive. Given that men already have positive fertility preferences, particularly for sons, a positively altered $\rho'$ can be interpreted as having a positive perception for daughters. In this context, it is reasonable to conclude that building a positive daughter perception will decrease women's odds of being abused.

Lastly, when comparing the two sets of policies, altering fertility preferences has more significant returns than altering domestic production preferences. However, caution needs to be exercised as it remains uncertain which of the two policies is more straightforward to implement due to cultural and religious resistance. Furthermore, in comparison to compulsory education intervention for men discussed in Subsection 9.1, the returns to

attitude intervention will be more immediate, as it is more contemporaneous, while only by the next generation, returns to education will be realised.

## 10 Conclusion

Culture and family characteristics guide ex-post and ex-ante marital outcomes. This paper explores these relations by examining how local traditions contribute to women's welfare and bargaining power. Specifically, the question of what contributes to the likelihood of women being in an abusive relationship after accounting for traditions of child brides and *Watta Satta* bride exchange is addressed. This question is vital for policymakers as ever, especially with the global push for women's rights, domestic abuse remains a leading contributor to violence against women. This question is also relevant in academic literature as most research has limited scope due to the problem of under-reporting by victims and surveyor response censoring.

By accounting for these limitations and controlling for local traditions of child bride and *Watta Satta* bride exchange, this paper finds that spousal abuse is influenced by a husband's demographic profile and his psychological preferences. A husband receiving secondary education has positive spillovers for women's welfare. Comparatively, the returns to male education for spousal abuse are higher than women-centric empowerment and education programs. Results indicate a strong presence of income effects in the odds of women being in an abusive relationship. Women from and married into highly subsist households are more prone to domestic abuse than landless and non-subsistence households.

Moreover, a man's latent preferences about fertility and home production also contribute to domestic abuse. The estimates indicate that abuse is a repercussion of a husband's dissatisfaction with housework, where interventions in the form of social campaigns that alter perception about housework lead to a positive reduction in likelihood. Similarly, victims of domestic abuse also have higher fertility because the likelihood of abuse increases with a preference for sons. That is, an abusive husband would keep on having children until he has the desired number of sons. Finally, policies aimed at altering perceptions about daughters also lead to a reduced incidence of marital abuse.

Amongst the four policies examined, the paper establishes that in a society with patriarchal preferences, culturally and religiously accepted policy prescription that will reduce domestic abuse and child bride preferences is complicated. In this context, the most practical policy prescription is educating boys, but even this does not come without drawbacks. The impact of educated men on women's abuse likelihood would not materi-

alise contemporaneously but would only be realised in the following generations.

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# Appendices

## A Proofs

*Proof for Proposition 2.* Equation 13 states that abuse is a function of aforementioned taste parameters. The difference between equilibrium abuse in a *Watta Satta* marriage and a benchmark marriage is that in a benchmark marriage $a_{jj} = \theta = 0$; and $\psi_i = 1$. ∎

*Proof for Lemma 1.* The consequence of the punishment mechanism on equilibrium abuse, $a_{ii}$ depends on the individual type ($\psi$). Partial derivative of $a_{ii}$ with respect to $\psi_i$ and $\psi_j$ prove that $\psi$ increases abuse

$$\frac{\partial a_{ii}}{\partial \psi_i} > 0; \quad \frac{\partial a_{ii}}{\partial \psi_j} > 0.$$

*Proof for Lemma 2.* According to equation 12, fertility is a function of reactive violence parameter $\psi$ for both $i$ and $j$. Equilibrium fertility, $n_i$ is decreasing in $\psi$;

$$\frac{\partial n_i(\psi_i, \psi_j)}{\partial \psi_i} < 0, \quad \frac{\partial n_i(\psi_i, \psi_j)}{\partial \psi_j} < 0.$$

## B Reciprocity and Concordance

Before exploring *Watta Satta* marriage's role in odds of being a child bride and spousal abuse, the concordance and reciprocity *Watta Satta* is investigated. Using the 253 reported pairs domestic abuse information, a linear seemingly unrelated regression for system of equations for domestic abuse, child bride and *Watta Satta* is used to estimate concordance. For the spousal abuse, $y_a$ *Watta* sister-inlaw abuse response is added to the specification.The descriptive regression for abuse is

$$y_a = \lambda_0 + \lambda \mathbf{X} + \lambda_1 y_a^s + \epsilon,$$

where $\mathbf{X}$ are the control variables from Table 2 and $\epsilon$ is the error term. The parameter of interest is $\lambda_1$ and is estimated to be $\lambda_1 = 0.469$ with SE $= 0.109$. This show that *Watta* wives are concordant and that if one reports abuse the other reciprocates.

## C Misclassification Results

Table 6: MISCLASSIFICATION OF DOMESTIC ABUSE

| | $WS$ | $c$ | $a$ |
|---|---|---|---|
| Endogamy | -0.002 | -0.072 | 0.04 |
| | (0.088) | (0.105) | (0.033) |
| Husband has secondary education | 0.077 | -0.290** | -0.146* |
| | (0.102) | (0.153) | (0.094) |
| Natal family resides locally | -0.425 | -0.272** | -0.104 |
| | (0.268) | (0.150) | (0.183) |
| Patrilocal residence | -0.194 | -0.212 | -0.399** |
| | (0.181) | (0.143) | (0.184) |
| Father landholding $\leq$ 100 kanals | -0.524** | -0.046 | 0.211 |
| | (0.285) | (0.101) | (0.146) |
| 200 $\geq$ Father landholding $>$ 100 kanals | -0.783* | 0.355 | 0.261*** |
| | (0.368) | (0.245) | (0.042) |
| Father landholding $>$ 200 | -0.483* | 0.134 | -0.130*** |
| | (0.264) | (0.229) | (0.039) |
| Number of sons | -0.343 | 0.029 | 0.027*** |
| | (0.223) | (0.038) | (0.009) |
| Number of daughters | -0.203 | 0.065 | -0.033 |
| | (0.215) | (0.052) | (0.085) |
| Watta Satta | | 0.185* | -0.121 |
| | | (0.125) | (0.098) |
| father-in-law's landholding $\leq$ 100 kanals | 0.047 | 0.091 | 4.534*** |
| | (0.187) | (0.109) | (0.911) |
| 200 $\geq$ father-in-law's landholding $>$ 100 kanals | 0.002 | -0.348 | 0.235*** |
| | (0.225) | (0.246) | (0.096) |
| father-in-law's landholding $>$ 200 kanals | 1.208*** | -0.381 | -0.237** |
| | (0.186) | (0.269) | (0.114) |
| Number of brothers-inlaws | 0.088 | -0.014 | 0.114 |
| | (0.219) | (0.025) | (0.091) |
| Household decision making autonomy | 0.708*** | 0.403* | -0.053 |
| | (0.202) | (0.232) | (0.09) |
| Dower | 1.035*** | -0.032 | -2.079*** |
| | (0.203) | (0.091) | (0.234) |
| Paid worker | 0.880*** | 0.187* | -0.170* |
| | (0.22) | (0.121) | (0.094) |
| Number of brothers $\leq$ 5 years older | 1.077*** | | |
| | (0.202) | | |
| Number of sisters $\leq$ 5 years older | 1.239*** | | |
| | (0.21) | | |
| Number of female cousins $\leq$ 5 years older | 1.171*** | | |
| | (0.199) | | |
| Misclassification indicator | 0.150 | | |
| | (0.571) | | |
| Log Likelihood | | -2109.059 | |

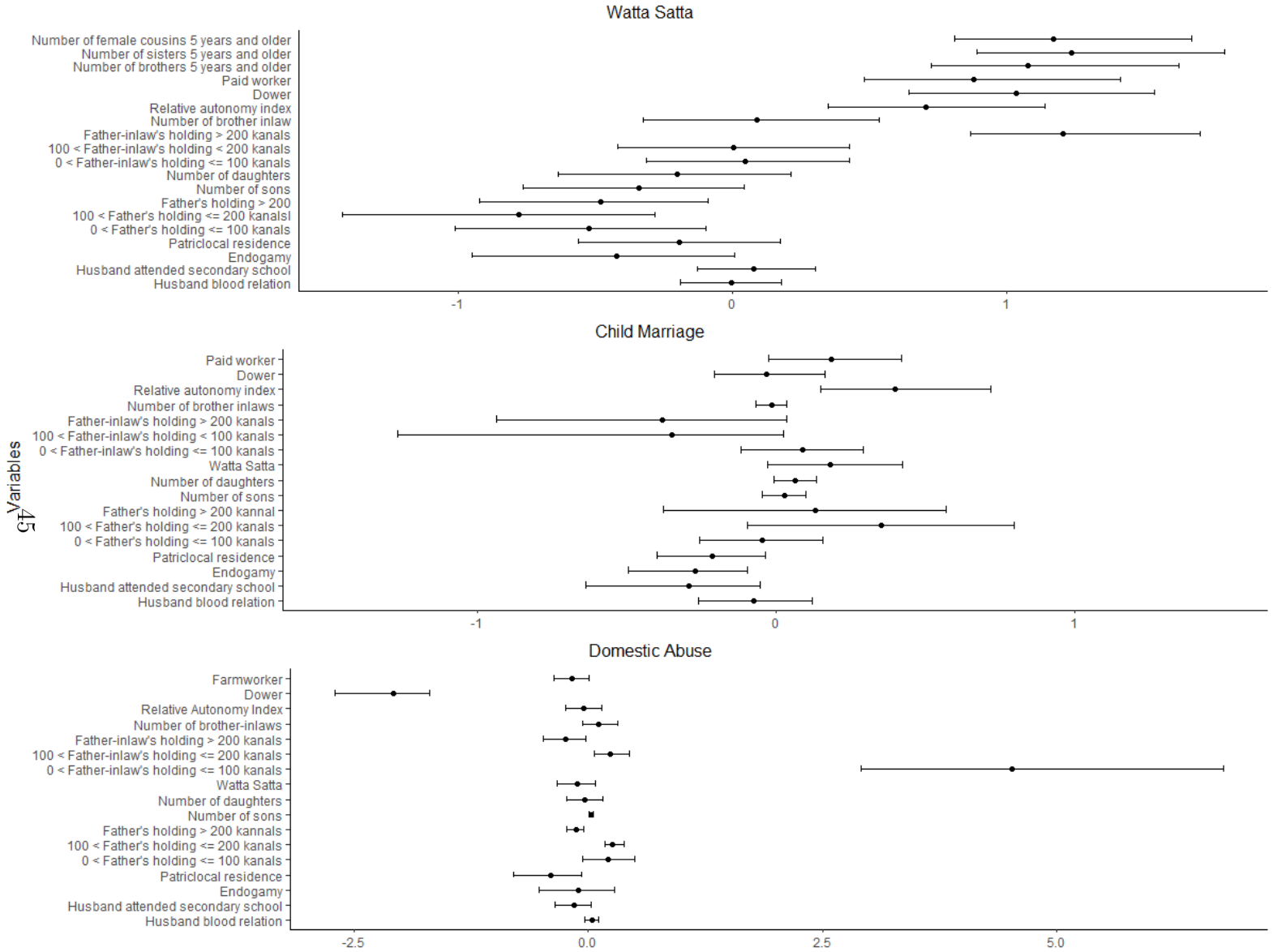


Figure 4: 95 per cent confidence interval from 1400 replications of numerical optimisation with censorship under the Broyden, Fletcher, Goldfarb and Shanno algorithm.