

Peer Networks as a Determinant of Female Autonomy and Child Welfare*

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Abstract

We quantify the impact of network-based learning and influence on measures of female power and child nutrition in rural India. Empowering women to have greater say in child rearing may generate greater and more lasting benefits to children than nutrition supplementation. While researchers have used proxy reports or correlates like caste to trace networks, we map networks by surveying friends of respondents. We use participation in a women's education program to identify increases in female power, as well as stronger and more diverse networks. We study the ways in which networks affect individuals, namely learning and influence. Finally, we characterize the benefits of using survey data rather than proxies to identify networks. Our results linking networks to child nutrition should also inform child health policy.

JEL Codes: D13, D85, J13, O15

1.1 Motivation

Almost a third of all children in developing countries are malnourished (Smith and Haddad, 2000). One way to improve child welfare is to empower women: evidence suggests mothers invest more than fathers in their children, hence women who can influence their household's resource allocation have healthier children than those who cannot (Maitra, 2004; Thomas et

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al., 2002; Quisumbing and Brière, 1999). In this paper, we quantify the impact of network-based learning and influence on measures of female autonomy and child nutrition. We do so using a causal model and primary data from India.

A woman’s ability to influence household resource allocation depends on her notion of identity, her bargaining power, and the social norm¹, which in turn depend on the local culture (Akerlof and Kranton, 2010). Identity can be a source of strength and confidence (Sen, 2006) but in the presence of constricting social norms, identity can confine and limit power. In remote and poor regions, we argue peer networks are an effective way to change social norms, bargaining power, and hence child nutrition.

To study whether peer networks influence bargaining power and therefore child welfare, we test the following hypotheses:

- Does the bargaining power of a woman’s peers affect her own bargaining power?
- Do social learning and influence cause networks to change a woman’s parenting behavior?
- Do women with greater bargaining power invest more in their children?
- Do women with greater bargaining power invest more equally in boys and girls?

Individuals learn new information from peers and trust the information because it came from a friend. They also compare themselves to their friends and define their well-being relative to their peers. Friends provide information and influence behavior, thus helping define identity. Peer networks in traditional societies may be homogenous and stratified by income or social hierarchy, which may limit social learning and influence. By strengthening and diversifying networks, policy-makers can harness network-based learning and influence to improve child welfare.

¹A social norm refers to the behavioral expectations within society or a sub-group of society. Norms “coordinate people’s expectations in interactions that possess multiple equilibria” (Durlauf and Blume, 2008).

Indian per-capita income has more than doubled since the mid-nineties. Agricultural production is at an all-time high, and large buffer stocks of cereals lie in government granaries. Such economic and agricultural success notwithstanding, over forty percent of all Indian children younger than five suffer from malnutrition. By contrast, only about thirty percent of sub-Saharan African children are similarly malnourished (Gragnotati, et al., 2005). In addition, social norms greatly restrict a woman’s say in her household, and she is used to thinking of herself almost as someone’s property. The lack of empowered mothers worsens the problem of Indian child malnutrition.

We present a utility maximization model in which consumption smoothing gives parents an economic incentive to invest in their children. Social networks influence the mother’s allocation decision in three ways: first, support groups increase her disagreement utility, and allow her greater control of household resources.² Second, learning from friends removes constraints placed by social norms, allowing the woman a greater range of choices in her domestic life. Third, identity utility from belonging to networks causes a woman to be influenced by her friends’ choices, and mimic their actions.³

We collect primary data on self-reported networks, female empowerment, and child nutrition in rural north India because existing datasets do not report information on peer networks. The data are from the state of Uttarakhand, which is nestled in the Indian Himalayas (the cross-hatched region in the inset of Figure ??). We model a shock to female bargaining power and social networks using a government program called *Mahila Samakhya*. The program aims to increase female bargaining power through education and has been in place in Uttarakhand since 1995 (program districts are represented with a thick border in Figure ??). Our survey area covers six randomly-chosen Uttarakhand districts, four with the program and two without. (The survey districts are represented in Figure ?? with a dotted pattern. The four districts with a thick border and dotted patterns are program districts.

²Disagreement or threat-point utility refers to the utility each adult receives if the household bargain fails and cooperation breaks down (Mas-Collel, Whinston, and Green, 1995, p. 839).

³Identity utility is the “gain when actions conform to actions and ideals, and the loss insofar as they do not” (Akerlof and Kranton, 2010, p.18).

The two dotted districts without a thick border are non-program districts.)

Studying the links between networks, female power, and child welfare helps us understand how best to target development programs aimed at empowering women or improving child welfare. The importance of network ties suggests development programs should target clusters of villages to exploit the social learning and social influence effects of networks. Further, if improving female power has a greater marginal impact on child malnutrition than nutrition supplementation, policies should invest more in programs that aim to increase female power.

2 Literature Review

This paper is the first to study how networks affect child welfare through bargaining power, and differs from existing literature in three ways. The economics literature assumes that women invest more than men in children because they are more altruistic. Rather than make this arbitrary assumption, we develop a causal model that provides women an economic incentive to invest in their children. Second, economists usually ignore the role of networks in determining bargaining power. We combine elements of the demography diffusion literature with identity economics to model bargaining power as a function of peer networks. We can thus explicitly measure the effect of peer networks on bargaining power and child welfare. Third, economists exploit rigidity in social hierarchy to use caste and sub-caste as proxies for peer networks in India. A program like *Mahila Samakhya* expands and diversifies networks, which would not be captured by caste or sub-caste. We use primary data on self-reported networks to test whether caste and sub-caste are good proxies for actual networks.

Economists often assume that men and women have inherently different preferences with regard to household resource allocation, so bargaining power affects the allocation of household resources as well as labor supply decisions (Ghosh and Kanbur, 2008; Agarwal, 2004; Sahn and Stifel, 2002; Quisumbing and Maluccio, 2000). As a result, a woman with little bargaining power within the household gets a smaller share of the household's resources than

a woman with more bargaining power (Phipps and Burton, 1998; Thomas, 1990). Further, household resource allocations can vary significantly depending on who makes the decisions: men spend most of the money on personal consumption while women channel a large share to their children's education and health (Kanbur and Haddad, 1994).

Since female bargaining power is an inherently unobservable concept, the economic literature uses proxies to control for it; education, contraceptive use, and asset-ownership are three key proxies. Rahman and Rao (2004) study the determinants of female autonomy in India, finding that a better-educated mother has greater bargaining power. They also find culture, as measured by state fixed-effects, to be significant despite several control variables. Evidence from India shows strong positive correlations between female education as a proxy for bargaining power, and freedom of movement and better maternal health as bargaining outcomes (Malhotra et al., 2003). Schuler and Hashemi (1994) find that more empowered women are more likely to use contraception in Bangladesh. Beegle et al. (2001) find evidence that a woman's influence on resource allocation varies with her family's social status, and with her and her father's education relative to that of her husband. A woman with assets that she perceives as her own also has a greater influence on reproductive- and child- health decisions than a woman with no share of household assets.

While the economic literature often ignores the role of networks in determining female power, the demographic diffusion literature has extensively studied the impact of social interactions on individual contraceptive use. *Social learning* and *social influence* describe how individuals act on information acquired from peers (Montgomery and Casterline, 1996). In this literature, social learning occurs when women obtain information about contraceptive methods from peers and family. Therefore, social networks provide information and help individuals gauge the quality of the information (Kohler et al., 2001). Social influence occurs when individuals act in similar ways to avoid conflict within the social group. Networks also work through examples to encourage individuals to copy peers' behavior (Behrman et al., 2002). Networks thus provide the set of peers to whom we compare ourselves and relative

to whom we define our well-being (Akerlof, 1980).

Few papers have linked the theoretical advances of the contraceptive-use diffusion literature with the female bargaining power literature. No other paper has used self-reported networks in studying the determinants of female power and child welfare. Can peer networks increase women's bargaining power and thereby improve child welfare? In this paper, we seek to answer this question by explicitly modeling female bargaining power as a function of connectedness to peer networks.

3 The *Mahila Samakhya* Program

In 1988, *Mahila Samakhya* was launched in three states of India to empower women through formal, informal, and vocational education. The targeted community-level program was placed in districts identified by (1) low rates of female education, (2) low school attendance by girls, (3) remoteness, and (4) lack of development and restricted access to infrastructure. Participation in the program is voluntary, and no monetary incentives are offered.⁴

3.1 Background on Uttarakhand

Following decades of local demand for a separate state, Uttarakhand was carved out of the state of Uttar Pradesh in November 2000. The state is small and rural, comprising less than one percent of the Indian population, and five cities with more than 100,000 people. Small, scattered villages without access to roads pose challenges to the state's development. Most villages are remote and many lack basic infrastructure such as schools and hospitals. Households generally engage in subsistence-type agriculture, although the state also supplies migrant labor to Delhi and other large towns. The literacy rate in Uttarakhand is 72 percent, lower than the national average of 80 percent. It is also relative wealthy: in 2005-06, only eight percent of Uttarakhand households fell in the poorest wealth quintile, as compared to

⁴When participants travel to district-meetings, they are housed and fed at the program headquarters, and their travel expenses are reimbursed.

eighteen percent for the entire country (IIPS and ORC Macro, 2007).

Uttarakhand has a large Hindu population— 85 percent as compared to 80 percent for the entire country (Census of India, 2001), with 18 percent belonging to Scheduled Castes and Tribes.⁵ Caste hierarchy is strictly maintained in Uttarakhandi villages, and most interactions are limited to members of the same caste. Houses within villages can spread out across the hilly terrain, further limiting contact with others.

Villagers rely on the forest for firewood, water, and grass to feed livestock, while soil erosion threatens farmers' livelihood. As a result, Uttarakhandi people have long been associated with an active interest in natural resource management. The *Chipko* movement of the seventies is perhaps the most famous case where Uttarakhandi villagers, and women in particular, literally hugged trees to prevent felling.⁶ Villagers have also protested the development of resorts and the diversion of water sources to richer communities.

3.2 The Status of Uttarakhandi Women

On the surface, Uttarakhandi women may appear to be more empowered than the average. Women led the *Chipko* movement, as well as in the demand for a separate state. However, looking beneath the surface reveals a different story. Although the state has a literacy rate of 72 percent, the Census reports only 60 percent of all women are literate. A more detailed measure of literacy than reported in the census finds 43 percent of Uttarakhandi women cannot read at all, while an additional 5 percent can only reads parts of a sentence (IIPS and ORC Macro, 2007). Therefore, the effective literacy rate for females may be closer to 50 percent.

Although 46 percent of all Uttarakhandi women work, 64 percent of these women were not paid for their work, and over 70 percent worked in agriculture. These women likely work on their family's farmland, which does little to empower them. As well, 23 percent of

⁵The Constitution of India categorizes the lower castes and tribes as Scheduled Castes and Tribes and provides them special protections and rights to help overcome the effects of discrimination by higher castes.

⁶The Hindi word *Chipko* means to stick.

Uttarakhandi women have no say over how their household spends money, and almost 43 percent do not have the final say on their own healthcare. Over half (54.80 percent) did not have the final say on large purchases made by their household (IIPS and ORC Macro, 2007).

Alcoholism and resultant domestic violence are common problems in Uttarakhandi families. Almost forty percent of Uttarakhandi men consume alcohol, compared to the national average of 32 percent, and more than a quarter (26 percent) of all Uttarakhandi women have ever experienced physical violence (IIPS and ORC Macro, 2007). Only 18 percent of these women have sought help to control or end the violence. Uttarakhandi women thus not only have little say in their household, but also frequently suffer from abuse.

Uttarakhandi women also tend to have very low mobility. Firewood and water collection are women's tasks and often consume more than half the day. The remoteness of the region and lack of good roads combined with stringent social norms mean that once married, women are unable to visit friends or even parents regularly. As many as 47 percent of Uttarakhandi women reported not having the final say on visits to family and friends. Women's lives are thus defined by their husbands, children, and in-laws, and they seldom participate in the political process, even at the village level. This state of isolation and ignorance, accompanied by constricting social norms restrict women to the narrow spheres of family and housework.

3.3 Mahila Samakhya in Uttarakhand

Mahila Samakhya started in Uttarakhand in 1995 and implements its agenda through village-level groups of women. The program covers 2416 villages in six of thirteen of Uttarakhandi districts. More than 42,000 women participate in this program, and over 2500 girls have been educated in its centers.

Mahila Samakhya conducts literacy camps and provides continuing formal education to women and girls. The program provides vocational training to enable participants to earn an income. Participants have used the training to become midwives, herbal medicine manufacturers, bakers, grocers, candle makers, and tailors. In addition, the program provides special

education on resolving domestic disputes, and conflicts within the community. The program also encourages women to participate in village politics as a means of self-empowerment. Participants hear about the success women have had in the labor force, and the important roles women can play in Indian society. They are also told about the benefits of having a daughter and of not discriminating against her. Groups of participants support each other on issues like domestic violence, alcoholism, dowry, and female infanticide.

Village- and district-level meetings allow participants to step outside their homes and villages, making their lives less solitary. They meet women from other castes and religions, which expands their peer networks and also lets them engage in conversation not pertaining to domestic chores and family. The semi-formal and well-structured nature of these interactions facilitates dialogue, and enhances the program's effectiveness. The information provided by *Mahila Samakhya* as well as that exchanged within the newly-expanded networks can help change social norms. The learned vocational skills allow participants to engage in income-generating activities. Changed social norms and the ability to earn an income enables these women to have greater control over household resources.

Mahila Samakhya enters a village through program workers called *sahayoginis*. The worker first conducts several rounds of talks with local women to determine what their needs are, and what they would like from the program. This process can take up to several weeks, but as a result, the program's activities are tailored to each village. The program often starts with literacy or education camps because these are the most frequently-voiced concerns. Initially only a few women may participate, but as others see the benefits of participation, they muster up the courage to participate despite family opposition.

The program can meet with resistance from the men in the village, who may see the program as subversive and be unwilling to let their wives participate. In such cases, workers stress the educational rather than empowerment component of the the intervention. Once the men observe the benefits of participation, generally in the form of earnings, they reduce their opposition. Sometimes, as the women become more mobile, men might again oppose

participation, but usually the women are so empowered at this point that the opposition does no longer deters them.

The program is funded by the Indian government and the British Department for International Development. Annual national and state reviews of the program use summary statistics to evaluate its effectiveness in increasing female empowerment, as measured by educational attainment, the regularity of village- and district-level group meetings, and political participation in the village council. Reviews also use information from focus groups to gauge whether the program has raised the level of confidence and the sense of community in participants.

In the only econometric review of this program, Janssens (2010) uses Intent-to-Treat estimates to evaluate *Mahila Samakhya* in the state of Bihar. She finds that the program significantly increases trust and engenders social capital. Participants are more likely to contribute to local educational and infrastructural community projects. Significant spillovers also exist: non-participant households in program villages exhibit higher levels of trust and are more likely to engage in community building activities than households in non-program villages. However, while trust and social capital are important tools in female empowerment, they alone will not result in tangible changes in women’s lives if social norms and individual identity continue to restrict.

4 The Causal Mechanisms

Mahila Samakhya has two effects on female empowerment: one direct, and one indirect. The direct effect works through education, while the indirect effect works through changing social networks. In this paper, we focus on the indirect effect. Figure ?? describes the causal mechanisms at work. The ovals represent observables— participation in *Mahila Samakhya*, individual characteristics, the size, strength, and composition of networks, investments in child welfare, and remittances from children. The blocks represent unobservables— village

culture, identity utility from the social norm, constraints placed by the social norm, and individual bargaining power. Dotted lines present feedback effects, such as the effect of the program on village culture via individual characteristics .

4.1 Direct Effect

Participation in the program increases the woman's educational attainment, which is an endogenous individual characteristic. Providing a woman education improves her job prospects (Phipps and Burton, 1998). When bargaining with her husband over household resources, knowing about better job opportunities and having more marketable skills increase her disagreement utility. More education thus raises bargaining power, which in turn increases the investment in children.

4.2 Indirect Effect

Participation also expands peer networks and access to information. In interviews, participants reported not even knowing five people outside their families prior to participation in the program. *Mahila Samakhya* introduced them to many more women, and through them to information on the opportunities and facilities available to women. Participants then realized the benefits of educating their daughters and of immunizing their children. The program also changes the composition of networks by introducing women from different villages, sub-castes and castes, and religions, which diversifies networks. Higher caste women are more likely to be educated, and meeting more high caste women may encourage lower caste women to avail of the educational facilities provided by the program.

The influence of and learning from peers affect (1) a woman's bargaining power, (2) the constraints placed by the social norm, and (3) the identity utility received from belonging to a group. Strong networks provide support groups that influence individual behavior and increase the woman's power within her household. Individuals also learn from and are influenced by friends. Observing peers adopt new behaviors influences a woman's behavior

because she trusts her peers and their judgment. Finally, people receive identity utility from belonging to a network, and from behaving like their friends, allowing networks to further influence behavior.

4.2.1 Bargaining Power

The social influence of networks changes individual bargaining power. Participants have more opportunities to interact with their peers, especially away from home. They develop a stronger network that can support them if they face domestic violence, or help change the household resource allocation. A woman with no support group will remain in the status quo for fear of being ostracized. By organizing women into support groups, the program increases their power within the household and community without fear of social sanction. The support group also intervenes directly when a participant's family refuses to improve its treatment of her. A participant reported that her *Mahila Samakhya* network intervened when her husband and in-laws did not allow her to feed her daughter as well as her son. Another respondent said that her husband's treatment of her improved after she joined *Mahila Samakhya* because he was worried that program officials would intervene in his domestic life and shame him in the village. Participants have "strong ties" (Kohler et al., 2001), which give them the strength and confidence to have greater say within the household.

4.2.2 Constraints Placed by Norms

Social learning can help remove the constraints placed by norms so women have more choices. A woman can learn new information from her peers. She may not have realized certain choices (for instance, the ability to study or work) were available to her. This effect can be thought of "as expanding the set of choices known to the woman" (Montgomery and Casterline, 1996, p. 158). Further, the outcomes of the educational and employment choices made by her friends provide an "empirical demonstration of the range of consequences that can follow

from the adoption of a particular choice and may thereby shape the woman’s subjective probability distributions” (Montgomery and Casterline, 1996, p. 158). Such learning is not restricted to close friends and can occur through “weak ties” (Granovetter, 1983), such as the ties with program participants from other villages.

Information about new opportunities can also be valuable for its own sake. For instance, one interviewed participant said that just knowing that women were successful lawyers, diplomats, professors, and entrepreneurs changed her outlook on life. The information caused her to want to earn an income and be more self-reliant. This effect of information is consistent with Jensen and Oster’s (2009) finding that urban Indian women with access to cable television were more empowered than those without cable television.

The question then arises, why do social norms that harm individuals persist in the absence of an intervention like *Mahila Samakhya*, and how do network-based learning and influence interact with such norms? Akerlof (1980) notes social norms disadvantageous to individuals may persist for fear of social sanction by the group against the individual trying to challenge the social norm— social influence at work. Further, people may not want to be outliers because of a negative feedback loop resulting from the social relativism of others. Program participants often reported being unsure what others would say if they tried to stand up to their in-laws or stop their husbands from hitting them— “We did not want to risk being different.” As well as improving connections with existing peers, the program alters peer sets by expanding networks. Program workers are also more empowered than average, and provide a reference point for a different social norm.

4.2.3 Identity Utility

Peers behave like one another not only to avoid conflict and to coordinate with each other but also because they gain identity utility from being insiders in the group (Akerlof and Kranton, 2010). Identity is endogenous and thus identity utility is influenced by changes in the reference group. The program changes the participant’s relative set of peers so that the

people she compares herself with are now more educated and have less traditional attitudes about women's role in society. Respondents often talked of the pride they felt in being program participants, and how they were happier because of the changes in their peer network. Non-participants have weaker ties to peers, hence their identity utility from belonging to a network is lower than that of participants.

4.2.4 Village Culture

Changes in peer networks can cause more women to study, have jobs, and be empowered, but in the absence of a program like *Mahila Samakhya* networks are the realization of village culture. If the culture is such that most women only interact with others of their sub-caste, peer networks will be stratified by sub-caste. *Mahila Samakhya* changes networks, which affects individual characteristics and thereby influences village culture. Networks become more diverse, and eventually change the village culture so it is more accommodating of such diversity. By affecting endogenous characteristics like education, the direct effect of the program also changes the village culture.

4.2.5 Feedback Effects

Learning and influence associated with networks can also have important feedback effects on the household and on village culture. Changes in networks can affect individual characteristics like education, contraceptive use, and mobility. These changes lead to more empowered women, and thus greater investments in children. More empowered, educated, and mobile women also change village culture. Participants told us that before joining the program they faced a constricting social norm, reinforced by the village culture. They could not work, were barely educated, had little say in the resources allocated to their children, and were told to discriminate against daughters. Their identity was always subsumed in their husband's, brother's, father's, or in-laws' identity. After participating in *Mahila Samakhya*, women realize they have their own identity, that they can work if they want to, that they

should study, and that they can influence household and community decisions. In the long run, as more people invest in their children, and investments become more equitable between the two sexes, the village culture will reflect the new patterns in investment.

Coleman (1988) notes both the power of information, and the cost of its acquisition. Along with explicitly providing participants information on various possibilities they might not otherwise know about, information also has indirect effects by expanding the perceived feasible set for participants. Through its effect on peer networks, *Mahila Samakhya* changes the norm faced by participants as well as their identity. Directly and indirectly, the program changes the woman's bargaining power and enables her to allocate more resources to her children. The greater investments in child welfare may lead to larger remittances to parents when they are old.

5 Model

To start, we model the husband and wife as playing a cooperative Nash bargaining game. If the bargain breaks down, the husband and wife each receive disagreement utility, which is lower than what they would have received if the bargain had been successful (McElroy, 1990; Lundberg and Pollak, 1996). The standard household Nash bargaining model does not account for the role of networks in determining disagreement utility, nor for the effects of identity utility or social learning and influence on the outcome of the bargain. To incorporate networks into the Nash bargaining model, first, we model the adults as maximizing their utility for two time periods over a bundle, \mathbf{x} , comprising a private good c , leisure l , and a public good reflected by investment in children r and their share of control over household resources, θ . The bargain leads to optimal values of the bundle for each adult, \mathbf{x}^* and θ^* . These consumption bundles belong to a set $\{X\}$ of all possible choices of \mathbf{x} . In period one, the adults choose their optimal \mathbf{x} for each time period to maximize the current period utility and expected utility in the next time period.

To model constraints imposed by the norms, we make the set of choices X known to an individual a mapping of the set of observed choices available to his/her peers X_N . The observed set of choices available to peers, X_N , is in turn the union of all the consumption bundles chosen by them.⁷ The more empowered a woman's peers, the larger is X_N , and therefore the less constraining is the social norm on her and her friends.

Second, we represent the influence of networks by assuming individuals receive utility by being better off than their peers, and suffer a penalty to utility if they are worse than their peers. The additional bonus or penalty utility is denoted as U_r , and is a function of the average utility of the social network, N . We thus add identity utility U_r from the relative set or network N , to each utility function. Since male and female networks are different, we use the subscripts m and f to denote these differences. Identity utility can be negative if the individual is worse-off than her reference group, and positive if she is not worse off than her peers. Note also that identity utility increases in the strength of ties. The third change to the basic Nash bargaining problem reflects social influence on individual bargaining power by making disagreement utilities V a function of networks because networks can provide support in domestic disputes. The exponents α and β reflect the relative levels of bargaining power captured by husband and wife. These exponents reflect village culture, and can change over time to reflect a more equitable culture.

The household thus faces the following maximization problem with respect to the constraints on \mathbf{x} described above, and a full-income budget constraint.

$$\begin{aligned} \max_{\mathbf{x}_f, \mathbf{x}_m, \theta} & [U_f(\mathbf{x}_{f,1}) + EU_f(\mathbf{x}_{f,2}) + U_r(N_f, \mathbf{x}_{N_f}^*) - V_f(N_f)]^\alpha \\ & [U_m(\mathbf{x}_{m,1}) + EU_m(\mathbf{x}_{m,2}) + U_r(N_m, \mathbf{x}_{N_m}^*) - V_m(N_m)]^\beta \end{aligned} \quad (1)$$

s.t. $??, ??, ??, ??$

⁷The set X_N does not include choices available to peers but not chosen by them because the maximizing individual only observes his/her peers actions. For instance, the participant who said that knowing women can be lawyers, doctors etc. empowered her did not say that knowing that women know they can be lawyers also empowered her. Therefore, only the observed \mathbf{x}^* matters.

$$\mathbf{x} \in \{X\} \quad (2)$$

$$X = f(X_N) \quad (3)$$

$$X_N = \bigcup \mathbf{x}_N^* \quad (4)$$

The household's full-income budget constraint (FIBC) derives from the individual budget constraints faced by the man and the woman. Each gets utility from consuming the vector of goods \mathbf{x} in each time period. The vectors \mathbf{p}_m and \mathbf{p}_f reflect the prices faced by the man and the woman. The prices associated with the private good c and leisure l are p_c , w_f for the woman, and w_m for the man. We model the public good r as a numeraire, hence the associated price is one. Since the woman has an economic incentive to invest more in her children, her optimal choice of i is greater than the man's optimal choice. The woman's FIBC looks as follows:

$$\mathbf{p}_f(\mathbf{x}_{f,1} + \mathbf{x}_{f,2}) \leq \theta \left[\sum_{t=1,2} Y_{f,t} + (Y_{m,1} + \rho Y_{m,2}) + E(T_f) + \rho E(T_m) \right] \quad (5)$$

where θ represents the wife's control over the share of assets and ρ represents the probability that the woman is married in period 2. The share is endogenous, so that as the woman's bargaining power and identity utility increase, so does θ . $E(T)$ refers to the expected transfers from children. The man's FIBC looks as follows:

$$\mathbf{p}_m(\mathbf{x}_{m,1} + \mathbf{x}_{m,2}) \leq (1 - \theta) \left[\sum_{t=1,2} Y_{m,t} + (Y_{f,1} + \rho Y_{f,2}) + E(T_m) + \rho E(T_f) \right] \quad (6)$$

Adding up the constraints in equation ?? and equation ?? yields the full-income budget

constraint faced by the household (equation ??).

$$\begin{aligned}
& \mathbf{p}_f(\mathbf{x}_{f,1} + \mathbf{x}_{f,2}) + \mathbf{p}_m(\mathbf{x}_{m,1} + \mathbf{x}_{m,2}) \leq \\
& \sum_{t=1,2} Y_{m,t} + \theta \left[\sum_t Y_{f,t} - \sum_t Y_{m,t} \right] + \theta(Y_{m,1} + \rho Y_{m,2} - Y_{f,1} - \rho Y_{f,2}) \\
& +(Y_{f,1} + \rho Y_{f,2}) + [E(T_m) + \rho(E(T_f) - \theta E(T_m) - \theta \rho E(T_f))]
\end{aligned} \tag{7}$$

Consider the husband and wife’s utility to be the outputs produced by the household; these outputs are a function of the utility from labor allocation, consumption, investment in children, and participation in networks. A household utility possibilities frontier (UPF) gives us all the feasible pairs of husband and wife utility production. We perceive three ways in which bargaining power, social norms or information sets might affect the observed equilibrium. (1) Levels of and changes in bargaining power can affect the observed equilibrium. If a woman does not have much bargaining power, the equilibrium will result in greater utility to the husband than to the wife. (2) Further, not knowing about all the choices or feasible levels of utility might constrain the equilibrium to a subset of the full UPF. The social norm might constrict women so they may not realize that certain high levels of utility are attainable. (3) Finally, if the woman’s relative set of peers follow the social norm, i.e. do not work and have little or no education, the household may be on a lower UPF than it would otherwise.

5.1 Bargaining Power

Figure ?? represents the household’s utility space, a UPF, and the equilibrium resulting from the husband and wife’s choice sets. The dashed lines represent the husband and wife’s levels of disagreement utility. If the bargain breaks down, they receive V_m and V_f , represented in utility-space by the intersection of the two dashed lines. The disagreement utilities place lower bounds on the UPF with respect to the x - and y - axes. Now consider the situation

in which the woman joins *Mahila Samakhya*, and the resultant support group intervenes in her domestic situation and increases her disagreement utility so that she is better-off even if the bargain breaks down. Also consider the case in which her husband’s disagreement utility decreases because the support group forces him to improve his treatment of her. The new disagreement utilities, represented by the dotted lines, expose a previously-unattainable part of the UPF that represents higher utility to the woman, and limits part of the UPF associated with lower utility to her.

In the flow chart, this effect is depicted through the program’s impact on individual bargaining power. The anecdote of the woman who said her husband’s treatment of her improved after she joined the program because he was afraid of being shamed in the village mirrors this effect on bargaining power. Further, by providing support groups the program decreases the woman’s fear of ostracism and empowers her to change her situation within the household. Social influence thus enables the woman to change the available UPF to include better outcomes for her and restrict the possibilities that make her worse off. The educational effect of the program also increases the woman’s disagreement utility by raising her reservation wage: knowing about better job prospects and having more marketable skills raise the reservation wage and thus increase bargaining power.

5.2 Constraints Placed by Norms

Social learning enables *Mahila Samakhya* to change the social norm through the “expansion of the set of choices available to women” and the “the empirical demonstration of the range of consequences” from adopting certain behaviors (Montgomery and Casterline, 1996, p. 158). Figure ?? illustrates how the constraints placed by the program can restrict the UPF to a small portion of the true frontier. Point A is a possible equilibrium outcome, at which the husband’s utility is U_A^m and the wife’s utility is U_A^f . However, neither spouse knows the extent of true UPF because social norms constrain their choice sets to less than the full feasible set. Constraints on the husband restrict the frontier along the x-axis, while

constraints on the wife limit the frontier along the y-axis. Point B is on the same UPF but is not available because the higher level of female utility it represents is ruled out by social norms. The indirect network effect of *Mahila Samakhya* removes the constraints—initially only for the woman, but eventually also for her husband. Point B now becomes feasible. A move to point B would increase her utility ($U_B^f > U_A^f$) and decrease her husband’s utility ($U_B^m < U_A^m$).

Even without the constraints, a move from A to B would not be observed if the woman’s bargaining power was very low. The household’s relative value of a woman’s happiness increases in the woman’s bargaining power, hence the slope of the indifference curve at the point of tangency to the UPF is the ratio of bargaining powers, BP_f/BP_m . To observe an equilibrium where the woman gets a larger share of utility, the value of the exponent α must increase. The values of α and β depend on village culture. If the culture is such that women do not get a large share of utility, then α will continue to be low. By changing endogenous individual characteristics like education and mobility, *Mahila Samakhya* changes the village culture. Over time, exposure to the program can result in a new culture where the exponents are similar in magnitude, reflecting a more equal distribution of bargaining power.

5.3 Identity Utility

The third effect of networks might be to shift out the UPF available to the household. The woman’s utility is a function of the attitude or actions of her relative set of peers. She defines her well-being relative to this set, and gains identity utility from behaving like the people in the set (Akerlof and Kranton, 2010). If these peers have traditional attitudes and adhere to the social norm although it discriminates against them, their ties are likely to be weak, hence the woman’s gain in identity utility is also low. Such a relative set leaves little scope for social learning and may cause the woman’s household to be on a lower UPF than they can attain. However, identity also has a relative component. The woman gains utility from being at least as well off as her peers, and loses utility if she is worse-off than them. By

observing other women holding jobs and being educated, the woman is motivated to make similar changes in her life.

If the program strengthens a woman's peer network, she stands to gain identity utility. The program also introduces her to more empowered women, who likely receive a greater share of the household's utility. She now needs an even higher level of utility than before in order to be as well off as her peers. At point A in figure ??, without accounting for identity utility, the woman receives U_A^f in utility. However, her peers have a higher level of utility, U_r^1 , which effectively shifts back her UPF. After accounting for this loss in utility, the woman only receives $U_A^{f,r}$. The loss in utility from U_A^f to $U_A^{f,r}$ represents the negative identity utility to the woman from being worse off than her peers.

If the equilibrium occurs at point B, the woman is better off than her peers, which is represented by a shifting out her of her UPF. The gain in identity utility means she effectively receives $U_B^{f,r}$, which is greater than U_B^f . Now if the woman's relative set changes because of *Mahila Samakhya* and the new relative set has higher utility, U_r^2 , the woman needs a greater gain in utility to be as well-off as before. Now, some parts of the UPF (between X and Y on the y -axis, where she was better-off than a less empowered relative set) shift in because she is worse off than her new relative set. Stronger networks from participation thus lead to a greater change in identity utility than a weaker network.

In this framework, the direct (educational) effect of the program raises the woman's bargaining power through an increase in her opportunity cost. The indirect (network) effect of the program works through networks to change the woman's bargaining power, increase the feasible set of choices available to her, and change the UPF that is attainable to her household. The model presented here yields hypotheses that we can test with our data.

6 Identification Strategy

Our identification strategy has three parts: first, we identify causal peer effects using a recent extension to networks of the Generalized Spatial 2SLS estimator. Next, we instrument for the endogeneity of program participation using family composition. Finally, we instrument for the endogeneity of networks using distance to firewood and water source.

6.1 Identifying Peer Effects

Manski (1993) points out that the reflection problem confounds identification of causal peer effects. Do people behave in similar ways because they have learned from or been influenced by their friends, or are they friends because they behave in similar ways? Manski presents three hypotheses regarding the observed similarities in the behavior of friends. (1) Correlated effects occur when people act alike because they face a similar environment or have similar characteristics. (2) Contextual effects such that individuals are more likely to act in a given way depending on the distribution of group members' characteristics. (3) Endogenous effects, where the group affects individual behavior through social interaction. The third effect is key to identifying the causal impact of networks.

Much of the literature following Manski (1993) has focused on the econometric issue of separating the causal peer effect from that of correlated unobservables (Conley and Udry, 2008; Miguel and Kremer, 2004, Foster and Rosenzweig, 1995). A straightforward way of disentangling these effects is to randomize the intervention or new technology at the friend-level (Oster and Thornton, 2009). Randomization allows for the identification of the endogenous effect because the number of friends who receive the intervention or technology is exogenous. The *Mahila Samakhya* intervention is not randomized, so our identification strategy uses a recent extension to networks of Kelejian and Prucha's (1996) Generalized Spatial 2SLS estimator.

We use a recently developed technique (Bramoullé et al., 2009; De Giorgi et al., 2010)

in which partially overlapping networks generate friends of friends or “excluded friends”. Since a woman does not know (or know well) these excluded friends, they can only affect her behavior through shared friends. Similarities in the behavior of excluded friends and the woman is then evidence that networks change behavior. We use information on self-reported friends to generate a weight for each pair of friends such that the higher the weight, the stronger the friendship, and the greater the hypothesized influence of or learning from the friend. Then, the excluded friend’s effect on the individual is weighted by the strength of the individual’s ties with the shared friend.

Even after identifying the causal effect, correlated effects continue to be a source of bias, particularly in the presence of proxy-reported peer behavior (Hogset and Barrett, 2010). Since we conduct follow-up interviews with friends (called snowball sampling), our data face reduced problems with correlated effects. Another benefit of using excluded friends to instrument for the endogeneity of peer behavior is that the network yields a substantial number of instruments to account for correlated effects. The combination of snowball sampling and the use of excluded friends as instruments allows us to isolate the effect of interactions from that of the individual group shock.

6.2 Endogeneity of Program Participation and Networks

Since participation in *Mahila Samakhya* is most likely endogenous, we use family composition as an instrumental variable. A woman who lives near younger sisters-in-law (husband’s younger sisters or husband’s younger brother’s wife) can rely on these sisters-in-law to look after her children as well as any domestic chores while she attends *Mahila Samakhya* activities. Relationship hierarchy prevents a woman from asking her parents-in-law or older sisters-in-law to take care of her share of housework, but allows her to ask a younger sister-in-law for such help. Most families in the region are extended in structure, and male siblings live close to each other. So, if a woman has younger sisters-in-law (particularly the husband’s brother’s wife), they likely live nearby and facilitate her participation in the program.

Similarly, a woman with children of different ages can have her older children attend to younger siblings and take care of housework while the mother attends program activities. On the other hand, women with young children of similar ages find it difficult to leave their houses for extended periods of time and are unlikely to participate in the program. Therefore, we use family composition variables to instrument for the endogeneity of program participation. Note that we do not assume that sisters-in-law or children facilitate participation: we specifically ask respondents who looks after their domestic chores and youngest child while they participate in the program.

Another source of endogeneity may arise from the networks themselves. Women with more spare time may have larger and stronger peer networks. We control for such endogeneity using time to the source of firewood and water as our instruments. Water and firewood collection from the forest are women's tasks and often the sources of water and firewood are several hours away. As a result, women must spend a large part of the day in the forest, leaving little time for interaction with others. Even when they travel to these sources in groups, they must walk up and down sides of hills and are hard at work in the forest, neither of which facilitates interaction. As a result, those with distant firewood and water sources have smaller and weaker networks. Hence, we use distance to firewood and water sources as instruments for the strength and size of networks.

7 Data

Researchers have used caste to proxy for peers in India because caste is a strong signifier of networks (Munshi and Rosenzweig, 2006), but there may be networks of varying strength within castes. Household data from India do not include information on self-reported networks, and preclude an analysis of the effect of networks on child welfare. As a result, we collect our own data from the north Indian state of Uttarakhand, collecting information on instruments for social learning, influence, female power, and their role on child nutrition

outcomes. In addition, we also collect data on participation in *Mahila Samakhya*. Program centers have been present in Uttarakhand villages for periods lasting anywhere from three months to five years, allowing us to use time-variation in exposure to the program to identify its impact on networks and child nutrition.

Our data are from six of thirteen Uttarakhand districts, four with the program and two without. The target sample size is 500 women. We employ restricted snowball sampling where we start with five women in each village and then follow up with two of their five closest friends. Our survey instrument includes the following key questions:

- Networks:
 - Who are your five closest friends and how do you know these people? How often do you see them? Where do you usually see them?
 - Do you participate in the *Mahila Samakhya* intervention? How about your closest friends?
 - How important is it to you and your husband what your friends and the community think of you?
 - If one of your friends told you to give your daughter more milk, would you?
- Proxies for Female Autonomy:
 - What kind of work do you do? What kind of work does your husband do?
 - Do you currently use contraception? If not, why not? If yes, what type?
 - What is your level of education? What is your husband's level of education?
- Investment in Children:
 - How much should a child be educated? How much education will your children receive?

- Do you expect to receive monetary or other assistance from your children when you are old?
- How much food has each child eaten in the past 24 hours? (Enumerators are provided standard bowls and respondents are asked to estimate how many bowls of food each child ate.)
- How many hours did each child spend on chores in the past 24 hours? Which chores did they help out with?
- How much do you spend each month on your children’s education?
- Information on each child’s immunization status and their height.

These questions will help us identify the effect of peer networks on an individual’s household bargaining power and therefore on child welfare.

7.1 Key Hypotheses

We conduct our empirical analysis in two stages. In the first stage, we test whether participation in the program increases female bargaining power and investment in children. In the second stage, we test how program participation interacts with networks to increase investments in children. The three mechanisms through which the second stage of effects work are: changing bargaining power, removing constraints on social norms, and changing identity utility. We test the following first and second stage hypotheses in this paper:

7.1.1 First stage

- Bargaining outcomes such as share of household resources held by a woman, or contraceptive use depend on participation in the program, as instrumented by family composition.
- Measures of investment in children such as food intake, education, domestic chores also depend on participation in the program.

- The more a woman cares what others think of her, the greater is the effect of program participation on her bargaining power.

7.1.2 Second Stage

- Bargaining Power: The more a woman cares what others think of her, the greater is the effect of her friends' power (such as the share of household resources held by them) on her own bargaining power.
- Constraints of Social Norms: Weak ties, as represented by friends of friends, influence behavior by expanding the feasible set.⁸ *Mahila Samakhya* can make a woman invest more equitably in her children by influencing the investments the friends of her friends make in their children.⁹
- Identity Utility: Participation in *Mahila Samakhya* changes identity utility by changing the reference group: for instance, if a non-participant has participant friends, she should invest more in her children than a non-participant with no participant friends. Further, women who care more about what their friends think of them are more likely to behave like their friends, regardless of program participation.

⁸Oster and Thornton (2009) call those ties weak where a person names someone as a friend, but the friend does not name the other person. We plan to try this approach to weak ties as well as the friends-of-friends approach.

⁹We disentangle social influence from the instrument by differentiating between beliefs and the observable choices made by friends of friends. Beliefs of friends of friends are unlikely to influence individual behavior but actions can. When instrumenting for close friends, both beliefs and actions are important. So we use beliefs to represent influence and both beliefs and actions as instruments.

8 References

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Figure 1: Uttarakhand, India

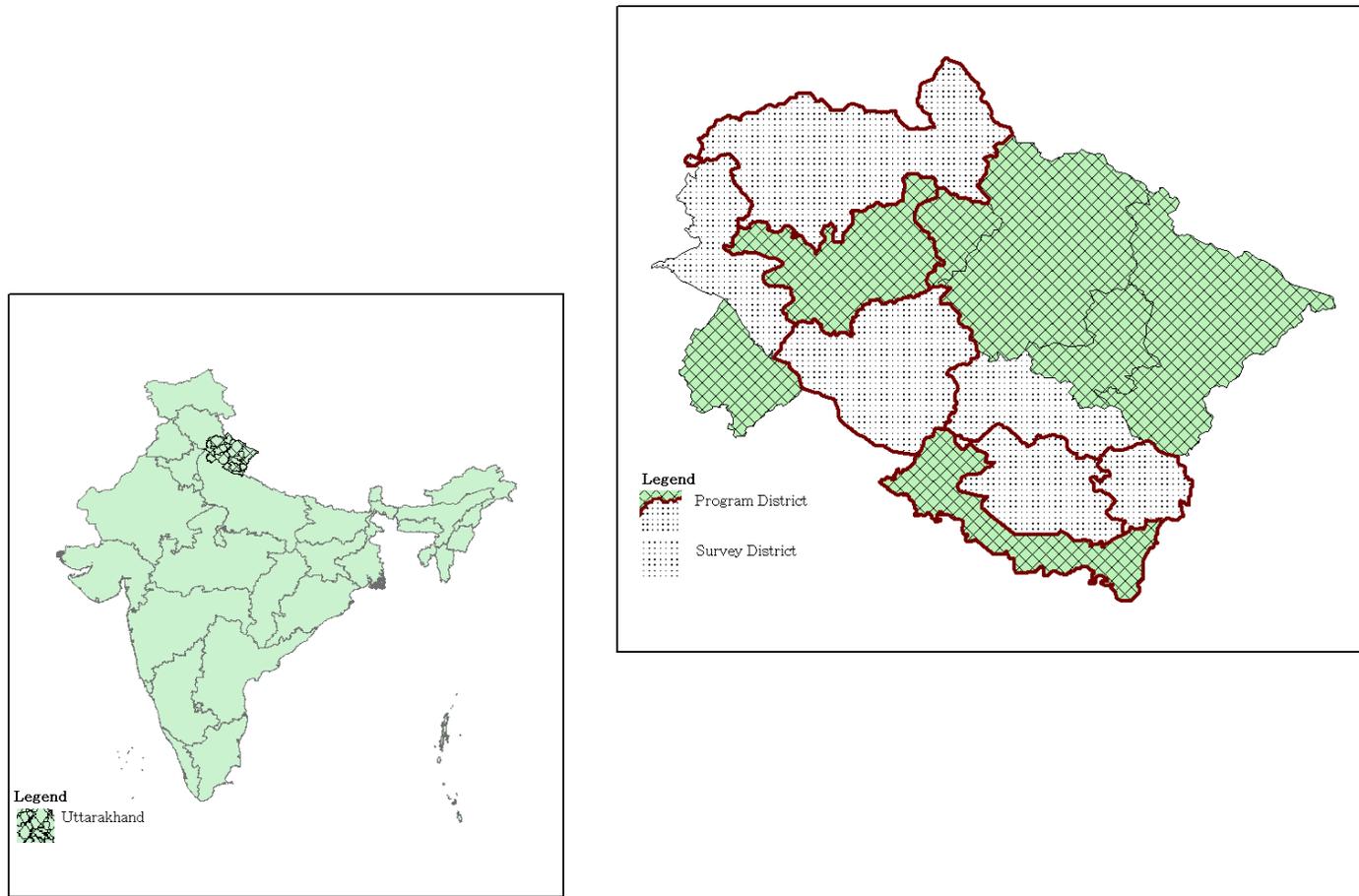


Figure 3: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

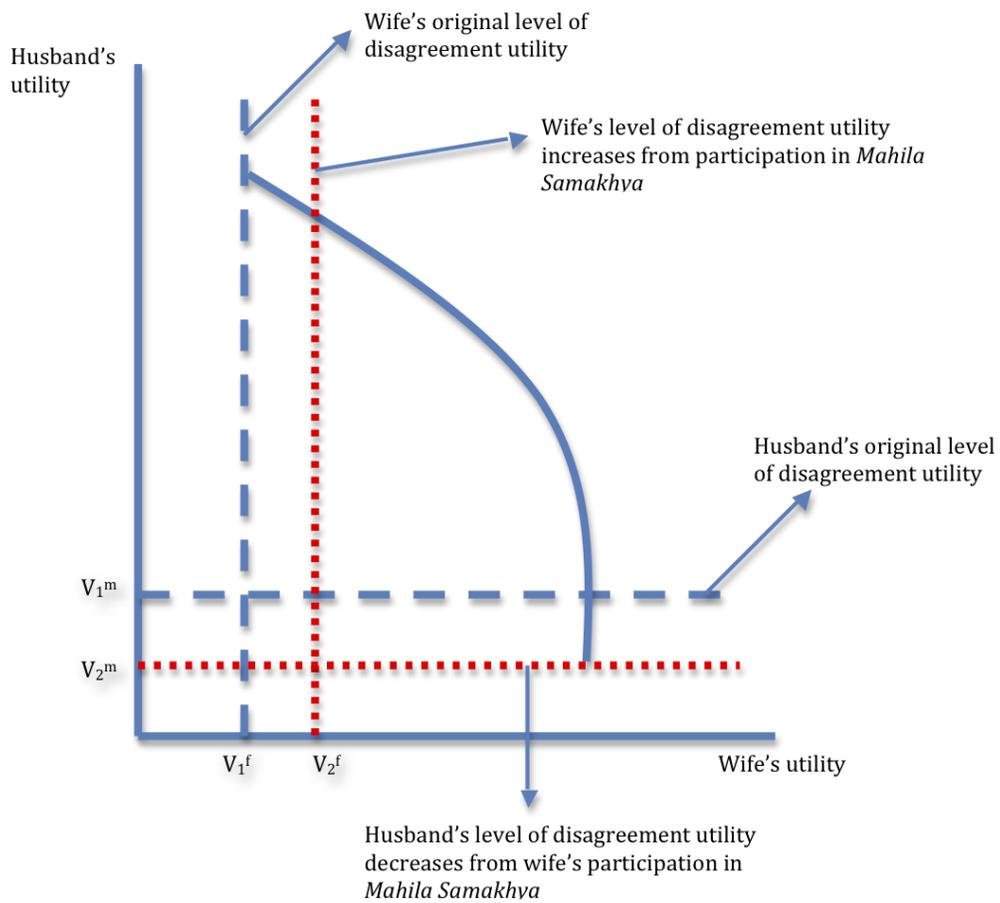


Figure 4: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

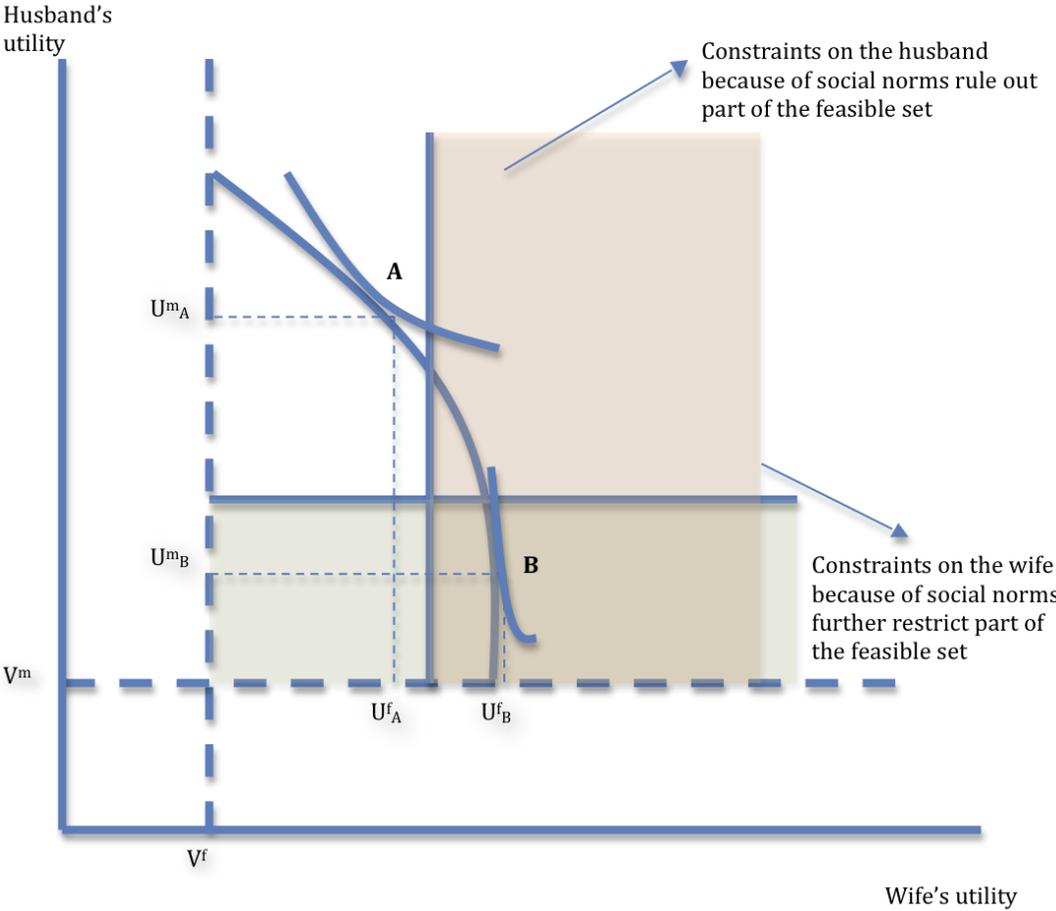


Figure 5: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

