

# Socioeconomic Distance 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 womens 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.

### 1.1 Motivation

1 Almost a third of all children in developing countries are malnourished (Smith and Haddad,  
2 2000). How can we improve child welfare? One possible solution is to empower women.  
3 Evidence suggests mothers invest more than fathers in their children, hence women who  
4 can influence their household’s resource allocation have healthier children than those who  
5 cannot (Maitra, 2004; Thomas et al., 2002; Quisumbing and Brière, 1999). In this paper, we  
6 quantify the impact of network-based learning and influence on measures of female autonomy  
7 and child nutrition.

8 A woman’s ability to influence household resource allocation depends on her notion of  
9 identity, her bargaining power, and the social norm<sup>1</sup>, which in turn depend on the local  
10 culture (Akerlof and Kranton, 2010). Identity can be a source of strength and confidence  
11 (Sen, 2006) but in the presence of constricting social norms, identity can confine and limit  
12 power. Since bargaining power is an inherently unobservable concept, economists use proxy  
13 variables to quantify it. Education, contraceptive use, and asset-ownership are three key  
14 proxies but can be difficult to influence in remote and poor regions. In such regions, we  
15 argue peer networks can be more effective than traditional approaches at changing the social  
16 norm, bargaining power, and hence child nutrition.

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<sup>1</sup>A 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).

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

- 19 • Does the bargaining power of a woman's peers affect her own bargaining power?
- 20 • Do social learning and influence cause networks to change a woman's parenting behav-  
21 ior?
- 22 • Do women with greater bargaining power invest more in their children?
- 23 • Do women with greater bargaining power invest more equally in boys and girls?

24 Connectedness to peer networks, as measured by network size, strength, and composi-  
25 tion, affects individual identity. Individuals learn new information from peers and trust the  
26 information because it came from a friend. They also compare themselves to their friends  
27 and define their well-being relative to their friends. Friends provide information and support,  
28 and also influence behavior. Friends thus help define identity, and can even change how an  
29 individual sees herself. Peer networks in traditional societies (as in many developing coun-  
30 tries) may be homogenous and stratified by income or social hierarchy. Such homogeneity  
31 may limit the flow of information across the network. In combination with restricting social  
32 norms, homogenous and weak networks leave little scope for friends to influence each other's  
33 behavior in positive ways. In this paper, we examine whether network-based learning or  
34 influence can increase female autonomy, and thus improve child welfare. We examine this  
35 relationship using a causal model and primary data from India.

36 Indian per-capita income has more than doubled since the mid-nineties. Agricultural  
37 production is at an all-time high, and large buffer stocks of cereals lie in government granaries.  
38 Such economic and agricultural success notwithstanding, over forty percent of all Indian  
39 children under the age of five suffer from malnutrition. By contrast, only about thirty percent  
40 of sub-Saharan African children are similarly malnourished (Gagnolati, et al., 2005). The  
41 fruits of India's economic growth do not appear to be reaching many of its youth. In addition,

42 social norms greatly restrict a woman’s say in her household, and she is used to thinking  
43 of herself almost as someone’s property. As a result, the woman often has little say in the  
44 household resource allocation, and Indian children continue to suffer from malnutrition.

45 Most theoretical models of parental investment in children assume arbitrarily that the  
46 mother inherently prefers greater investment in children, i.e. that she is more altruistic  
47 than the father (Agarwal, 2004). In this paper, we develop a utility maximization model  
48 in which consumption smoothing gives parents an economic incentive to invest in their  
49 children. Social networks influence the mother’s allocation decision in three ways: first,  
50 support groups increase her disagreement utility, and allow her greater control of household  
51 resources.<sup>2</sup> Second, learning through networks removes constraints placed by social norms,  
52 allowing the woman a greater range of choices in her domestic life. Third, identity utility  
53 from belonging to networks causes a woman to be influenced by her friends’ choices, and  
54 mimic their actions.<sup>3</sup> Policy-makers can harness the power of learning and influence through  
55 networks to bring about greater investments in child welfare.

56 We collect primary data on self-reported networks, female empowerment, and child nu-  
57 trition in rural north India because existing datasets do not report information on peer  
58 networks. The data are from the state of Uttarakhand, which is nestled in the Indian Hi-  
59 malayas (the cross-hatched region in the inset of Figure 1). Most villages are remote and  
60 lack access to basic infrastructure such as government schools and hospitals. Uttarakhandi  
61 women tend not to be well educated and have very low mobility. The remoteness of the  
62 region and lack of good roads combined with stringent social norms mean that once married,  
63 women are unable to visit friends or even parents regularly. This state of isolation and igno-  
64 rance, accompanied by the constricting social norms restrict women to the narrow spheres  
65 of family and housework.

66 To model a shock to female bargaining power, we use a government program called

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<sup>2</sup>Disagreement 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).

<sup>3</sup>Identity 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).

67 *Mahila Samakhya* (MS). The program aims to increase bargaining power through education  
68 in targeted areas. *Mahila Samakhya* has been in place in Uttarakhand since 1995, covering  
69 2416 villages in six of thirteen districts in the state (program districts are represented with a  
70 thick border in Figure 1). Our survey area covers six randomly-chosen Uttarakhand districts,  
71 four with the program and two without. (The survey districts are represented in Figure 1 with  
72 a dotted pattern. The four districts with a thick border and dotted patterns are the program  
73 districts. The two dotted districts without a thick border are non-program districts.)

74 This paper is the first to study how networks affect child welfare through bargaining  
75 power. We explicitly measure the effect of peer networks on bargaining power and child  
76 welfare. We also collect data on a unique community-level intervention to increase female  
77 empowerment through education and use it to identify a shock to female bargaining power  
78 and spillover effects through peer networks. Further, economists tend to use caste or sub-  
79 caste as proxies for networks in India. The result of a program like *Mahila Samakhya* is  
80 to expand and diversify networks, which would not be captured by caste or sub-caste. Our  
81 data allow us to examine the quality of caste and sub-caste as proxies for networks.

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

## 89 **2 Literature Review**

90 This paper differs from existing literature in three ways. The economics literature assumes  
91 that women invest more than men in children because they are more altruistic. Rather than

92 make this arbitrary assumption, we develop a causal model that provides women an economic  
93 incentive to invest in their children. Second, economists usually ignore the role of networks in  
94 determining bargaining power. We combine elements of the demography diffusion literature  
95 with identity economics to model bargaining power as a function of peer networks. Third,  
96 economists exploit rigidity in social hierarchy to use caste and sub-caste as proxies for peer  
97 networks in India. We use primary data on self-reported networks to test whether caste and  
98 sub-caste are good proxies for actual networks.

99 Economists tend to assume that men and women have inherently different preferences  
100 with regard to household resource allocation, so bargaining power affects the allocation of  
101 household resources as well as labor supply decisions (Ghosh and Kanbur, 2008; Agarwal,  
102 2004; Sahn and Stifel, 2002; Quisumbing and Maluccio, 2000). As a result, a woman with  
103 little bargaining power within the household gets a smaller share of the household's resources  
104 than a woman with more bargaining power (Phipps and Burton, 1998; Thomas, 1990). The  
105 greater the woman's control over resources, the higher the level of investment in children.  
106 Household resource allocations can vary significantly depending on who makes the decisions:  
107 men spend most of the money on personal consumption while women channel a large share  
108 to their children's education and health (Kanbur and Haddad, 1994).

109 Since female bargaining power is an inherently unobservable concept, the economic lit-  
110 erature uses proxies to control for it. Education, contraceptive use, and asset-ownership  
111 are three key proxies; evidence from India shows strong positive correlations among female  
112 education, freedom of movement, and better maternal health (Malhotra et al., 2003). Rah-  
113 man and Rao (2004) study the determinants of female autonomy in India, finding that a  
114 better-educated mother has greater bargaining power. They also find culture, as measured  
115 by state fixed-effects, to be significant despite several control variables. Schuler and Hashemi  
116 (1994) find that more empowered women are more likely to use contraception in Bangladesh  
117 Beegle et al. (2001) find evidence that a woman's influence on resource allocation varies  
118 with her family's social status and with her and her father's education relative to that of her

119 husband. A woman with some assets that she perceives as her own also has a greater influ-  
120 ence on reproductive- and child- health decisions than a woman with no share of household  
121 assets.

122 While the economic literature often ignores the role of networks in determining female  
123 power, the demographic diffusion literature has extensively studied the impact of social  
124 interactions on individual contraceptive use. *Social learning* and *social influence* describe  
125 how individuals act on information acquired from peers (Montgomery and Casterline, 1996).  
126 In this literature, social learning occurs when women obtain information about contraceptive  
127 methods from peers and family. Therefore, social networks provide information and help  
128 individuals gauge the quality of the information (Kohler et al., 2001). Social influence occurs  
129 when individuals act in similar ways to avoid conflict within the social group. Networks also  
130 work through examples to encourage individuals to copy peers' behavior (Behrman et al.,  
131 2002). Networks thus provide the set of peers to whom we compare ourselves and relative  
132 to whom we define our well-being (Akerlof, 1980).

133 Few papers have linked the theoretical advances of the contraceptive-use diffusion liter-  
134 ature with the female bargaining power literature. No other paper has used self-reported  
135 networks in studying the determinants of female power and child welfare. Can peer networks  
136 increase female intrahousehold bargaining power and thereby improve investments in child  
137 welfare? In this paper, we seek to fill this gap by explicitly modeling female bargaining  
138 power as a function of connectedness to peer networks.

### 139 **3 The *Mahila Samakhya* Program**

140 In 1988, *Mahila Samakhya* was launched in three states of India to improve formal, informal,  
141 and vocational education for women. The community-level program was placed in districts  
142 targeted both for their low rates of female education and low school attendance by girls, rela-  
143 tive to male educational outcomes. The program also targets remote areas, with little access

144 to infrastructure. Participation in the program is voluntary, and no monetary incentives are  
145 offered.<sup>4</sup>

146 *Mahila Samakhya* started in Uttarakhand in 1995 and implements its agenda through  
147 village-level groups of women. The program is funded by the Indian government and the  
148 British Department for International Development. Annual national and state reviews of  
149 the program use summary statistics to evaluate its effectiveness in increasing female empow-  
150 erment, as measured by educational attainment, the regularity of village- and district-level  
151 group meetings, and political participation in the village council. Reviews also use informa-  
152 tion from focus groups to gauge whether the program has raised the level of confidence and  
153 the sense of community in participants. Janssens (2010) uses Intent-to-Treat estimates to  
154 evaluate the *Mahila Samakhya* program in the state of Bihar, and finds that the program  
155 significantly increases trust and engenders social capital. Non-participant households in pro-  
156 gram villages also exhibit higher levels of trust and are more likely to engage in community  
157 building activities than households in non-program villages.

158 *Mahila Samakhya* conducts literacy camps and provides continuing formal education to  
159 women and girls. The program provides vocational training to enable participants to earn an  
160 income. Participants have used the training to become midwives, herbal medicine manufac-  
161 turers, bakers, grocers, candle makers, and tailors. In addition, the program provides special  
162 education on resolving domestic disputes and conflicts within the community. The program  
163 also encourages women to participate in village politics as a means of self-empowerment.  
164 Participants hear about the success women have had in the labor force, and the important  
165 roles women can play in Indian society. They are also told about the benefits of having a  
166 daughter and of not discriminating against her. Groups of participants support each other  
167 on issues like domestic violence, alcoholism, dowry, and female infanticide.

168 Village- and district-level meetings allow participants to step outside their homes and  
169 villages, making their lives less solitary. They meet women from other villages, castes, and

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



170 religions, which expands their peer networks and also lets them engage in conversation not  
171 pertaining to domestic chores and family. The semi-formal and well-structured nature of  
172 these interactions facilitates dialogue, and enhances the program’s effectiveness. The infor-  
173 mation provided by *Mahila Samakhya* as well as that exchanged within the newly-expanded  
174 networks can help change social norms. The learned vocational skills allow participants to  
175 engage in income-generating activities. Changed social norms and the ability to earn an  
176 income enables these women to have greater control over household resources.

## 177 **4 The Causal Mechanisms**

178 *Mahila Samakhya* has two effects on female empowerment: one direct, and one indirect.  
179 The direct effect works through education, while the indirect effect works through changing  
180 social networks. In this paper, we examine the indirect effect. Figure 2 describes the causal  
181 mechanisms at work. The ovals represent observables— participation in *Mahila Samakhya*,  
182 individual characteristics, the size, strength, and composition of networks, investments in  
183 child welfare, and remittances from children. The blocks represent unobservables— village  
184 culture, identity utility from the social norm, constraints placed by the social norm, and  
185 individual bargaining power. Dotted lines present feedback effects, such as the effect of the  
186 program on village culture via individual characteristics .

### 187 **4.1 Direct Effect**

188 Participation in the program increases the woman’s educational attainment, which is an en-  
189 dogenous individual characteristic. Providing a woman education improves her job prospects  
190 (Phipps and Burton, 1998). When bargaining with her husband over household resources,  
191 knowing about better job opportunities and having more marketable skills increase her dis-  
192 agreement utility. More education thus raises bargaining power, which in turn increases the  
193 investment in children.

## 194 4.2 Indirect Effect

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

204 The influence of and learning from peers affect (1) a woman's bargaining power, (2) the  
205 constraints placed by the social norm, and (3) the identity utility received from belonging  
206 to a group. Strong networks provide support groups that influence individual behavior  
207 and increase the woman's power within her household. Individuals also learn from and are  
208 influenced by friends. Observing peers adopt new behaviors influences a woman's behavior  
209 because she trusts her peers and their judgment. Finally, people receive identity utility from  
210 belonging to a network, and from behaving like their friends, allowing networks to further  
211 influence behavior.

### 212 4.2.1 Bargaining Power

213 The social influence of networks changes individual bargaining power. Participants have  
214 more opportunities to interact with their peers, especially away from home. They develop  
215 a stronger network that can support them if they face domestic violence, or help change  
216 the household resource allocation. A woman with no support group will remain in the  
217 status quo for fear of being ostracized. By organizing women into support groups, the  
218 program increases their power within the household and community without fear of social  
219 sanction. The support group also intervenes directly when a participant's family refuses to

220 improve its treatment of her. A participant reported that her *Mahila Samakhya* network  
221 intervened when her husband and in-laws did not allow her to feed her daughter as well  
222 as her son. Another respondent said that her husband’s treatment of her improved after  
223 she joined *Mahila Samakhya* because he was worried that program officials would intervene  
224 in his domestic life and shame him in the village. Participants have “strong ties” (Kohler  
225 et al., 2001), which give them the strength and confidence to have greater say within the  
226 household.

#### 227 **4.2.2 Constraints Placed by Norms**

228 Social learning can help remove the constraints placed by norms so women have more choices.  
229 A woman can learn new information from her peers. She may not have realized certain choices  
230 (for instance, the ability to study or work) were available to her. This effect can be thought  
231 of “as expanding the set of choices known to the woman” (Montgomery and Casterline,  
232 1996, p. 158). Further, the outcomes of the educational and employment choices made by  
233 her friends provide an “empirical demonstration of the range of consequences that can follow  
234 from the adoption of a particular choice and may thereby shape the woman’s subjective  
235 probability distributions” (Montgomery and Casterline, 1996, p. 158). Such learning is not  
236 restricted to close friends and can occur through “weak ties” (Granovetter, 1983), such as  
237 the ties with program participants from other villages.

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

244 The question then arises, why do social norms that harm individuals persist in the absence  
245 of an intervention like *Mahila Samakhya*, and how do network-based learning and influence

246 interact with such norms? Akerlof (1980) notes social norms disadvantageous to individuals  
247 may persist for fear of social sanction by the group against the individual trying to challenge  
248 the social norm— social influence at work. Further, people may not want to be outliers  
249 because of a negative feedback loop resulting from the social relativism of others. Program  
250 participants often reported being unsure what others would say if they tried to stand up to  
251 their in-laws or stop their husbands from hitting them— “We did not want to risk being  
252 different.” As well as improving connections with existing peers, the program alters peer  
253 sets by expanding networks. Program workers are also more empowered than average, and  
254 provide a reference point for a different social norm.

### 255 **4.2.3 Identity Utility**

256 Peers behave like one another not only to avoid conflict and to coordinate with each other  
257 but also because they gain identity utility from being insiders in the group (Akerlof and  
258 Kranton, 2010). Identity is endogenous and thus identity utility is influenced by changes in  
259 the reference group. The program changes the participant’s relative set of peers so that the  
260 people she compares herself with are now more educated and have less traditional attitudes  
261 about women’s role in society. Respondents often talked of the pride they felt in being pro-  
262 gram participants, and how they were happier because of the changes in their peer network.  
263 Non-participants have weaker ties to peers, hence their identity utility from belonging to a  
264 network is lower than that of participants.

### 265 **4.2.4 Village Culture**

266 Changes in peer networks can cause more women to study, have jobs, and be empowered,  
267 but in the absence of a program like *Mahila Samakhya* networks are the realization of village  
268 culture. If the culture is such that most women only interact with others of their sub-caste,  
269 peer networks will be stratified by sub-caste. *Mahila Samakhya* changes networks, which  
270 affects individual characteristics and thereby influences village culture. Networks become

271 more diverse, and eventually change the village culture so it is more accommodating of such  
272 diversity. By affecting endogenous characteristics like education, the direct effect of the  
273 program also changes the village culture.

#### 274 **4.2.5 Feedback Effects**

275 Learning and influence associated with networks can also have important feedback effects on  
276 the household and on village culture. Changes in networks can affect individual characteris-  
277 tics like education, contraceptive use, and mobility. These changes lead to more empowered  
278 women, and thus greater investments in children. More empowered, educated, and mobile  
279 women also change village culture. Participants told us that before joining the program  
280 they faced a constricting social norm, reinforced by the village culture. They could not  
281 work, were barely educated, had little say in the resources allocated to their children, and  
282 were told to discriminate against daughters. Their identity was always subsumed in their  
283 husband's, brother's, father's, or in-laws' identity. After participating in *Mahila Samakhya*,  
284 women realize they have their own identity, that they can work if they want to, that they  
285 should study, and that they can influence household and community decisions. In the long  
286 run, as more people invest in their children, and investments become more equitable between  
287 the two sexes, the village culture will reflect the new patterns in investment.

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

## 5 Model

In this paper, we start with a basic Nash bargaining problem and model the husband and wife as playing a cooperative Nash bargaining game. If the bargain breaks down, the husband and wife each receive their 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, we make the following changes: 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,  $\theta$ . The bargain leads to optimal values of the bundle for each adult,  $\mathbf{x}^*$  and  $\theta^*$ . 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.<sup>5</sup>

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

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<sup>5</sup>The 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.

320 use the subscripts  $m$  and  $f$  to denote these differences. Identity utility can be negative if the  
321 individual is worse-off than her reference group, and positive if she is not worse off than her  
322 peers. Note also that identity utility increases in the strength of ties. The third change to  
323 the basic Nash bargaining problem reflects social influence on individual bargaining power  
324 by making disagreement utilities  $V$  a function of networks because networks can provide  
325 support in domestic disputes. The exponents  $\alpha$  and  $\beta$  reflect the relative levels of bargaining  
326 power captured by husband and wife. These exponents reflect village culture, and can change  
327 over time to reflect a more equitable culture.

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

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

s.t. 2, 3, 4, 7

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

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

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

330 The household's full-income budget constraint (FIBC) derives from the individual budget  
331 constraints faced by the man and the woman. Each gets utility from consuming the vector  
332 of goods  $\mathbf{x}$  in each time period. The vectors  $\mathbf{p}_m$  and  $\mathbf{p}_f$  reflect the prices faced by the man  
333 and the woman. The prices associated with the private good  $c$  and leisure  $l$  are  $p_c$ ,  $w_f$  for  
334 the woman, and  $w_m$  for the man. We model the public good  $r$  as a numeraire, hence the

335 associated price is one. Since the woman has an economic incentive to invest more in her  
 336 children, her optimal choice of  $i$  is greater than the man's optimal choice. The woman's  
 337 FIBC looks as follows:

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

338 where  $\theta$  represents the wife's control over the share of assets and  $\rho$  represents the prob-  
 339 ability that the woman is married in period 2. The share is endogenous, so that as the  
 340 woman's bargaining power and identity utility increase, so does  $\theta$ .  $E(T)$  refers to the ex-  
 341 pected transfers from children. The man's FIBC looks as follows:

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

342 Adding up the constraints in equation 5 and equation 6 yields the full-income budget  
 343 constraint faced by the household (equation 7).

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

344 Consider the husband and wife's utility to be the outputs produced by the household;  
 345 these outputs are a function of the utility from labor allocation, consumption, investment  
 346 in children, and participation in networks. A household utility possibilities frontier (UPF)  
 347 gives us all the feasible pairs of husband and wife utility production. We perceive three ways  
 348 in which bargaining power, social norms or information sets might affect the observed equi-  
 349 librium. (1) Levels of and changes in bargaining power can affect the observed equilibrium.  
 350 If a woman does not have much bargaining power, the equilibrium will result in greater



351 utility to the husband than to the wife. (2) Further, not knowing about all the choices or  
352 feasible levels of utility might constrain the equilibrium to a subset of the full UPF. The  
353 social norm might constrict women so they may not realize that certain high levels of utility  
354 are attainable. (3) Finally, if the woman's relative set of peers follow the social norm, i.e.  
355 do not work and have little or no education, the household may be on a lower UPF than it  
356 would otherwise.

357 Figure 3 represents the household's utility space, a UPF, and the equilibrium resulting  
358 from the husband and wife's choice sets. The dashed lines represent the husband and wife's  
359 levels of disagreement utility. If the bargain breaks down, they receive  $V_m$  and  $V_f$ , represented  
360 in utility-space by the intersection of the two dashed lines. The disagreement utilities place  
361 lower bounds on the UPF with respect to the  $x$ - and  $y$ - axes. Now consider the situation  
362 in which the woman joins *Mahila Samakhya*, and the resultant support group intervenes in  
363 her domestic situation and increases her disagreement utility so that she is better-off even  
364 if the bargain breaks down. Also consider the case in which her husband's disagreement  
365 utility decreases because the support group forces him to improve his treatment of her. The  
366 new disagreement utilities, represented by the dotted lines, expose a previously-unattainable  
367 part of the UPF that represents higher utility to the woman, and limits part of the UPF  
368 associated with lower utility to her.

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

378 raise the reservation wage and thus increase bargaining power.

379 Social learning enables *Mahila Samakhya* to change the social norm through the “ex-  
380 pansion of the set of choices available to women” and the “the empirical demonstration of  
381 the range of consequences” from adopting certain behaviors (Montgomery and Casterline,  
382 1996, p. 158). Figure 4 illustrates how the constraints placed by the program can restrict  
383 the UPF to a small portion of the true frontier. Point A is a possible equilibrium outcome,  
384 at which the husband’s utility is  $U_A^m$  and the wife’s utility is  $U_A^f$ . However, neither spouse  
385 knows the extent of true UPF because social norms constrain their choice sets to less than  
386 the full feasible set. Constraints on the husband restrict the frontier along the x-axis, while  
387 constraints on the wife limit the frontier along the y-axis. Point B is on the same UPF but  
388 is not available because the higher level of female utility it represents is ruled out by social  
389 norms. The indirect network effect of *Mahila Samakhya* removes the constraints— initially  
390 only for the woman, but eventually also for her husband. Point B now becomes feasible. A  
391 move to point B would increase her utility ( $U_B^f > U_A^f$ ) and decrease her husband’s utility  
392 ( $U_B^m < U_A^m$ ).

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

403 The third effect of networks might be to shift out the UPF available to the household.  
404 The woman’s utility is a function of the attitude or actions of her peers— her “relative set”.

405 She defines her well-being relative to them, and gains identity utility from behaving like  
406 them (Akerlof and Kranton, 2010). If her relative set of peers have traditional attitudes and  
407 adhere to the social norm although it discriminates against them, their ties are likely to be  
408 weak, hence the woman's gain in identity utility is also low. Such a relative set leaves little  
409 scope for social learning and may cause the woman's household to be on a lower UPF than  
410 they can attain. However, identity also has a relative component. The woman gains utility  
411 from being at least as well off as her peers, and loses utility if she is worse-off than them. By  
412 observing other women holding jobs and being educated, the woman is motivated to make  
413 similar changes in her life.

414 If the program strengthens a woman's peer network, she stands to gain identity utility.  
415 The program also introduces her to more empowered women, who likely receive a greater  
416 share of the household's utility. She now needs an even higher level of utility than before in  
417 order to be as well off as her peers. At point A in figure 5, without accounting for identity  
418 utility, the woman receives  $U_A^f$  in utility. Her relative set of peers have a higher level of  
419 utility,  $U_r^1$ , which effectively shifts back her UPF. After accounting for this loss in utility, the  
420 woman only receives  $U_A^{f,r}$ . Now if the equilibrium is at point B, so she is better off than her  
421 peers, which shifts out her UPF. The gain in identity utility means she effectively receives  
422  $U_B^{f,r} > U_B^f$ . Now if the woman's relative set changes because of *Mahila Samakhya* and the  
423 new relative set has higher utility,  $U_r^2$ , the woman needs a greater gain in utility to be as  
424 well-off as before. Now, some parts of the UPF (between  $X$  and  $Y$  on the  $y$ -axis, where  
425 she was better-off than a less empowered relative set) shift in because she is worse off than  
426 her new relative set. Stronger networks from participation thus lead to a greater change in  
427 identity utility than a weaker network.

428 In this framework, the direct (educational) effect of the program raises the woman's  
429 bargaining power through an increase in her opportunity cost. The indirect (network) effect  
430 of the program works through networks to change the woman's bargaining power, increase  
431 the feasible set of choices available to her, and change the UPF that is attainable to her

432 household. The model presented here yields testable hypotheses that we can examine using  
433 the data.

## 434 **6 Identification Strategy**

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

### 439 **6.1 Identifying Peer Effects**

440 Manski (1993) points out that the reflection problem confounds the identification of causal  
441 peer effects. Do people behave in similar ways because they have learned from or been  
442 influenced by their friends, or are they friends because they behave in similar ways? Manski  
443 presents three hypotheses regarding the observed similarities in the behavior of friends. (1)  
444 Correlated effects occur when people act alike because they face a similar environment or  
445 have similar characteristics. (2) Contextual effects such that the “propensity of an individual  
446 to behave in some way varies with the distribution of background characteristics in the  
447 group” (Manski, 2007, p. 1). (3) Endogenous effects, where the group affects individual  
448 behavior through social interaction. The third effect is key to identifying the causal impact  
449 of networks.

450 Much of the literature following Manski (1993) has focused on the econometric issue of  
451 separating the causal peer effect from that of correlated unobservables (Conley and Udry,  
452 2008; Miguel and Kremer, 2004, Foster and Rosenzweig, 1995). A straightforward way  
453 of disentangling these effects is to randomize the intervention or new technology at the  
454 friend-level (Oster and Thornton, 2009). Randomization allows for the identification of the  
455 endogenous effect because the number of friends who receive the intervention or technology

456 is exogenous. The *Mahila Samakhya* intervention is not randomized, so our identification  
457 strategy uses a recent extension to networks of Kelejian and Prucha’s (1996) Generalized  
458 Spatial 2SLS estimator.

459 Our identification strategy relies on overlapping peer networks to identify causal peer  
460 effects. We use a recently developed technique (Bramoullé et al., 2009; De Giorgi et al., 2010)  
461 in which partially overlapping networks generate friends of friends or “excluded friends”.  
462 Since a woman does not know (or know well) these excluded friends, they can only affect  
463 her behavior through shared friends. Similarities in the behavior of excluded friends and the  
464 woman is then evidence that networks change behavior. We use information on self-reported  
465 friends to generate a weight for each pair of friends such that the higher the weight, the  
466 stronger the friendship, and the greater the hypothesized influence of or learning from the  
467 friend. Then, the excluded friend’s influence on the individual is weighted by the shared  
468 friend’s influence

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

## 477 **6.2 Endogeneity of Program Participation and Networks**

478 Since participation in *Mahila Samakhya* is most likely endogenous, we use family composi-  
479 tion as an instrumental variable. A woman who lives near younger sisters-in-law (husband’s  
480 younger sisters or husband’s younger brother’s wife) can rely on these sisters-in-law to look  
481 after her children as well as any domestic chores while she attends *Mahila Samakhya* ac-

482 tivities. Relationship hierarchy prevents a woman from asking her parents-in-law or older  
483 sisters-in-law to take care of her share of housework, but allows her to ask a younger sister-  
484 in-law for such help. Most families in the region are extended in structure, and male siblings  
485 live close to each other. So, if a woman has younger sisters-in-law (particularly the husband's  
486 brother's wife), they likely live nearby and facilitate her participation in the program.

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

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

## 504 **7 Data**

505 Researchers have used caste to proxy for peers in India because caste is a strong signifier of  
506 networks (Munshi and Rosenzweig, 2006), but there may be networks of varying strength

507 within castes. Household data from India do not include report information on self-reported  
508 networks, and preclude an analysis of the effect of networks on child welfare. As a result,  
509 we collect our own data from the north Indian state of Uttarakhand, collecting information  
510 on instruments for social learning, influence, female power, and their role on child nutrition  
511 outcomes. In addition, we also collect data on participation in *Mahila Samakhya*. Program  
512 centers have been present in Uttarakhand villages for periods lasting anywhere from three  
513 months to five years, allowing us to use time-variation in exposure to the program to identify  
514 its impact on networks and child nutrition.

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

519 • Networks:

520 – Who are your five closest friends and how do you know these people? How often  
521 do you see them? Where do you usually see them?

522 – Do you participate in the *Mahila Samakhya* intervention? How about your closest  
523 friends?

524 – How important is it to you and your husband what your friends and the commu-  
525 nity think of you?

526 – If one of your friends told you to give your daughter more milk, would you?

527 • Proxies for Female Autonomy:

528 – What kind of work do you do? What kind of work does your husband do?

529 – Do you currently use contraception? If not, why not? If yes, what type?

530 – What is your level of education? What is your husband's level of education?

531

- Investment in Children:

532

- How much should a child be educated? How much education will your children receive?

533

534

- Do you expect to receive monetary or other assistance from your children when you are old?

535

536

- 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.)

537

538

539

- How many hours did each child spend on chores in the past 24 hours? Which chores did they help out with?

540

541

- How much do you spend each month on your children's education?

542

- Information on each child's immunization status and their height.

543

These questions will help us identify the effect of peer networks on an individual's house-

544

hold bargaining power and therefore on child welfare.



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Figure 1: Uttarakhand, India

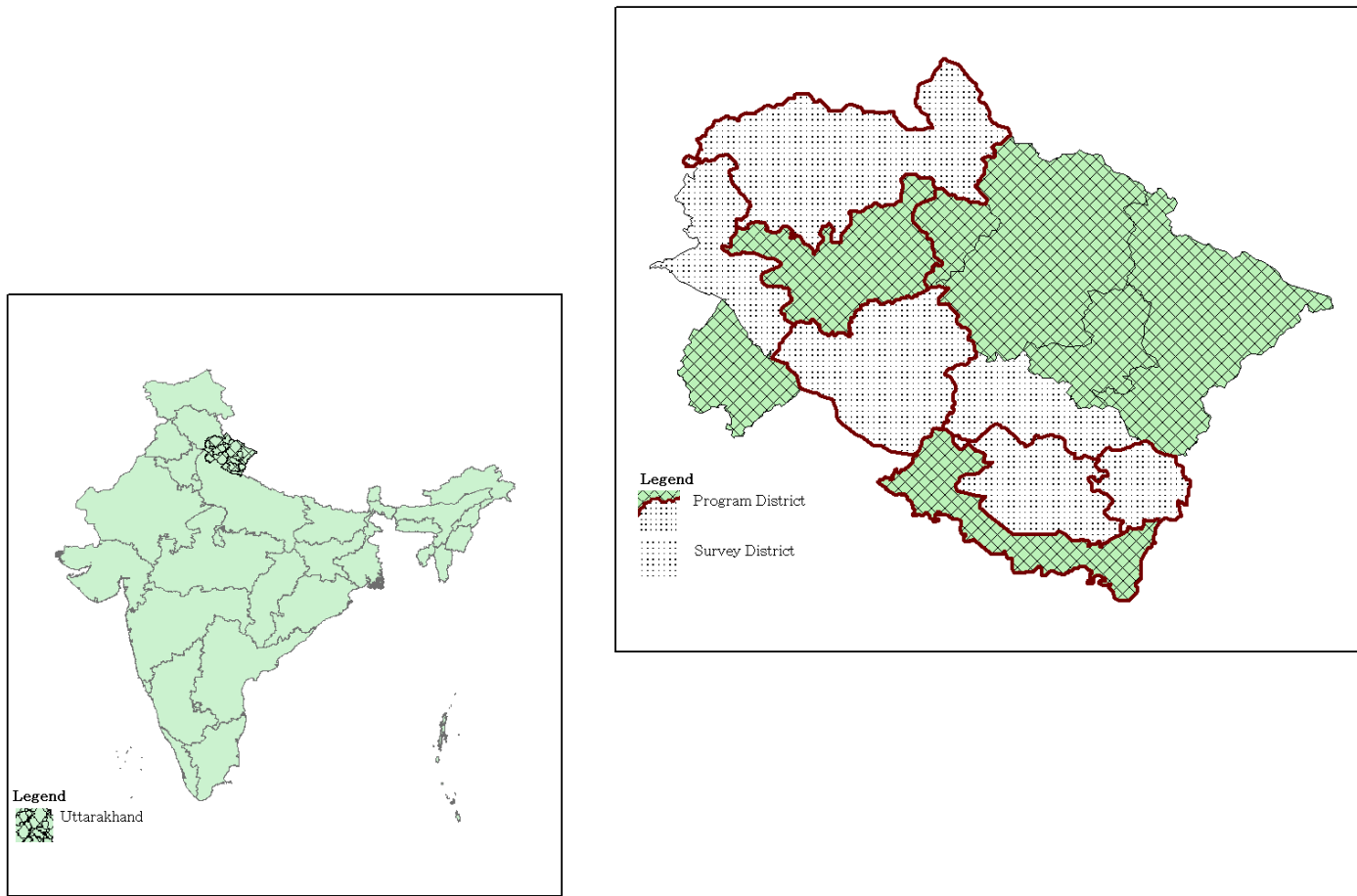


Figure 2: The Causal Relationships Between *Mahila Samakhya* and Child Welfare

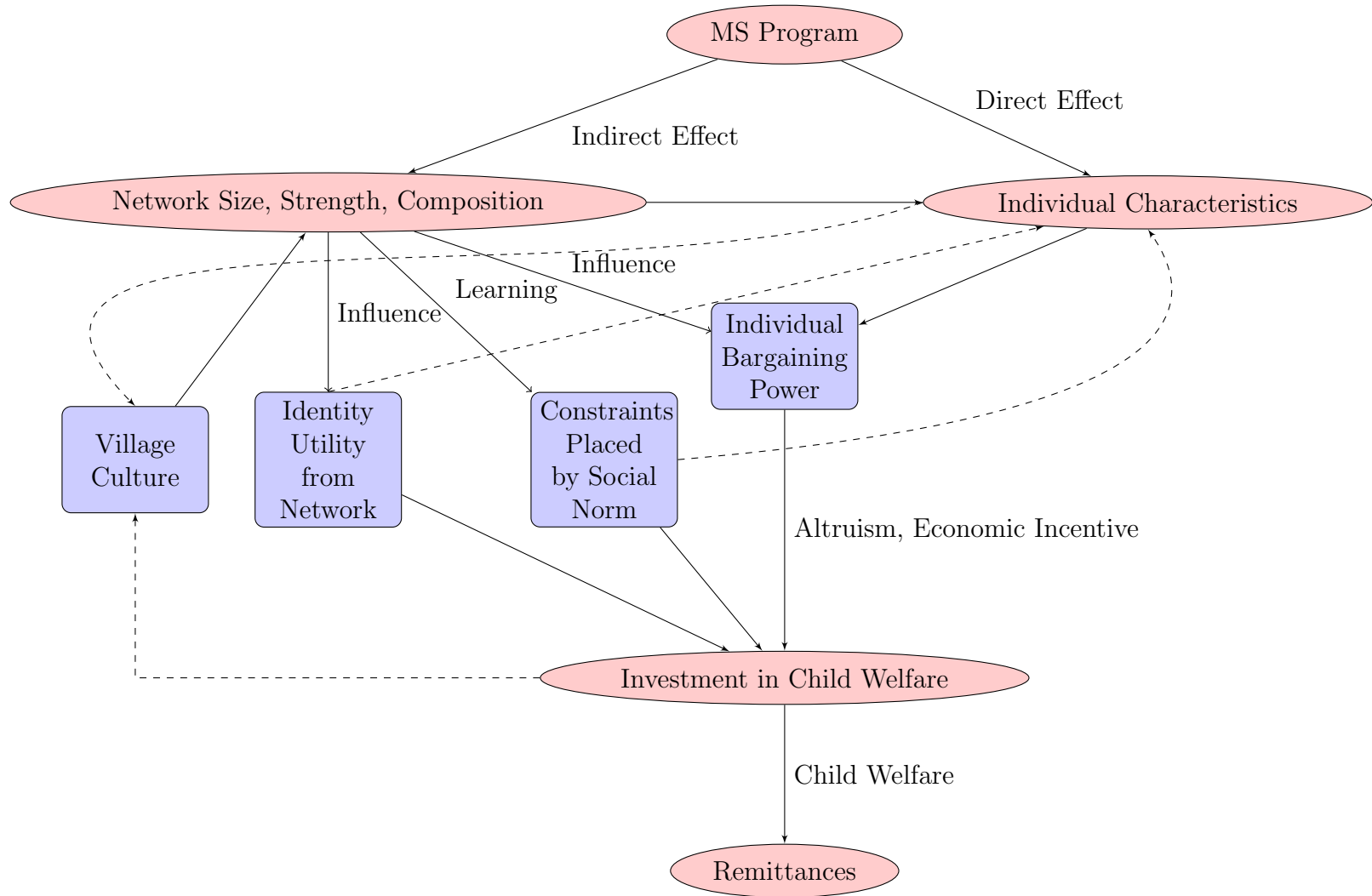


Figure 3: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

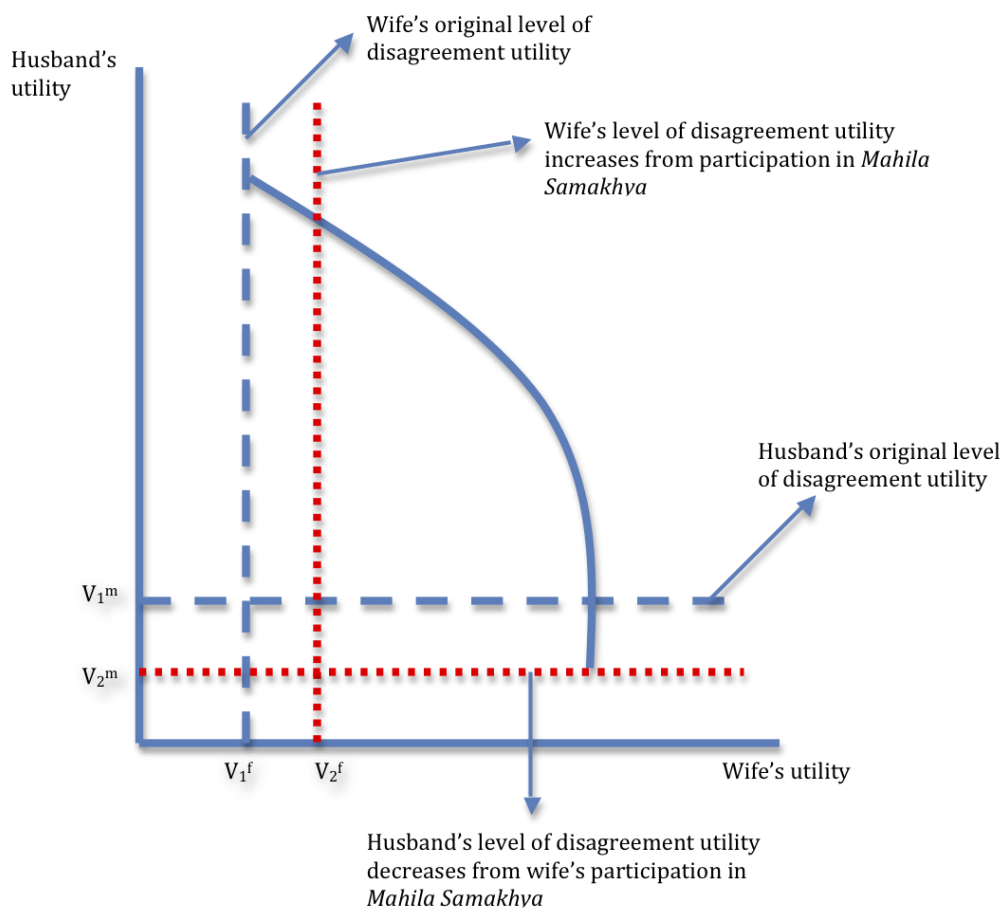


Figure 4: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

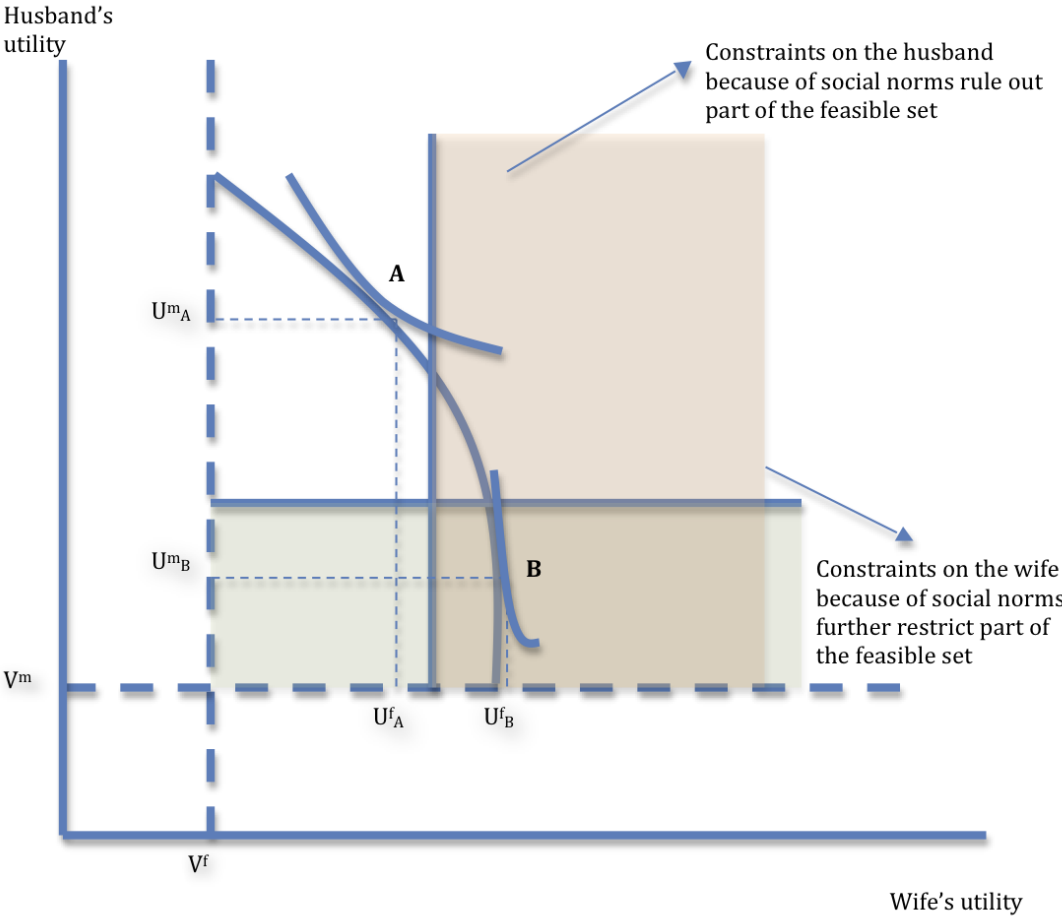


Figure 5: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

