THREE ESSAYS ON INVESTMENTS IN CHILD WELFARE IN INDIA

BY

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DISSERTATION

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ABSTRACT

In this dissertation, I evaluate two approaches that have the potential to improve child welfare, which persists at high levels in the developing world. In the first essay, I evaluate whether the Indian government's child nutrition intervention, the Integrated Child Development Services (ICDS) is able to reduce long-term malnutrition in children as measured by stunting. The ICDS provides supplements, peri-natal services, and daycare to targeted villages, and is one of many such programs in the developing world . Previous evaluations of ICDS have not adequately controlled for its targeted nature, introducing downward bias in their estimates, nor have such evaluations in India or elsewhere looked at the program's distributional effects. Controlling for targeting and using new data, I find significant treatment effects particularly for the most malnourished children. Unlike previous studies, I control for non-normality of ICDS coverage; however, like previous work, I find problems with the targeting of the program: while ICDS targets poor areas, it fails to target those with low average education or with unbalanced sex ratios.

In the second essay, I examine the impact of an Indian women's empowerment program, *Mahila Samakhya* on empowerment outcomes. The program aims to empower women through education and by organizing them into support groups. First, I use primary data on 487 women in the state of Uttarakhand to match non-participants with untreated women and establish that the program is not targeted at any particular part of the population. Then, matching women over districts with and without the program, I show that program participants are more likely to (1) work, (2) attend village council meetings, (3) have identification cards to a government employment scheme that give them access to

outside employment, and (3) leave the house without permission. My results thus establish that the *Mahila Samakhya* significantly improves gender empowerment. This study is only the second evaluation of the *Mahila Samakhya* program and the first to evaluate whether it improves female empowerment. This study is also the first to explore the how employment and social norm might differ in their impact on female empowerment.

In the third essay, I quantify the impact of peer network-based learning and influence on female empowerment and child food intake using primary data on networks in Uttarakhand. I use participation in the *Mahila Samakhya* program to identify increases in the empowerment of the participant herself and her social network. Using a conceptual framework that combines the Nash bargaining framework, the demographic diffusion literature, and identity economics, I characterize three ways in which networks function: social learning, social influence, and identity utility. I then use 3SLS on network-weighted instruments to estimate the relative sizes of these mechanisms on empowerment and child food intake. Results show that female empowerment is significantly affected by social influence and identity through participation, while child food intake benefits most from learning.

To Ma and Yusuke.

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TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

"There are people in the world so hungry, that God cannot appear to them except in the form of bread."– Mohandas Karamchand Gandhi

Over a third of all children in developing countries continue to be malnourished (Smith and Haddad, 2000). Malnutrition early in a child's life can lower educational attainment and lifetime earnings (Alderman et al., 2006b). Thus, investments in the welfare of children lead to more productive adults and greater national income (Mayer, 2001). Economic growth, on the other hand, need not guarantee improvements in child welfare. 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 40 percent of all Indian children are malnourished, compared to 33 percent in sub-Saharan Africa (Gragnolati et al., 2005).

In this dissertation, I examine two ways of improving child welfare using primary and secondary data from India. The first works through the integrated delivery of key services including nutrition supplementation, pre- and post-natal care, vaccinations, and daycare facilities. Although such programs tend to be targeted at the most vulnerable households and are free, worldwide the utilization of such programs tends to be low, and estimated effects are negligible. I use nationally representative data to examine the Indian Integrated Child Development Services to find that although the program improves long-term child nutrition, its impact is too small to end India's struggle with child hunger and malnutrition.

The rest of my dissertation focuses on a second way of improving child nutrition: through gender empowerment. A large and growing body of literature suggests that

mothers invest more than fathers in their children. Women who can influence their household's resource allocation have healthier children than those who cannot (Maitra, 2004; Thomas et al., 2002; Quisumbing and de la Brière, 2000). Traditionally, economists have looked at education, contraceptive use, and asset ownership as determinants of empowerment. But improving educational attainment, changing contraceptive use or asset-ownership first calls for changing rigid social norms that prevent women from getting an education, using contraceptives or owning assets.

Empowering a woman to control a greater share of her household's resources depends on her notion of identity and social norms,[1] as well as the interaction of these forces. However, even in areas where norms are rigid and patriarchal, friends are always present to provide information and influence behavior, thus helping define identity. I study whether harnessing the power of preexisting peer networks can help change norms to make these norms friendlier to women. In the second and third essays, I use primary data from rural north India to study the impact of a community-level empowerment program, *Mahila Samakhya*, that empowers women through education and strengthens and diversifies networks, on female autonomy and child welfare.

In the second essay, I test whether *Mahila Samakhya* participants are in fact more empowered than non-participants. I also test to see whether the program is targeted at the worst-off women, which would entail correcting for program placement to avoid underestimating the program's effect. I examine whether participants are in fact more physically mobile, have better access to employment, and more active in community-level politics. The *Mahila Samakhya* program primarily aims to provide education and thus improve employability, but may also have significant spillover effects on female empowerment through information flows and peer networks. Thus, I compare the empowerment levels of women who participate in the program but do not work— and thus

[1] A social norm refers to the behavioral expectations within society or a sub-group of society. Norms organize individual's beliefs and interactions when there is more than one possible equilibrium (Young, 2008).

do not benefit from the improved employment aspect of the program— with untreated women to find evidence of any such spillover effects.

After estimating the employability and spillover effects of the program on participants, in the third essay, I study further examine the spillover effect. I provide evidence that such a spillover effect likely works through networks, and ask whether the empowerment of a woman's peers affects her own empowerment. Going beyond most of the literature on peer networks, I decompose the causal peer effect into its component mechanisms of social learning, social influence, and identity utility. Finally, I consider the impact of own and friends' empowerment on children's food intake. The second and third essays thus help answer whether and how peers can affect female empowerment and therefore child welfare. My results suggest that traditional empowerment or child welfare interventions may benefit from explicitly incorporating peer networks into program design.

CHAPTER 2

BEYOND AVERAGE TREATMENT EFFECTS: THE DISTRIBUTION OF CHILD NUTRITION OUTCOMES AND PROGRAM PLACEMENT IN INDIA'S ICDS

2.1 Introduction

2.1.1 Motivation

Malnutrition early in a child's life can lower educational attainment and lifetime earnings Alderman et al. (2006b). Indias Integrated Child Development Services (ICDS) is one of several programs in the developing world that target long-term nutrition and development of children. This program provides nutritional supplements, vaccinations, health checkups and referral services, and day care. Much of the literature evaluating these programs finds little or no evidence of significant, sizable causal effects on chronic child malnutrition. In this situation, the evaluation of causal impact is complicated by numerous factors. First, causal effects depend on the details of the program and on their context; reductions to long-term child malnutrition need not occur homogeneously with a direct effect. Further, most integrated programs are endogenously placed to target areas of most need, making effective placement of centers crucial to their success. Globally, children from rural and agricultural communities face reduced access to health-care facilities, which in turn renders them particularly vulnerable to the long-term effects of malnutrition. Hence, the impact of ICDS on chronic child malnutrition is relevant not only for Indian policy-makers but also for similar program design in other developing countries.

I evaluate ICDS on two main counts: whether the program has a positive treatment effect on the long-term nutrition of targeted children and whether program placement

effectively targets vulnerable segments of the population. I use data from the nationally representative Indian National Family and Health Survey of 2005-06 or NFHS-3 (IIPS and Macro, 2007) and take standardized height-for-age Z-scores (HAZ scores) to reflect long-term child nutritional status. ICDS is the largest program of its kind globally; it has been in place since 1977 and although it cost approximately $1.5 billion in 2008, previous evaluations using data from 1998-99 and earlier showed no evidence of its effectiveness (Das Gupta et al., 2005; Gragnolati et al., 2005). Recently, the Bank (2007) recommended that the Indian government redesign the ICDS for a total cost of $9.5 billion. The hefty price tag of redesign, its potential impact on poor households, and the availability of new data motivate this re-evaluation of the impact of the ICDS.

This evaluation of the ICDS contributes to the debate on evaluation of integrated child development program on several counts. First, since ICDS targets children who would otherwise be malnourished, I use Propensity Score Matching to control for endogenous placement. Second, in addition to treatment effects for the entire sample, I also estimate treatment effects for the moderately stunted and severely stunted to determine whether ICDS decreased long-term malnutrition in most-at-risk children. Third, I also estimate these distributional effects for earlier waves of NFHS data to examine whether by focusing on the entire distribution, previous evaluations missed evidence of impact on the most vulnerable. Fourth, although most analyses of program placement (for ICDS, see Das Gupta et al. (2005)) rely on probit regressions to study targeting the distribution of state-wise ICDS coverage exhibits negative skewness which violates normality required by probit. In this paper, I use beta regression to control for the negative skewness of coverage to determine whether program placement works as intended. Comparison with probit specifications highlights the importance of accounting for skewness. Finally, I use newly available household survey data as well as budget data from the Indian government to evaluate ICDS. These approaches reveal unambiguous evidence that ICDS significantly reduces long-term child malnutrition in India.

I conduct my analysis in two steps: first, Propensity Score Matching (PSM) identifies the effect of ICDS on HAZ scores. Second, probit and beta regression examine the placement of ICDS in villages as a function of the observables on which the government bases its placement decision, namely population, average income, district-level sex ratios, and infrastructure. PSM shows ICDS increases average HAZ scores by approximately six percent; this effect size is larger than estimated treatment effects from similar programs in other developing countries. I also find significant treatment effects for the worst-off children, girls in particular. Treatment effect estimates thus suggest ICDS significantly reduces chronic child malnutrition.

Placement results suggest that while ICDS effectively targets poor areas with risky water sources, sex ratios and landholdings do not play a significant role in placement. ICDS targets areas with more educated mothers, which appears regressive because villages with fewer educated people might benefit most from the intervention. I also find that voting patterns correlate with the allocation of national ICDS funds to states while the states chronic child malnutrition levels do not. In summary, my results show that while ICDS significantly increases HAZ scores, program placement fails to target villages in most need, and political alliances play an important role in budget allocation. This paper contributes by being the first in this literature to estimate distributional treatment effects for HAZ scores due to ICDS. This paper also highlights the importance of accounting for the nature of the data distribution in estimating, say, program placement. Finally, this paper is the first to find evidence of a significant impact of ICDS on chronic child malnutrition.

2.2 Literature Review

Although real Indian GDP per capita doubled in the last fifteen years (Group, 2007), child stunting only decreased by sixteen percent over the same period: 69 percent of children under five were stunted in 1992-93 (NFHS-1), 68 percent in 1998-99 (NFHS-2), and 58

percent in 2005-06 (NFHS-3). Further, data from the NFHS-3 show that 45.9 percent of all Indian children are severely undernourished (three or more standard deviations from the global reference mean for any nutritional indicator). The Indian government takes a two-step approach to reducing child malnutrition: a Public Distribution System makes food available at subsidized prices, and the Integrated Child Development Services (ICDS) provides nutritional supplements, bundled child and maternal services, and day-care facilities to targeted households.

Evaluations of integrated child development programs in most developing countries have yielded little evidence of an impact on HAZ scores. Walker et al. (1996) find that early childhood food supplementation does not improve HAZ scores in Jamaica, while one study reports that a nutrition education program in South Africa failed to affect HAZ scores although it had significant positive effects on other measures of nutrition (Walsh et al., 2002). Similarly, Armecin et al. (2006) evaluate a Philippine early child development program to find significant positive effects on short-term nutrition and on cognitive, social, motor and language development but not on HAZ scores. An evaluation of a Peruvian milk subsidy program, *Vaso de Leche* finds that although the intervention is well-targeted, it failed to significantly improve child nutrition (Stifel and Alderman, 2003). In contrast, a few studies find integrated child nutritional programs have a small impact on HAZ scores. Behrman and Hoddinott (2001) find that the Mexican PROGRESA caused a three percent decrease in the probability of a child being stunted. Thus the lack of evidence of a large and statistically significant effect of ICDS on HAZ scores appears to be the norm rather than an exception. Worldwide, chronic malnutrition as measured by HAZ scores appears to be the hardest measure to improve.

A rich literature surrounds the evaluation of other non-integrated child nutrition interventions. This literature tends to find that providing early childhood nutrition intervention significantly improves health and educational attainment, even in adulthood. For instance, a study uses panel data from Guatemala to evaluate the impact of an

intervention that provided protein supplements from 1969-77 (Maluccio et al., 2009). The authors use a sub-sample of children younger than seven at the time of the intervention to find participation increased schooling and standardized test scores 25 years after the intervention. Similar evidence suggests that a Chinese national salt iodization intervention halved goiter rates (Gillespie et al., 2001). Unconditional cash transfers also appear to significantly improve child nutrition: a study of the South African unconditional cash transfer program to find it significantly improves child height-for-age, and results in a large earning gain in adulthood (Aguero et al., 2006). Paxson and Schady (2007) study the Ecuadorean unconditional cash transfer program to find it improves child nutrition, but not other outcomes such as visits to health clinics or parenting practices. In a unique, non-causal approach, Naschold and Barrett (2010) use stochastic dominance to find evidence that public expenditure is correlated with a positive impact on the nutritional outcomes of the worst-off children. In summary, while integrated programs appear to fail to significantly reduce child stunting, cash transfers and focused nutritional supplementation might significantly reduce child malnutrition.

ICDS targets the physical and psychological development of children younger than six in the most vulnerable and economically disadvantaged sections of the population. Village ICDS centers provide food supplements, health care including immunizations and referral services, and information on nutrition and health. Centers also provide early childhood care, daycare and preschool education (of Women and Development, 2009). The government directs ICDS funds through a two stage targeting process. First, the national government provides each state with an ICDS budget based on state-level development characteristics. Each state then uses its ICDS budget to place centers in villages based on village-level development characteristics. Community-level surveys and the enumeration of families living below the poverty line provide national and state governments information on development characteristics like poverty rates, infrastructure, and health outcomes. The government also hopes to reduce the incidence of female infanticide and feticide by placing

ICDS in areas with significantly fewer girls than boys. In addition to providing nutritional support, ICDS centers provide information on the benefits of investing in daughters.

Evaluations of ICDS tend to concur that implementation issues limit its effectiveness. A major World Bank evaluation (Gragnolati et al., 2005) finds that while using all the services provided by local ICDS centers might result in health and nutritional benefits, most families use only nutritional supplements, immunization services, or day care facilities, which yield insignificant benefits. Other studies have identified similar limitations, albeit on a smaller scale. A study of a sample of 610 children under the age of three receiving full, partial, or no services through ICDS over a one-year period (Saiyed and Seshadri, 2000). Although full utilization of ICDS services results in a significant improvement in stunting, wasting, and weight-for-age, partial utilization has a much smaller impact.

The multi-agency Indian Coalition for Sustainable Nutrition Security contends that food supplementation as delivered by the ICDS may not be the optimal nutrition intervention. The Coalition argues that immunization services and parental counseling may have a greater effect on stunting than food supplements. However, researchers have found that ICDS fails to improve parenting practices and is often unable to provide necessary medical referrals. Prinja et al. (2008) study 60 ICDS centers in the Northwestern state of Haryana and find that participation in an ICDS center affects neither breastfeeding patterns nor the involvement of the mother in the child's growth monitoring. Gragnolati et al. (2005) observe that ICDS centers provide minimal parental counseling and often lack linkages with the health sector. Although much of an individual's nutritional status is determined in the first three years of life, an evaluation (Das Gupta et al., 2005) finds that ICDS services are more likely to reach children older than three.

The ICDS redesign project is motivated by the studies discussed above which find that ICDS does not have a significant impact on child stunting, wasting, or anemia. However, recent work (Gragnolati et al., 2005) is based solely on summary statistics of earlier waves of the data I use in this paper. Other major evaluations (of Public Cooperation and

Development, 1992); (Das Gupta et al., 2005), conduct econometric analyses but use older data. The Indian government places ICDS centers in target areas of high malnutrition, but most previous studies evaluating ICDS fail to control for such endogeneity, leading to downward biased results. The notable exception is an evaluation (Das Gupta et al., 2005) that uses matching techniques to control for targeted program placement. However, this study (Das Gupta et al., 2005) restrict its analysis of ICDS impact to estimating average treatment effects for the entire distribution. Since ICDS aims to target children of most need, this paper estimates treatment effects for the worst-off children in addition to average treatment effects for the whole sample.

2.3 Data and Summary Statistics

2.3.1 Description of the Dataset

Data are from the third round of the Indian National Family Health Survey (NFHS-3) of 2005-2006. The first NFHS survey was conducted in 1992-93 and the second in 1998-99. The NFHS-3 applied a module from the Demographic and Health Survey to a sub-sample of 36,850 randomly chosen women who had given birth to at least one child in the past five years. This sub-sample covered 3842 villages in all 29 Indian states. Urban and rural samples within each state were drawn separately and the sample within each state was allocated proportionally to the size of the states urban and rural populations. The rural sample was selected in two stages: first stage selection of primary sampling units (villages) with probability proportional to population size, followed by the random selection of households within each village (IIPS and Macro, 2007). This module measured the height, weight, and hemoglobin content of 31,556 women and collected the same anthropometric measures for 41,306 of their children below the age of five. Anthropometric measures are not reported for 1385 women and their children or slightly over four percent of the sub-sample.

Demographic and Health Surveys (DHS) do not report income figures. Instead DHS report a wealth index that is a summary measure of asset ownership (land, livestock, jewelry, vehicles), housing characteristics (material and quality of roof, walls and floor), and ownership of durables (television, radio). The wealth index is a score variable generated from factor analysis on the ownership of 33 assets and household characteristics from the survey instrument. Each asset is assigned a weight and normalized asset scores are assigned to each household, which in turn has a factor score (Gwatkin et al., 2000). Factor scores are then summed to get a household-specific wealth index. The resultant index indicates the level of wealth consistent with expenditure and income (Rutstein, 1999).

In previous rounds, the NFHS provided district- and village-level data that could be used to compute the probability of a village hosting an ICDS center. These data included distance to the district headquarters, connection to an all-weather road and train station, any history of epidemics in the past two years, average household wealth, village sex ratio, percentage of mothers with primary and secondary education, and whether the village had electricity. Since the NFHS-3 includes HIV testing data for a small sample of the population, any geographic identifiers below the state-level were scrambled to protect the identity of tested individuals. While villages are not identified, it is possible to tell which people live in the same village. Therefore, to determine the likelihood of a village receiving ICDS coverage, I developed village-level aggregates using available data. I was able to generate the average household wealth of the village, sex ratio, percentage of mothers with primary and secondary education, average landholding size, use of irrigation, availability of drainage and electricity. Robustness checks presented at the end of this paper show that results are unlikely to have been contaminated by the lack of village-level data.

2.3.2 Summary Statistics

Table 2.1 shows that the average woman in the sample of mothers was 27 years old and had completed four years of education. Her first (and in most cases only) marriage

occurred when she was eighteen and she had an average 3 births ever and 1.6 births in the past five years. Only 29 percent of surveyed respondents were working at the time of the survey. About 74 percent of the respondents lived in areas covered by the ICDS. Slightly over half of all ICDS centers had been present in the village for over a decade. Since the average child in this sample was two years old, most children had lived in either an ICDS village or a non-ICDS village their entire lives.

The average child in this sample was 1.7 standard deviations (SD) below the WHO reference mean height-for-age. Boys were 1.73 SD below the mean, while girls were 1.68 SD below the mean. The difference between male and female child HAZ scores was -0.05, significant at the 95 percent level, implying that on average boys were worse-off. 23 percent of children were moderately stunted (two to three standard deviations below the global reference HAZ score mean), while 21 percent were severely stunted (three or more standard deviations below the global reference HAZ score mean); a total of 43.9 percent of all children younger than five were either moderately or severely stunted. (Full summary statistics available from author.)

Since ICDS centers are endogenously placed to target poor villages, household wealth is likely to predict a familys utilization of ICDS services. To explore the impact of wealth on the effectiveness of ICDS, I present two sets of kernel density estimates– one controlling for wealth and the other not. Figure 2.1 presents a series of six kernel density estimates showing the distribution of HAZ scores for children living in ICDS villages and those from non-ICDS villages; the first panel shows the kernel density estimates for all children, while the next five are by quintiles of the wealth index. For the entire sample, the distribution of HAZ scores for children from ICDS-covered districts has a higher mass below the mean, which suggests these children are more likely to be malnourished and that centers are placed in areas of most need but do not appear to significantly improve outcomes. However, in the poorest quintile, ICDS appears to increase average HAZ scores: children from ICDS villages are more likely to be just above the mean. Similarly, in the next two

poorest quintiles, ICDS covered children seem less likely to be below the mean than those from non-ICDS areas. These graphs indicate that among the poorest, children from ICDS villages have higher HAZ scores than those from non-ICDS villages. The picture is perhaps clearest for the fourth quintile.

In the fourth quintile, the ICDS appears to shift out the distribution of HAZ scores: ICDS covered children are less likely to be below the mean and more likely to be at or above the mean. In the richest quintile, the two distributions overlap for the most part indicating the lack of a significant difference between ICDS and non-ICDS villages for the wealth. These kernel density plots emphasize the importance of controlling for wealth: when not controlling for income, ICDS appears not to have any impact on HAZ scores while after controlling for income, ICDS coverage tends to be correlated with higher HAZ scores in all but the richest quintile.

2.4 Empirical Analysis

2.4.1 The Impact of the ICDS

Appropriate placement of ICDS centers implies endogenous program placement, which creates selection bias. To control for bias from endogenous program placement, a previous study used Propensity Score Matching (PSM) on the first two rounds of the NFHS (1992-93 and 1998-99) and find that, on average, ICDS fails to increase HAZ scores (Das Gupta et al., 2005). PSM controls for endogenous program placement by matching treated individuals to untreated individuals on a conditional probability measure of treatment participation. PSM allows the comparison of treated individuals to a control group using observables such as demographic and economic characteristics to construct the control group. Like Das Gupta et al. (2005), I use PSM to measure the impact of ICDS on HAZ scores. However, the above study only estimated the average treatment effect on the treated (ATT) of the ICDS over the entire survey sample, which may have masked a

positive impact on target groups. In this paper, I extend the analysis by estimating treatment effects for moderately and severely stunted children, in addition to estimating an ATT for the full sample.

The notion of propensity scores is useful in the context of non-random treatment assignment. The propensity score is a conditional probability measure of treatment participation, given observable characteristics, $\mathbf{x}$, and is expressed as follows:

$$P_i(\mathbf{x}) = P[D_i = 1|\mathbf{X} = \mathbf{x}], \tag{2.1}$$

given that the balancing condition is satisfied (Cameron and Trivedi, 2005). PSM eliminates selection bias if controlling for $\mathbf{x}$ eliminates selection bias from endogenous placement (Rosenbaum and Rubin, 1983). Since in the current data, not every community-level characteristic which should determine participation in ICDS is available, it is possible that the observed x variables do not entirely eliminate selection bias. Each child in ICDS areas is matched with replacement with one from areas without ICDS based on the propensity score of each child. In this paper, I use kernel matching in which all treated observations are matched with a weighted average of the propensity score for all control observations. I also conducted PSM using metrics other than kernel (Mahalanobis, nearest neighbor, and caliper); results were similar in size and significance. Weights are inversely proportional to the distance between the propensity scores of treated and control observations (Becker and Ichino, 2002). I conduct this matching based on observed factors that likely affect both ICDS participation and HAZ scores: age, birth order and sex of the child, the mothers age, education, caste, and religion, household wealth, village population and other community-level development indicators (Das Gupta et al., 2005), and then test for the significance of differences in HAZ scores, maintaining the unconfoundedness assumption (Imbens and Wooldridge, 2009):

$$D_i \perp (Y_i(1), Y_i(0))|P_i(\mathbf{x}) \tag{2.2}$$

where $\perp$ signifies independence. The unconfoundedness assumption implies treatment assignment, D_i is independent of HAZ scores, Y_i after controlling for propensity scores, or that there are no unobservables that affect HAZ scores and probability of treatment.

I conducted PSM in STATA using *psmatch2* (Leuven and Sianesi, 2003) for 28,935 ICDS-treated and 8,853 control children for whom the NFHS-3 provides anthropometric measures. Table 2.2 presents the results of matching analysis for the entire distribution and the two lowest quartiles of the distribution of HAZ scores. Unmatched observations over the entire distribution in the upper panel suggest that children in ICDS villages are shorter for their age than children from non-ICDS villages. ICDS appears to have a significant negative impact on child nutrition. However, matched results in the lower panel show that ICDS significantly increases HAZ scores. Children who live in ICDS villages have five percent higher HAZ scores than the average matched child from a non-ICDS village, highlighting the importance of controlling for the targeted program placement. Over the entire sample, ICDS has a greater effect on the HAZ scores of boys: those from ICDS villages are over six percent closer to the global average height-for-age than boys from non-ICDS villages, while treated girls are four percent closer to the mean than untreated girls. These results contrast with the insignificant (and sometimes negative) estimates of ATT from matching on the first two waves of NFHS data (Das Gupta et al., 2005). Since the matching algorithm employed here is as close as possible to the one used by Das Gupta et al. (2005), the difference in results suggests that ICDS has become more effective in the five years between the second and third waves of the NFHS.

In contrast to results over the entire sample, matched results for moderately stunted (2 to 3 standard deviations below the reference HAZ mean) and severely stunted children (3

or more standard deviations below the reference HAZ mean) show that girls benefit more from ICDS than boys. However, the increase in HAZ scores due to ICDS is smaller than for the entire sample: severely stunted girls are only two percent closer to not being stunted while moderately stunted girls are only one percent better off. Neither moderately stunted boys nor severely stunted ones are significantly better off than untreated boys, suggesting that the worst-off girls benefit disproportionately from ICDS relative to the worst-off boys. Rose (1999) documents the presence of a "son syndrome" in parts of rural India where boys are better off than girls, not the other way around. Perhaps ICDS changes parental practices ever so slightly and leads to a more equitable distribution of household resources. Alternatively, the worst-off girls might benefit disproportionately from the free medical and nutritional services provided by ICDS that they would not have received otherwise. In either case, ICDS appears to somewhat mitigate the effects of the son syndrome.

I also estimate treatment effects for moderately and severely stunted children using NFHS-1 and NFHS-2 data. The results, presented in tables 2.3 and 2.4 show little of significance for the entire distribution. However, distributional treatment effects for the earlier waves yield more information. NFHS-1 data suggest ICDS increased boys' HAZ scores (consistent with Das Gupta et al.); the distributional effects tell us this improvement comes from the ICDS' impact on severely stunted boys. NFHS-2 data suggest that while ICDS had no impact on average, it did significantly increase HAZ scores of moderately stunted boys. By comparison, NFHS-3 data tell us stunted boys did not significantly benefit from ICDS, although stunted girls did. This change in pattern might indicate an increased focus on tackling the son syndrome through ICDS. Focusing on the entire distribution would have caused us to overlook these changes in effectiveness.

Since HAZ scores are largely determined in the first two or three years of an infant's life, I estimate ICDS impact on HAZ scores for children younger than two and three. Tables 2.5 presents evidence of significant positive treatment effects for children younger than two and three of both sexes. Once again, we observe the importance of controlling for endogeneity

via matching since unmatched results show a significant and large negative effect of the ICDS. These results suggest that ICDS significantly improves the nutritional outcomes of children in their vital formative years.

The 1385 missing observations in the anthropometric sub-sample of NFHS-3 may be of econometric concern. If these 1385 women were systematically unhealthier than the other women, the infants they give birth to would also likely be unhealthy. These children may have benefited disproportionately from ICDS intervention; by not including them in the sample, we may be underestimating the effect of the ICDS. Conversely, if the mother is simply too sick to look after her child or to take her child to the ICDS center, these children may be foregoing any of the ICDS benefits, despite living in an ICDS village. If this case is true, results would overestimate the impact of having an ICDS center in the area. While missing measurements may introduce a source of bias, I am unable to conclusively determine the direction of this bias.

2.4.2 Program Placement

The presence of significant positive treatment effects for moderately and severely stunted children indicates that ICDS provides vital assistance for the most at-risk Indian children. In order to determine whether the program effectively targets these children, I study the placement of ICDS centers in this section. As described above, national and state governments target ICDS centers to reach (1) large population points with (2) the most vulnerable households in (3) unequal, low-income areas with (4) unbalanced sex ratios, (5) inferior infrastructure, and (6) poor development outcomes, although no explicit targeting formula is provided. If placement is effective, state- and village- level values of the target criteria should influence the amount of funds allocated at each level. In this section, I examine program placement at both levels to see whether the allocation of funds and placement of centers actually follows the stated criteria. To study national-level placement, I examine the determinants of the amount of national ICDS funds allocated to a state.

However, since the data do not allow geographic identification of districts, I cannot use budget allocation for state-level placement analysis. Instead, I use two dependent variables on the placement of ICDS centers in a village: the first is whether a village has an ICDS center and the second is the proportion of villages in a state that have ICDS centers.

To address the six ICDS placement goals listed above, I estimate state-level coverage as a function of available and constructed village characteristics. These characteristics examine the goal of targeting (1) large population points by using linear and quadratic village population terms, (2) poor areas through average wealth of the village, average landholding (in acres), average irrigated landholding (in acres), (3) unequal areas with state-wise Gini coefficients (Jenkins, 2010) that increase with inequality, (4) areas with unbalanced sex ratios through the share of girls of the population, (5) inferior infrastructure using electrification, a dummy for rural areas, and (6) development outcomes via the share of mothers with a primary or secondary education, and whether over half the village population does not have access to improved water sources, i.e. household connections, boreholes, protected dug wells, protected springs, and rainwater collection. Das Gupta et al. used more detailed village characteristics that are not available in the NFHS-3; I subsume these variables in the rural dummy. Although the dummy variable for rural areas will be correlated with land holdings, I expect the rural dummy to capture unobserved community-level factors which partly determine participation probability, like the presence of other development programs, which tend to target rural areas.

Das Gupta et al. (2005) study the placement of ICDS centers at the national- and state-levels using probit analysis. They use a specification without state dummy variables for national level placement, and the one with state dummies for state-level placement. However, as Figure 2.2 shows, the state-wise distribution of ICDS centers has negative skewness. Probit analysis assumes normally distributed errors and the probit link function derives from the normal distribution, both of which invalidate the use of probit for evaluating asymmetric distributions like the one in Figure 2.2. Beta distributions are useful

in modeling proportions (variables continuously distributed on the (0,1) interval) such as state-level ICDS coverage because the distribution can assume a variety of shapes, depending on the governing shape parameters α and β. Ferrari and Francisco (2004) present a beta regression which assumes the dependent variable is beta distributed on the interval (0,1) with shape parameters determined by the mean and dispersion of the empirical density function. The key assumption underlying beta regression is that the parameters are beta distributed. Thus, from a theoretical perspective beta regression is the superior estimation strategy.

To demonstrate the value of accounting for negative skewness in state-level ICDS coverage, I estimate both probit specifications used by Das Gupta et al. and the beta regression. The dependent variable in the beta regression is the state-wise proportion of villages covered by ICDS. This specification presents an alternative to probit in studying state-level placement. I compare results from the beta regression to results from the two probit specifications (dependent variable is whether a village has ICDS) and highlight the differences in determinants of state-level placement. The first column (probit I) in Table 2.6 presents probit estimates without state dummies (national-level placement in Das Gupta et al.), while the second column (probit II) presents estimates with state dummies (state-level placement in Das Gupta et al.). Beta regression estimates are presented in the third column of Table 2.6. According to the Akaike Information Criterion (AIC), the probit specification with state dummies (probit II) performs better than the probit specification without state dummy variables (probit I), which would be expected since omitting state-level indicator variables overlooks state-level heterogeneity. Further, a test for the significance of state dummies strongly rejects the null that the dummies were insignificant (with $P = 0.00$ and $\chi^2(27) = 273.32$). While probit II is more reliable than probit I, negative skewness in ICDS coverage suggests beta regression better describes state-level placement.

Placement results highlight several important differences among the beta and two probit

specifications: a lack of access to an improved water source significantly reduces participation probability according to probit, but increases coverage in beta regression. Electrification also significantly increases coverage according to beta and probit I specifications, but not probit II. The electrification dummy was significant and positive in both specifications in Das Gupta et al., so the lack of significance in probit II suggests ICDS is being expanded to cover more disadvantaged areas. In contrast to probit results and stated target criteria, beta regression indicates that rural areas are not significantly more likely to receive ICDS coverage.

Although ICDS policy is to target large population points, the beta regression suggests an increase in average village population decreases state-level ICDS coverage. However, probit results suggest that the government targets large population centers. The beta regression result also contrasts with Das Gupta et al.'s finding of a significant positive correlation between population and ICDS coverage at the state level. This change in sign suggests that ICDS now targets smaller population points; perhaps an indicator of overall expansion in ICDS coverage over time. Also in contrast to stated policy, a change in the share of girls in total population does not significantly affect the probability of participation in either probit or beta specification, which is consistent with Das Gupta et al.'s results. In keeping with policy and Das Gupta et al.'s results, poorer villages are more likely to receive ICDS coverage at the state level. Further, areas with greater income inequality, i.e. with a higher value of the Gini coefficient, receive greater ICDS coverage. The two probit estimates of the Gini coefficient reverse signs, and have magnitudes that are considerably smaller than the beta regression, further suggesting the unreliability of probit in this context.

Other measures of economic welfare yield less convincing evidence of targeted placement. For instance, while average land holdings do not significantly affect placement, villages with larger irrigated landholdings receive more ICDS coverage, contradicting the policy of targeting areas with poor infrastructure. Again, results underline the difference between

probit and beta specifications as probit analysis suggests that size of irrigated landholdings does not significantly influence placement. All three specifications show that areas with more mothers with primary or secondary education receive greater ICDS. Das Gupta et al. (2005) report an insignificant positive correlation between the proportion of educated mothers and ICDS coverage; the increase in significance from their analysis to mine suggests the government is increasing targeting areas with more educated people between the NFHS rounds.

Placement results underline important differences from stated policy: unbalanced sex ratios do not influence state-level coverage, and electrified villages are more likely to receive ICDS coverage. Areas with more educated mothers are targeted rather than areas with worse levels of educational attainment. Population is inversely correlated with state placement, although stated policy is to target large population points. On the other hand, a decrease in average wealth increases state-level ICDS coverage while a lack of access to improved water sources increases placement probability; both results are consistent with the objective of targeting poor areas. Thus targeting appears to work for wealth and some development indicators, but fails in other important aspects like sex ratio, average educational attainment, and infrastructure. Villages without many educated mothers or electrification may also benefit most from ICDS, so the government should improve its coverage of these villages.

I study national placement of ICDS centers by examining the disbursement of ICDS funds to states by the federal government. The government claims to allocate federal ICDS funds to rural areas based on state poverty rates, population, stunting prevalence, women's education rates, and the sex ratio. I regress the share of national ICDS funds given to a state on the state's wealth and Gini coefficient, population (linear and quadratic terms), the natural log of HAZ scores, the natural log of mothers with primary and secondary education, the proportion of the state that is rural, and the sex ratio. I also include the percent of the state's votes for the ruling coalition and an interaction term between wealth

and percent of votes. Results presented in Table 2.7 show that given the state's wealth, votes for the political alliance that won the 2004 national election have a greater positive impact on fund allocation for richer states. In contrast, the states observed level of child malnutrition is uncorrelated with the allocation of national-level funds. Political alliances should not be correlated with the funds a state receives from the federal government but they appear to be; malnutrition levels should affect national allocation of ICDS but they do not.

2.5 Sensitivity Analyses

The following robustness checks address uncertainty over the quality of matching and bias from unobserved village-level characteristics contaminating the treatment effects.

2.5.1 Unconfoundedness Assumption

If the unconfoundedness assumption is invalid, i.e. if there are unobservables that affect HAZ scores and the probability of treatment even after controlling for propensity scores, PSM is not the appropriate technique to estimate treatment effects. Such unobservables might include culture, which may not have been adequately accounted for by religion and caste. Positive treatment effects from an alternative method would suggest that unconfoundedness may not be a major problem with the PSM estimates. Since children find it hard to recover from growth failure suffered before the age of three (Alderman et al., 2006a), so I used exposure to ICDS before the age of three to generate a natural control group and estimated the effect of ICDS on the HAZ scores of children younger than three. The independent variables in this analysis were identical to those used in the PSM analysis. Dummy variables for caste, religion, and wealth index were included in both. The results presented in Table 2.8 yield a positive average treatment effect of the ICDS. The magnitude of the ATT for children younger than three using these two methods is very similar; the

ATT from the PSM estimation was 0.08 versus 0.06 from this alternative method.

2.5.2 Quality of the Matching

Since ICDS centers are placed to target worst-off areas, malnutrition levels might also be worse in villages with ICDS. In general we expect matching to reduce the bias from targeted placement, but the ability to effectively reduce such bias depends on the quality of the matching. Several studies show that PSM is an efficient econometric technique for non-experimental estimations of treatment effect. PSM efficiently controls the bias from matching (Rubin, 1973). Dehejia and Wahba (2002) demonstrate the ability of PSM to replicate the experimental benchmark when observed treated samples are very different from control samples. Figure 2.3 presents kernel density plots of weighted propensity scores for treated and untreated observations used in matching the entire sample. This figure shows the propensity scores for the two samples closely track each other, representing goodness of matches. Further, t-tests show matching significantly reduces the bias in unmatched sample means for most variables. For instance, matching reduces bias from differences in birth order number by 0.1 percent, but the average treated child is 2.65th in birth order, and the average untreated child is 2.73th, after reduction in bias. The economic difference between an average birth order of 2.65 and 2.73 is small and unlikely to meaningfully bias the treatment effects. PSM appears to effectively reduce the bias from targeted program placement.

2.5.3 Bias from Unobserved Village-level Characteristics

NFHS-1 (1992-93) and NFHS-2 (1998-99) contained detailed information on village characteristics, including development characteristics, presence of other programs that might indirectly affect child health, and distance to administrative headquarters. These variables were not available in NFHS-3 (2005-06) data to protect the identity of the HIV

tested individuals. The village-level aggregates I generated using NFHS-3 data might not effectively control for factors like the presence of other programs affecting child health, and distance to administrative headquarters, leading to omitted variable bias in the PSM estimates of ICDS impact. To examine whether such unobserved characteristics cause an (upward) bias in my results, I conducted PSM on older data from NFHS-1 and NFHS-2 but omitting any village-level information not available in NFHS-3. Das Gupta et al. (2005) report insignificant treatment effects of ICDS using NFHS-1 and NFHS-2 data, so significant estimates for these waves using the village-level aggregates I employed in my analysis would suggest that the unobserved village characteristics are indeed contaminating my ICDS treatment effect estimates. However, even using these aggregates, results presented in Table 2.3 and 2.4 show insignificant treatment effects for NFHS-1 and NFHS-2, consistent with previous results in the literature (Das Gupta et al., 2005).

2.6 Conclusion

India's primary child nutrition intervention, the Integrated Child Development Services, aims to improve the physical and psychological well being of children under the age of five using targeted program placement. Previous studies of this program find that the ICDS has little or no effect and that it does not target the right children– the poorest of the poor and the very young. Most of this literature does not control for the targeted placement design of ICDS, which leads to a downward bias in estimates of its effectiveness. Nonetheless, based on such evidence, (Bank, 2007) recommended an expensive ICDS redesign project to the Indian government. Hence, this paper reexamines the ICDS using new data and different econometric techniques.

I analyze the ICDS on several dimensions, including treatment effects for the worst-off children as well as the entire distribution, and program placement. Results show evidence of effectiveness for some goals. I find that ICDS shifts out the marginal distributions of

HAZ scores for the worst-off children. Results also show that ICDS increases HAZ scores by about six percent. I find that placement does not uniformly target less-developed areas and that not controlling for skewness can lead to misleading conclusions about program placement. Finally, evidence suggests voting patterns correlate with national-level budget allocation, which might hamper the effectiveness of ICDS.

The evidence presented in this paper suggests that once a village gets ICDS, the intervention reduces chronic child malnutrition, but which village receives an ICDS center continues to be problematic. The government might benefit from improving its targeting of areas with skewed sex ratios, and focus on socioeconomic factors when determining budget allocation. Further, since the average treatment effect is greatest for the entire distribution, the government may consider redoubling its efforts to target moderately or severely stunted children.

This paper also highlights the importance of computing treatment effects for the most vulnerable parts of the population, in addition to the mean for the entire population. Targeted programs are intended to benefit the worst-off, so only looking at the average effect may mask variations in effectiveness. For instance, I find that ICDS significantly improves HAZ scores for worst-off children not only when there is a significant treatment effect for everyone, but more importantly, even in the absence of a significant effect for the entire population. In addition, this analysis shows that imposing assumptions on the distribution of the data can lead to misleading policy conclusions. My results suggest that a form flexible estimation strategy yields useful information on how the implementation of program centers can diverge from stated policy.

UNICEF (2006) estimates that child malnutrition costs India up to four percent of its national income. This paper finds ICDS increases average HAZ scores by six percent. Assuming stunting to be the only form of child malnutrition, ICDS increases Indian GDP by 0.0024 percent (0.06*0.04=0.0024). Based on the 2007 estimate of Indian GDP, $2.97 trillion, 0.0024 percent equals $7.118 billion. In the absence of the ICDS intervention, the

Indian GDP in 2007 would have been $7.118 billion lower. Since ICDS costs $1.5 billion per year, the net return from the ICDS was $5.618 billion or a per capita benefit of $4.89 for a 3.75 fold net return. Thus even in its current form, ICDS generates substantial returns.

As Das Gupta et al. (2005) point out, panel data tracking villages and individuals are the appropriate way to study the ICDS. Cross-sectional data may introduce selection bias if placement and treatment effectiveness are based on unobservables. However, such bias would likely be in the downward direction, meaning that my results would be a lower bound. Further, the data do not permit me to study the utilization of services provided by ICDS. Nonetheless, my results suggest ICDS increases HAZ scores particularly among the worst-off. However, benefits may increase if the program is strengthened to better target least-developed regions. India's economic growth has been spectacular, but for the socio-political stability of the country the Indian government cannot neglect its poor and its young.

2.7 Figures and Tables

Table 2.1: Summary Statistics of Indian NFHS-3 Data

Mother's Characteristics	Mean	Standard Deviation
Age	26.80	5.37
Years of Schooling	3.90	1.60
Age at First Marriage	18.05	3.75
Births in Last Five Years	1.62	0.67
Total Births	2.92	1.83
Primary Education (percent)	15.06	
Secondary Education (percent)	38.10	
Currently Working (percent)	29.01	
Children's Characteristics	**Mean**	**Standard Deviation**
Age (years)	2.05	1.39
HAZ Scores (standard deviations)	-1.71	0.66

Table 2.2: The Estimated Effect of ICDS on Height-for-Age Z-Scores of All, Moderately, and Severely Stunted Children, With and Without Matching Using Indian NFHS-3 (2005-06) Data

	Entire Distribution			Moderately Stunted			Severely Stunted		
Unmatched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-1.76	-1.78	-1.74	-2.46	-2.46	-2.46	-3.89	-3.91	-3.89
Controls	-1.66	-1.69	-1.61	-2.46	-2.46	-2.47	-3.93	-3.93	-3.94
Difference	-0.11	-0.09	-0.13	0.00	-0.01	0.01	0.04	0.02	0.05
	(0.02)***	(0.02)***	(0.03)***	(0.01)	(0.01)	(0.10)	(0.019)**	(0.03)	(0.03)*
Matched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-1.76	-1.78	-1.74	-2.46	-2.46	-2.46	-3.89	-3.91	-3.89
Controls	-1.85	-1.88	-1.82	-2.48	-2.47	-2.49	-3.94	-3.92	-3.97
Difference	0.09	0.10	0.07	0.02	0.00	0.03	0.04	0.01	0.08
	(0.03)***	(0.032)***	(0.03)**	(0.01)**	(0.01)	(0.01)*	(0.02)**	(0.03)	(0.04)***
Observations	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	28,935	15,027	13,900	6888	3507	3302	6232	3261	2939
Untreated	8853	4608	4245	1957	992	965	1825	1004	821

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.3: The Estimated Effect of ICDS on Height-for-Age Z-Scores of All, Moderately, and Severely Stunted Children, With and Without Matching Using Indian NFHS-1 (1992-93) Data

	Entire Distribution			Moderately Stunted			Severely Stunted		
Unmatched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-2.44	-2.23	-2.43	-2.47	-2.48	-2.47	-3.99	-3.89	-4.09
Controls	-2.68	-2.59	-2.48	-2.47	-2.45	-2.49	-4.11	-4.11	-4.11
Difference	0.23	0.36	0.04	-0.01	-0.03	0.02	0.12	0.22	0.02
	(0.05)***	(0.06)***	(0.06)	(0.02)	(0.02)	(0.02)	(0.036)***	(0.06)***	(0.06)
Matched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-2.45	-2.45	-2.43	-2.47	-2.48	-2.47	-3.99	-3.89	-4.07
Controls	-2.49	-2.38	-2.34	-2.48	-2.46	-2.50	-4.05	-4.11	-4.07
Difference	0.03	0.14	0.09	0.01	0.02	0.04	0.06	0.22	0.00
	(0.06)	(0.08)*	(0.08)	(0.02)	(0.03)	(0.03)	(0.05)	(0.06)***	(0.07)
Observations	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	1928	1042	1086	547	278	267	610	272	342
Untreated	1990	1148	1108	600	317	271	8180	425	385

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.4: The Estimated Effect of ICDS on Height-for-Age Z-Scores of All, Moderately, and Severely Stunted Children, With and Without Matching Using Indian NFHS-2 (1998-99) Data

	Entire Distribution			Moderately Stunted			Severely Stunted		
Unmatched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-1.72	-1.73	-1.71	-2.46	-2.47	-2.46	-3.99	-3.97	-4.01
Controls	-1.77	-1.73	-1.80	-2.45	-2.44	-2.46	-4.00	-3.99	-4.02
Difference	-0.05	0.00	-0.09	-0.01	-0.03	0.00	0.02	0.02	0.01
	(0.02)*	(0.03)	(0.04)*	(0.01)	(0.009)***	(0.01)	(0.02)	(0.03)	(0.03)
Matched	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	-1.72	-1.73	-1.72	-2.45	-2.46	-2.46	-3.99	-3.98	-4.01
Controls	-1.75	-1.73	-1.77	-2.46	-2.43	-2.46	-3.99	-3.98	-4.01
Difference	0.03	0.01	0.05	0.01	0.03	0.00	0.01	0.00	0.00
	(0.03)	(0.04)	(0.04)	(0.01)	(0.008)***	(0.01)	(0.03)	(0.03)	(0.03)
Observations	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Treated	11,667	6103	5478	2448	1269	1181	2443	1253	1218
Untreated	8720	4608	5478	1909	998	908	1937	1007	935

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.5: The Estimated Effect of ICDS on Height-for-Age Z-Scores of Children Younger than Two and Three, With and Without Matching Using Indian NFHS-3 (2005-06) Data

	Younger than Two			Younger than Three		
Unmatched	All	Boys	Girls	All	Boys	Girls
Treated	-1.61	-1.66	-1.55	-1.72	-1.76	-1.67
Controls	-1.49	-1.56	-1.40	-1.61	-1.67	-1.55
Difference	-0.12	-0.10	-0.15	-0.11	-0.09	-0.12
	$(0.03)^{***}$	$(0.039)^{**}$	$(0.04)^{***}$	$(0.02)^{***}$	$(0.028)^{***}$	$(0.03)^{***}$
Matched	All	Boys	Girls	All	Boys	Girls
Treated	-1.61	-1.66	-1.55	-1.72	-1.76	-1.67
Controls	-1.67	-1.76	-1.58	-1.78	-1.84	-1.74
Difference	0.06	0.09	0.04	0.08	0.08	0.07
	$(0.03)^{*}$	$(0.05)^{*}$	(0.05)	$(0.025)^{***}$	$(0.034)^{**}$	(0.044)
Observations	All	Boys	Girls	All	Boys	Girls
Treated	17,096	8847	8245	23,085	11,951	11,135
Untreated	5121	2632	2489	7014	3634	3380

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.01$, *** $p < 0.001$

Table 2.6: Village Participation in ICDS: State- and District-level Regressions Using Indian NFHS-3 (2005-06) Data

	Probit I	Probit II	Beta Regression
Village Population	0.021*	0.040***	-0.031***
	(2.22)	(3.85)	(-6.14)
Village Population Squared	-0.006**	-0.001***	0.000***
	(-2.71)	(-3.65)	(3.87)
District Sex Ratio	0.105	0.029	0.120
	(0.64)	(0.17)	(1.35)
Average Wealth	-0.334***	-0.286***	-0.195***
	(-5.96)	(-4.56)	(-6.26)
Gini Coefficient	5.038***	-137.1**	9.505***
	(7.52)	(-2.99)	(29.30)
Average Land Holding (acres)	0.044	-0.026	-0.047
	(0.44)	(-0.22)	(-0.86)
Average Irrigated Land Holding (acres)	0.007	-0.059	0.267***
	(0.09)	(-0.57)	(6.14)
Mothers with Primary Education	0.428*	0.513*	0.350***
	(2.34)	(2.48)	(3.46)
Mothers with Secondary Education	0.737***	0.453***	0.559***
	(6.06)	(3.41)	(9.02)
Electrification	0.350**	0.237	0.282***
	(2.85)	(1.58)	(5.03)
Rural Dummy	1.070***	1.255***	-0.0177
	(15.37)	(15.31)	(-0.46)
Highly Prevalent Riskywater Access	-0.103	-0.273**	0.214***
	(-1.23)	(-2.84)	(5.49)
Constant	-2.545***	49.79**	-3.444***
	(-8.32)	(3.00)	(-23.40)
Akaike Information Criterion	2936.45	2674.43	-2169.49
Observations	3288	3239	3240

t-statistic in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.7: Results from a State-level Regression of Federal Allocation of ICDS Administrative Budget

	LN(ICDS Admin Budget)
Wealth	-2.143**
	(-2.50)
Gini Coefficient	-1.214
	(-0.54)
Vote	-0.00534
	(-0.80)
Wealth*Vote	0.0456 *
	(2.18)
State Population	3.39e-08***
	(4.60)
State Population Squared	-1.12e-16*
	(-2.26)
LN(HAZ Score)	-0.112
	(-0.05)
LN(Mothers with Secondary Education)	1.117**
	(2.59)
LN(Mothers with Primary Education)	1.257**
	(2.80)
LN(Rural)	0.460
	(1.73)
LN(Sex Ratio)	-2.591
	(-1.05)
Constant	29.85
	(1.60)
Observations	29

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.8: ICDS Impact on HAZ-Scores of Children Under Age 3: NFHS-3 Data

	Exposed to ICDS Before Age Three
Exposed to ICDS Before Age Three	0.059**
	(2.90)
Current Age of Child	-0.244***
	(-40.29)
Sex of Child	0.046**
	(2.75)
Birth Order	-0.074***
	(-11.09)
Mother's Current Age	0.024***
	(10.95)
Mother Not Educated	-0.518***
	(-12.39)
Mother Has Primary Educ.	-0.439***
	(-9.84)
Mother Has Secondary Educ.	-0.346***
	(-9.08)
Hindu	0.144
	(1.77)
Muslim	0.177*
	(2.13)
Christian	0.191*

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Table 2.8 – Continued

	Exposed to ICDS Before Age Three
	(2.28)
Sikh	0.336***
	(3.33)
Poorest Quintile	-0.735***
	(-16.86)
Poorer Quintile	-0.602***
	(-15.41)
Middle Quintile	-0.494***
	(-14.31)
Richer Quintile	-0.326***
	(-10.98)
District Population	-0.017***
	(-5.91)
District Pop. Sq.	0.000***
	(3.39)
District Sex Ratio	0.055
	(0.89)
Mothers with Primary Educ.	0.070
	(1.08)
Mothers with Secondary Educ.	0.129**
	(2.83)

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Table 2.8 – Continued

	Exposed to ICDS Before Age Three
Average Wealth	-0.027
	(-1.22)
Average Land Holding (acres)	-0.0001*
	(-2.32)
Average Irrigated Land Holding (acres)	0.000
	(1.32)
Riskywater Access	0.121***
	(5.05)
Unimproved Sanitation	-0.118***
	(-3.94)
Electrification	0.040
	(1.70)
Gini Coefficient	0.346
	(1.79)
Constant	-0.936***
	(-5.85)
Observations	37790

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2.1: Kernel Density Estimates of Height-for-Age Z-Scores by ICDS Coverage and Wealth Index Quintiles: Indian NFHS-3 (2005-06) Data

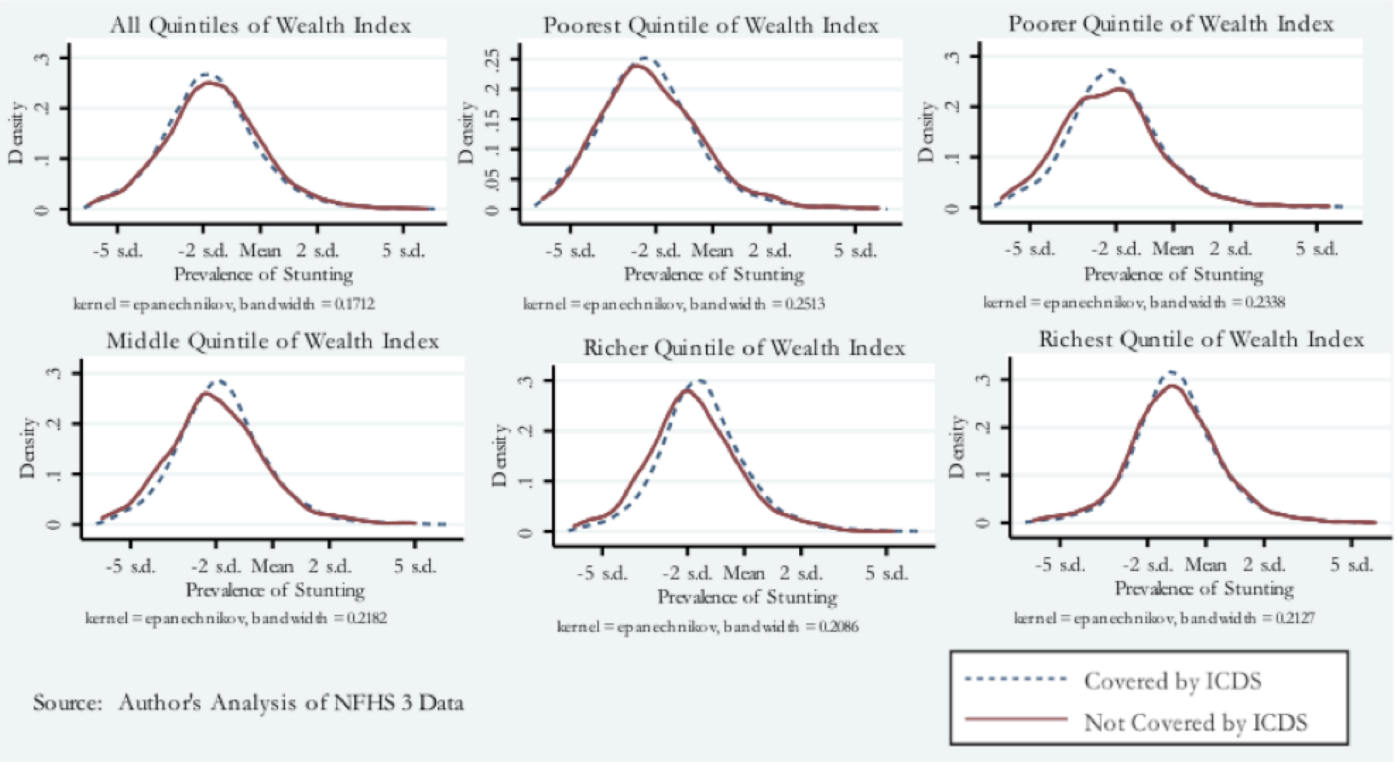


Figure 2.2: Distribution of State-wise ICDS Coverage: Indian NFHS-3 (2005-6) Data

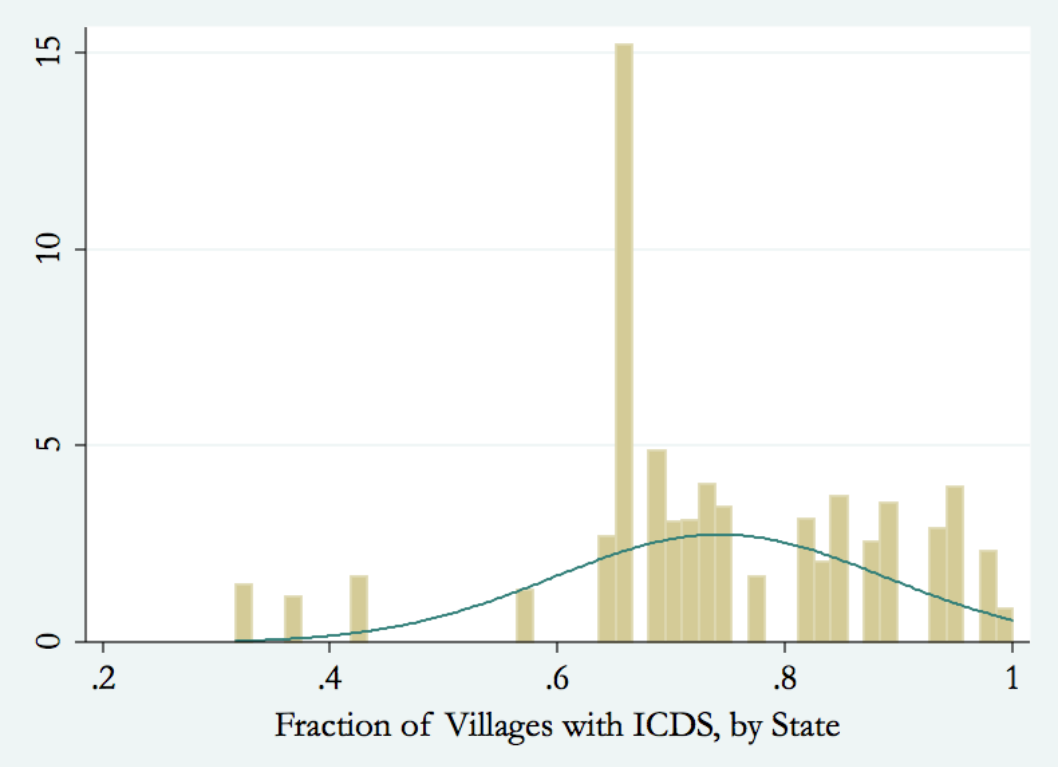
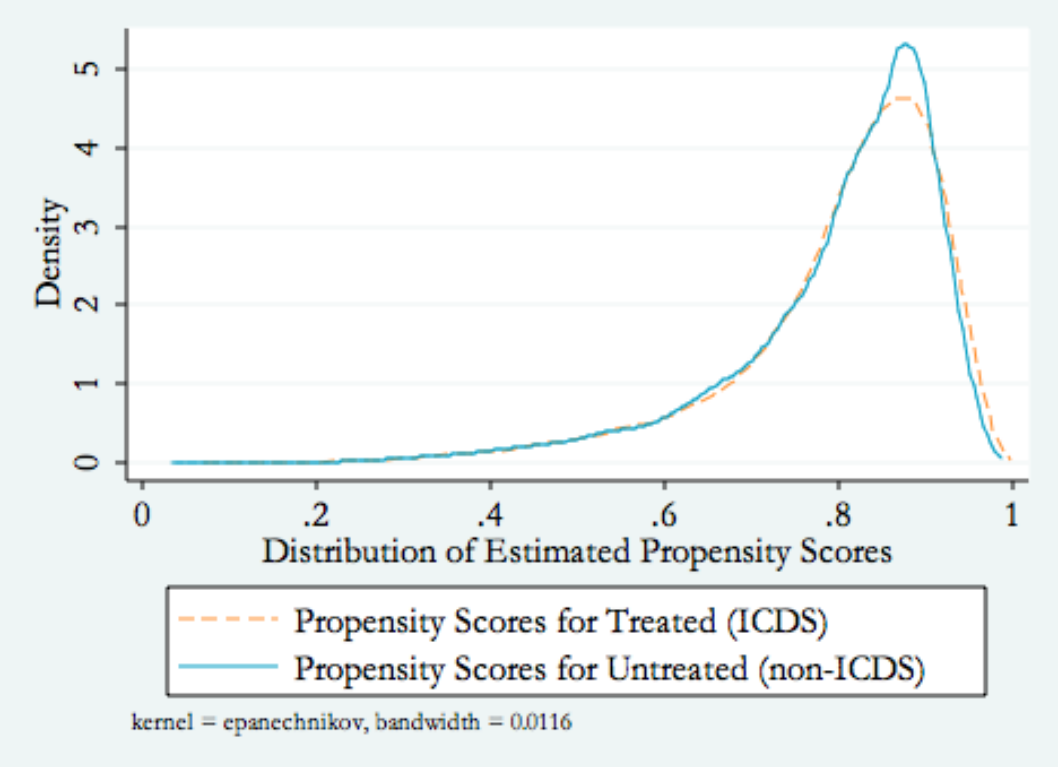


Figure 2.3: Propensity Scores by ICDS Coverage: Indian NFHS-3 (2005-6) Data



CHAPTER 3

EMPOWERING WOMEN THROUGH EDUCATION AND INFLUENCE: AN EVALUATION OF THE INDIAN *MAHILA SAMAKHYA* PROGRAM

3.1 Introduction

3.1.1 Motivation

Gender empowerment allows women to make the most of their human capital. Empowerment allows individuals to reach their full potential, to improve their political and social participation, and to believe in their own capabilities. Empowerment also has important ramifications for the rest of the household: empowered women have fewer children and higher child survival rates (Dyson and Moore, 1983), healthier and better-fed children (Quisumbing and de la Brière, 2000), and a generally greater allocation of resources to children (Thomas, 1990). Development programs have aimed to empower women by increasing their control over contraceptive choices, by providing them credit, and through education; however, many alternative mechanisms can empower women, including working with the community to change social norms.

In this paper, I use primary data from rural north India to examine the impact of an Indian women's empowerment program named *Mahila Samakhya* on female empowerment outcomes. *Mahila Samakhya* is a unique and innovative way to improve female empowerment. Women's empowerment is particularly hard to change within a generation because it is affected by strict social norms. While a number of programs aim to improve female empowerment through education, the *Mahila Samakhya* program in India combines providing education with support groups, and has the explicit objective of increasing

gender empowerment. The program attempts to empower women through education and organization into support groups. Education provided by the program improves job prospects and increases the reservation wage, and can thus help empower women to control a greater share of the household's resources and become more active participants in their communities. Further, information and social spillovers might empower participants who do not work, and thus do not benefit from the employment aspect of *Mahila Samakhya*. So, even unemployed participants may be empowered by *Mahila Samakhya*. This program is fairly unique, but has the potential to be replicated elsewhere in the developing world because it attempts to harness local peer networks to change social norms and empower women. As a result, this evaluation may provide valuable evidence on the effectiveness of community-level interventions in changing ingrained social patterns.

In establishing whether *Mahila Samakhya* has a significant impact of female empowerment, I need to account for two potential sources of endogeneity: program placement and self-selection of participants. As a result, I conduct my analysis in two stages: first, I use Propensity Score Matching to examine whether non-participants in treated and untreated are significantly different from each other. This step allows me to test whether the program is targeted in placement. If the program were in fact targeted to communities with lower initial bargaining power, treatment effect estimates that did not control for placement would be lower than the actual impact. However, if I find that non-participants in treated and untreated districts are not significantly different from each other, I can conclude the program is not targeted towards areas of most need. Next, I test whether participants are significantly more empowered than women from untreated districts to determine whether the program has a significant treatment effect. Finally, I focus on the empowerment outcomes of participants who do not work, comparing them to untreated women who also do not work. I find that even those participants who do no benefit from the enhanced employability effect of participation are significantly more empowered than untreated women.

Results show that non-participants in treated and untreated districts have similar empowerment outcomes. Hence, I conclude that the program does not target its placement at districts that represent particular segments of the population. My results also show that the program has a significant, positive treatment effect on female empowerment: participants are more likely to have access to outside employment, leave the house without permission, and participate in village council meetings. Village-level political participation and increased earnings are associated with greater control over household assets and greater say in the household. I also find a spillover effect that works independently of employment: participants who do not work are nonetheless more likely to report having access to outside employment and to leave the house without permission. My results thus establish that participation in the *Mahila Samakhya* program increases female empowerment.

3.2 Background on Uttarakhand and *Mahila Samakhya*

Uttarakhand is a rural state in the Indian Himalayas. The state is small and rural, comprising less than one percent of the Indian population. Only five cities contain more than 100,000 people. On the surface, Uttarakhandi women may appear to be more empowered than the average. Women led the *Chipko* movement[1] as well as 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 from a nationally representation household survey finds 43 percent of Uttarakhandi women cannot read at all, while an additional 5 percent can only read parts of a sentence (IIPS and 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

[1]The Hindi word *Chipko* means to stick. In the *Chipko* movement of the seventies, Uttarakhandi villagers, and women in particular, literally hugged trees to prevent deforestation.

work on their family's farmland, which does little to empower them. As well, 23 percent of 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 (55 percent) did not have the final say on large purchases made by their household (IIPS and Macro, 2007). Hence, Uttarakhandi women can lead very restricted lives with little say in the household or community.

In 1988, *Mahila Samakhya* was launched in three states of India to empower women through formal, informal, and vocational education. In theory, the 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. In practice, as my results will highlight, the program does not appear to be targeted. Participation in the program is voluntary, and no monetary incentives are offered.[2] The program entered Uttarakhand in 1995 and covers 2,416 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 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. Such training improves the participant's employability, giving her access to outside employment, and hence improving her level of empowerment in the household and the community. 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

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

participants support each other on issues like domestic violence, alcoholism, dowry, and female infanticide. These secondary interventions have the potential to generate significant spillover effects wherein even participants who do not work, and therefore do not benefit from improved employability, can be significantly more empowered than those who do not participate in the program.

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 sufficiently empowered at this point that the opposition no longer restricts their involvement.

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.

Participation in the program increases the woman's educational attainment, which is an

endogenous individual characteristic. Providing a woman with 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.[3] The education gained through this program is therefore expected to raise bargaining power.

3.3 Literature Review

The literature on female autonomy empowerment largely follows two approaches. The first set of studies considers the the determinants of female empowerment. The second set of studies examines different proxies for female empowerment. The only other evaluation of the *Mahila Samakhya* intervention; Janssens (2010) focuses on the social capital building aspects of the program rather than its direct impact on female empowerment.

Female autonomy or empowerment is measured by a woman's relative ability to make household decisions, compared to the husband. Since this ability cannot be explicitly measured, economists study whether variables such as education, contraceptive use, and asset-ownership are correlated with high female empowerment. These self-reported variables reflect the wide variety of choices and decisions at stake in the household bargain: employment, fertility, and resource allocation. Scholars tend to agree that a woman's autonomy depends on economic factors, demographic characteristics, culture, and political participation (Anderson and Eswaran, 2009; Rahman and Rao, 2004; Beegle et al., 2001; Hashemi et al., 1996).

A large body of literature finds that a woman's access to employment outside the house increases her household bargaining power (Rahman and Rao, 2004; Anderson and Eswaran, 2009). The ownership of assets, in particular, is one important way through which access

[3]The disagreement utility is simply each spouse's intertemporal utility if they remained single or if they were non-cooperating in marriage, and depends on the spouse's own earning potential and the partner's earning potential as well as on the non-cooperative equilibrium outcome of investment in children (Mas Colell et al., 1995, p. 839).

to employment helps empower women in developing countries (Agarwal, 2001). In addition, several analyses have found that access to credit programs— whether through micro-finance organizations or rotating savings and credit associations (ROSCA)— has a positive effect on female empowerment (Hashemi et al., 1996; Anderson and Baland, 2002).

Studies have also found a positive link between empowerment and contraceptive use (Schuler and Hashemi, 1994), as well as between the woman's influence on resource allocation and her family's social status (Quisumbing and de la Brière, 2000). In particular, the more educated she and her father are relative to her husband, the more empowered she is as well. Relative physical mobility is another important determinant of autonomy (Hashemi et al., 1996) since it reflects the woman's access to outside employment opportunities. Another study of the determinants of female autonomy in India finds that a better-educated mother has greater bargaining power through the channel of increased information (Rahman and Rao, 2004). The same study also finds culture, as measured by state fixed-effects, to be significant despite several variables like religion, and caste, that attempt to control for regional differences. Further 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).

The literature further agrees that the clearing of marriage markets depends on the number of men and women in the market (Becker, 1973a,b; Neelakantan and Tertilt, 2008). As a result, the local sex ratio works through the spousal age ratio to influence marriage markets and therefore household bargaining power. Scholars have found that, particularly in the Indian context, women have less bargaining power if their husbands are significantly older (Caldwell et al., 1983; Kantor, 2003). Since *Mahila Samakhya* targets married women, and none of the women in my sample participated in the program before marriage, the spousal age gap is not affected by program participation. In Uttarakhand, in particular, program officials of the *Mahila Samakhya* intervention told us that women

married to much older men have little say in the household, because often the age gap arises from a second marriage for the man, or some "undesirable" quality in the woman or her background. Hence, I treat a woman's spousal age gap as a proxy for her pre-participation level of empowerment.

Since empowerment is an unobservable latent variable, economists use its observable characteristics as proxies for empowerment. Women with high values of the proxies, such as a greater spousal age ratio, access to outside employment or a high level of political participation, likely also have greater bargaining power. Thus, among the indicators of a high level of empowerment are (1) access to outside employment, (2) physical mobility, and (3) political participation (Hashemi et al., 1996; Rahman and Rao, 2004; Anderson and Eswaran, 2009). As a result, the dependent variables I use to reflect high levels of female autonomy are (1) the ownership of identification cards for the national government's rural employment guarantee scheme, (2) the ability to leave the household without permission, and (3) participation in weekly village council meetings. I choose these variables because they represent a diverse set of ways in which the *Mahila Samakhya* program can potentially empower women.

With the exception of analyses of credit extension mechanisms, the studies discussed above focus on interventions targeted at the individual. Only a small number of papers look at community-level interventions. For instance, Imai and Eklund (2008) uses survey data on women's community-based organization in rural Papua New Guinea to assess the effectiveness of autonomous women's groups compared to women's groups those that receive external support. Their results— using a Heckman Selection Model as well as Propensity Score Matching— show that the autonomous groups are more effective in improving child welfare.

The only formal econometric evaluation of *Mahila Samakhya* uses data from the state of Bihar, but does not estimate the effect on women's empowerment (the programs intended goal), but on the spillover effect on trust and social capital (Janssens, 2010). The paper

uses Propensity Score Matching to calculate Intent-to-Treat estimates of the program. Matching women from treated villages to those from untreated villages, results suggest 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 with non-participants: 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.

3.4 Data

I use primary data that I collected from the Indian state of Uttarakhand (the cross-hatched region in Figure 3.1) on participation in *Mahila Samakhya*, measures of female empowerment, child welfare, and social networks. My survey area covers six Uttarakhand districts, four with the program and two without. (The survey districts are represented in the inset of Figure 3.1 with a dotted pattern. The four districts with a thick border and dotted patterns are program districts. The two dotted districts without a thick border are non-program districts.) Villages within the sample were randomly-chosen. The sample size is 487 women. The survey was designed to trace self-reported networks, and hence was implemented using restricted snowball sampling. In each village, I interviewed a randomly-chosen woman and asked her to list her five closest friends. I then conducted follow-up interviews with two randomly-selected women from these five friends. I asked each of these two follow-up interviewees about five of their closest friends, and interviewed two friends each. Thus, starting with one woman, my sampling strategy gave me a network of seven. My survey instrument includes the following key questions which will help me identify the effect of participation in the *Mahila Samakhya* intervention on an individual's level of empowerment:

- Female Empowerment Dependent Variables:

- Whether the respondent has an identification card for the National Rural Employment Guarantee Scheme (NREGS).[4]
- Whether the woman can leave the house without permission.[5]
- Whether the woman participates in the local village council.
- The woman's age relative to that of her husband.
- Does the woman work outside the house?

- Participation:
  - Whether the woman participates in the *Mahila Samakhya* intervention.
  - How long she has been a member of the program.

- Other Socioeconomic Characteristics
  - The number of children born to the woman and their ages. The number of boys and girls.
  - How much the woman cares about her friends' opinion. How much her husband cares about the villagers' opinions of him.
  - The number of rooms in the house and the primary source of lighting.

I distinguish between pre-determined empowerment characteristics, like the spousal age ratio, and characteristics that might be affected by participation, such as owning of the

[4]NREGS guarantees at least a hundred days of paid work to the rural poor. Having an identification card gives the women access to outside employment. Program supervisors sometimes deny women these cards because the work generated by NREGS is of a manual nature, and is thus considered "unsuitable" for a woman. *Mahila Samakhya* officers encourage participants to demand the cards, and where necessary report the supervisor to the local administrative officer.

[5]Since this variable is difficult to verify, it might suffer from reporting bias: participants know the "correct answer" to this question is that do not need permission to leave the house, and thus might be systematically more likely to overstate their physical mobility than non-participants. However, in field tests, we observed that participants were significantly more sensitive to their lack of household bargaining power and were likely to underreport the amount of say they had in the household because the program had made them aware of the entire feasible set of outcomes for women. Therefore, if we were to expect a sizable reporting bias by participants, it would be in the downward direction, i.e. participants would be likely to underreport their their physical mobility.

NREGS identification card or participation in village council meetings. As discussed above, the spousal age ratio is pre-determined because none of the women in my sample (and in general) participated in the program before marriage. I cannot rule out the possibility that an older relative of the woman, say her mother, is a *Mahila Samakhya* participant and that therefore the respondent's age at marriage was not completely unaffected by participation. However, program participants tend to be young women, and the program only came into the region in 1995, so the influence of the participation of an older relative on a later participant's marriage decision is likely to be minimal. The difference between matched pre-determined empowerment characteristics of participants and untreated women thus provides a baseline level of empowerment for participants.

3.4.1 Summary statistics

As Table 3.1 shows, the average woman in my sample is 32 years old, while her husband is 38 years old. She married at age 19, has 9 years of education, while her husband has an additional year of education. The average age of her sons is eight years, while that of her daughters is six years. Sons and daughters have, on average, equal amounts of education; about seven years. The average woman's house has three rooms and electricity.

Table 3.2 indicates that participants are significantly more empowered than non-participants. While on average, 60.62 percent of the women in my sample said they had NREGS cards, only 48.94 percent of non-participants did. In contrast, over 68 percent of participants had these cards. Similarly, while 70.89 percent of the sample said they did not need permission to leave the house. Only 58.82 percent of non-participants but 78.17 percent of participants did not need permission. Finally, while only 14.20 percent of non-participants reported attending village council meetings, almost half of all participants did. In summary, whether in the form of access to employment, physical mobility, or political participation, women who participate in *Mahila Samakhya* have higher levels of empowerment. Of course, these statistics do not tell us whether more empowered women

are simply targeted by or self-select into the program, or whether participation actually improves female autonomy.

Table 3.3 indicates the presence of self-selection into *Mahila Samakhya*. The average participant is three percentage points closer in age to her husband than the average non-participant in treated districts, which suggests that women with greater initial bargaining power may self-select into the program. Further, participants tend to have older and more sons than non-participants, although the differences are not quite significant. Participants are less likely to live with their husbands; the difference of 19 percent is highly significant. Participants are also close-to-significantly less likely to live with their parents-in-law. And finally, participants are significantly more likely to be Brahmin than non-participants.

Several other characteristics, such as the number and age of daughters, the spousal education ratio, and the woman's time to collect water, are statistically equal for participants and non-participants. Further, none of the wealth indicators, including number of rooms, electrification, improved toilet facilities, materials used in floor and wall construction, are different for these two groups, suggesting that poorer participants neither select into the program nor are they targeted based on indicators of wealth (number of rooms, electrification, access to improved toilet facilities, and nature of the construction materials used for the floor and walls of the house). Nonetheless, this table highlights the importance of controlling for selection in to the *Mahila Samakhya* program.

Table 3.4 shows us key characteristics of the four treated and two untreated districts in the sample. This table shows that the program does not appear to be targeted in placement because there are few significant differences between the average characteristics between treated and untreated districts. The only significant difference is in the number of sons; on average, participants have 0.27 sons more than non-participants. The magnitude of the difference suggests the economic impact, if any, is small. Thus, treated districts appear very much like untreated districts; the program does not appear to be targeting

districts with particular characteristics.

3.5 Empirical Analysis

3.5.1 Methodology

I estimate two sets of treatment effects. The first examines whether non-participants in treated and untreated districts are significantly different in terms of female empowerment outcomes. The second estimates the impact of the program on participants relative to non-participants with similar characteristics in untreated districts to account for any issues of self-selection. Although table 3.4 indicates the lack of any substantial differences between treated and untreated districts, the first treatment effect more formally tests this assumption.

To account for potential targeted placement of or self-selection into the *Mahila Samakhya* program, I use Propensity Score Matching (PSM) on my data. When treatment assignment or participation is not random but determined by observables, PSM allows us to compare treated individuals to untreated individuals (or non-participants in treated and untreated districts) using observables such as demographic and economic characteristics to construct the control group. Each individual in the dataset is assigned a propensity score that tells us the likelihood of an individual being treated. That propensity score is a conditional probability measure of treatment participation, given observable characteristics, $\mathbf{x}$, and is expressed as follows:

$$P_i(\mathbf{x}) = P[D_i = 1|\mathbf{X} = \mathbf{x}], \tag{3.1}$$

given that the balancing condition is satisfied (Cameron and Trivedi, 2005). Treated and untreated individuals are matched based on proximity of their propensity scores, thus

creating the control group. I can then estimate treatment effects by comparing the outcome of interest for the treated and control groups. PSM eliminates selection bias if controlling for $\mathbf{x}$ eliminates selection bias from endogenous placement. Since treated and untreated districts are not significantly different, treatment assignment appears to be random, assuming unobservables are distributed as observables are.

For the treatment effect comparing untreated individuals, each non-participant in treated districts is matched with replacement with one from districts without *Mahila Samakhya* based on the closeness of the propensity score. For the treatment effect comparing participants to untreated individuals, each participant is matched with replacement with an individual from an untreated district. I use kernel matching in which all treated observations are matched with a weighted average of the propensity score for all control observations. Weights are inversely proportional to the distance between the propensity scores of treated and control observations (Becker and Ichino, 2002).

I conduct this matching in Stata using *psmatch2* (Leuven and Sianesi, 2003), based on observed factors that likely affect both program participation and female empowerment: (1) spousal age ratio, (2) age at marriage, (3) her years of education, whether she literate, and whether she has less than four years of education (and is thus likely to need the education provided by the program), (4) how much she cares about her friends' opinion of her (reflecting her interest in community-level interventions such as *Mahila Samakhya*), (5) how much her husband cares about villagers' opinion of him (reflecting how binding social norms are on the household), (6) the number and age of children, (7) whether the respondent lives with in-laws and sisters-in-law, (8) whether she is a Brahmin, (9) the number of rooms in her house, and (10) whether her house has electricity. Village fixed effects are also included. I tried various specifications as well as matching metrics for the matching process; results are robust.

3.5.2 Results

Table 3.5 presents the two sets of treatment effects discussed above: the first comparing non-participants from treated and untreated districts, and the other comparing participants to women with similar characteristics from untreated districts. The upper panel of the table shows the results comparing non-participants. These results tell us that a non-participant is not significantly more empowered by simply living in a treated district. Empowerment is measured in two ways: (1) the pre-determined spousal age ratio which cannot be affected by *Mahila Samkhya*, and (2) characteristics that can be affected by participation, like having an NREGS identification card, leaving the house without permission, and attending village council meetings. Without matching, only the NREGS cards variable is significantly different, with non-participants being significantly more likely to own NREGS cards. After matching, the lack of significant differences tell us that, once matched, non-participants and untreated women have similar levels of base empowerment, suggesting that self-selection into the program might not be a very large concern. The decrease in significance in NREGS card ownership highlights the importance of controlling for selection in to the program. Indeed, given that treated and untreated districts are very similar, these estimates tell us *Mahila Samakhya* does not target districts with particularly low (or high) levels of empowerment.

The lower panel of table 3.5 presents treatment effects of the program on participants. These results show that participants and untreated women have statistically equal spousal age ratios, suggesting that individuals do not choose to participate based on initial bargaining power. Hence, any differences in the other measures of empowerment likely stem from the effect of the program. Evidence suggests that the program significantly increases access to outside employment, as 81 percent of participants own NREGS identification cards, compared to only 14.5 percent of untreated, which translates to a difference of 66.4 percentage points. Similarly, while 51 percent of all participants are likely to attend village council meetings, only 20.6 percents of the untreated do so. Participants

are also significantly more likely to leave the house without permission, although the significance of this difference is much lower than the rest. A woman's ability to leave the house without permission depends on a high stakes bargain with her husband and in-laws, rather than on a much lower stakes conversation with "outsiders" like the NREGS supervisor. As a result, this ability may depend not only on program participation but also on the behavior of her peers and support from them; this link is studied in greater detail in the following chapter of this dissertation.

Table 3.5 also shows that program participation increases the likelihood of a woman working, compared to untreated women; however, the associated t-statistic is 1.53, making this difference a little short of statistically significant at the ten percent level. In addition to an effect of the program on empowerment through increased employability, there may also be a sizable spillover effect even on participants who do not work.

Table 3.6 presents treatment effects of the program on these women by matching them to the untreated. These results suggest the presence of a significant spillover effect: participants who do not work are still more likely to have an NREGS card and to leave the house without permission. They are not, however, more likely to participate in village council meetings. The fact that non-working women still own NREGS cards maybe because NREGS only generates a hundred days of employment; hence participants may not have been working at the time of the interview, but still had access to the NREGS program. In summary, the *Mahila Samakhya* program empowers women through employability and spillovers, even though it does not appear target the intervention at women of most need.

3.6 Conclusion

This paper uses primary data from the rural north Indian state of Uttarakhand to study the impact of the *Mahila Samakhya* program on women's empowerment. *Mahila Samakhya* aims to empower women, especially through education, and takes a grassroots approach to

its implementation. Uttarakhand is a remote and rural state in northern India, and women, in particular, lead disempowered and oppressed lives. *Mahila Samakhya* aims to empower women through education and information. I find that the program has resulted in significant increases in access to outside employment, the woman's ability to leave home without permission, and political participation, all of which are associated with higher levels of female bargaining power. I also find that participants who do not work are still more able to leave the house without permission and have access to outside employment. Thus, evidence presented in this paper shows that *Mahila Samakhya* succeeds in empowering women.

These results should be interpreted with some caution if selection on unobservables is a serious concern. Further, the *Mahila Samakhya* intervention adopts a slow and careful approach to rolling out its activities. These results can thus not be generalized to programs following a faster, more individual-focused, or a traditional top-down approach. Ideally, I would have panel data that would let me better understand the dynamics of the observed treatment effect. Any bias from program placement would, if anything, tend to result in underestimated outcomes because the program would target women with low levels of empowerment. Thus, the treated would, by design, have worse empowerment outcomes than the untreated, leading to the results being lower bounds on the true treatment effect.

Nonetheless, my results show that a community-based intervention such as *Mahila Samakhya* can significantly improve female empowerment, both through improved employability as well as significant spillovers. More empowered women invest more in their children, and as a result have healthier and better-fed children. Hence, the success of this program has encouraging implications not just for female empowerment goals, but also for the other factors affected by empowerment, such as child welfare goals.

3.7 Tables and Figures

Figure 3.1: Uttarakhand, India

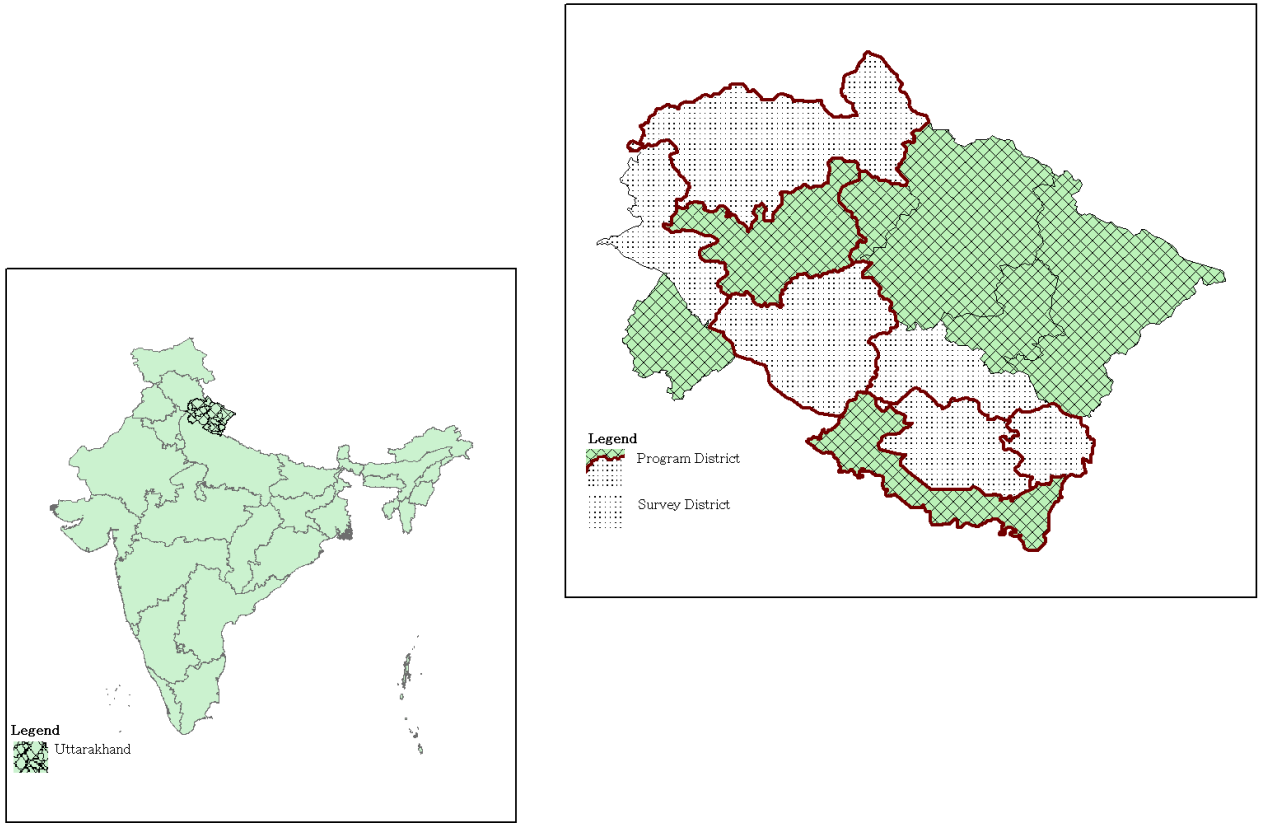


Table 3.1: Summary Statistics Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Variables	Observations	Mean	Std. Dev	Min	Max
Respondent's Age	472	32.18	8.11	20	65
Husband's Age	437	37.89	9.25	23	80
Respondent's Age at Marriage	463	19.25	3.34	1	30
Average age of sons	487	8.05	7.79	0	36
Average age of daughters	487	6.18	6.70	0	30
Respondent's Years of Education	397	8.82	4.06	0	17
Husband's Years of Education	414	10.13	3.68	1	17
Sons' Years of Education	443	7.04	4.34	1	17
Daughters' Years of Education	355	6.73	4.23	1	17
Number of Rooms	487	3.33	2.12	0	19
Electrification	487	0.89	0.31	0	1

Table 3.2: Female Bargaining Power: Dependent Variables from a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Dependent Variables	Percent Yes
Has NREGS ID Card	
All	60.62
Non-participants	48.94
Participants	68.02
Can Leave House Without Permission	
All	70.89
Non-participants	58.82
Participants	78.17
Participates in Village Council Meetings	
All	36.36
Non-participants	14.20
Participants	49.49

Table 3.3: Basic Characteristics of Participants and Non-participants in Districts with *Mahila Samakhya* Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Variables	Non-participants	Participants	Difference	t-test
Demographics				
Own-to-husband's age	0.84	0.86	-0.03	-2.53**
	(0.01)	(0.01)	(0.08)	
Age at Marriage	18.48	19.17	-0.69	1.63
	(0.38)	(0.21)	(0.42)	
Age of Sons	7.26	8.97	-1.71	-1.81
	(0.77)	(0.50)	(0.95)	
Age of Daughters	6.33	6.54	-0.21	-0.25
	(0.73)	(0.44)	(0.84)	
Number of Sons	1.16	1.37	-0.21	-1.87
	(0.09)	(0.06)	(0.11)	
Number of Daughters	0.98	1.14	-0.16	-1.31
	(0.08)	(0.07)	(0.12)	
Own-to-husband's education	0.66	0.58	0.07	1.38
	(0.05)	(0.03)	(0.05)	
Low Education	0.29	0.31	-0.14	-0.26
	(0.05)	(0.03)	(0.06)	
Respondent Lives with Husband	0.85	0.67	0.19	3.10**
	(0.04)	(0.03)	(0.06)	
Respondent Lives with In-laws	0.55	0.44	0.12	1.90
	(0.05)	(0.03)	(0.06)	
Respondent Works	0.52	0.59	-0.06	-1.02
	(0.05)	(0.03)	(0.06)	
Brahmin	0.06	0.20	-0.14	-3.18**
	(0.03)	(0.03)	(0.05)	
Time to water source	25.65	24.09	1.55	0.24
	(3.77)	(3.19)	(6.38)	
Wealth Indicators				
Number of Rooms	3.09	3.30	-0.21	-0.81
	(0.21)	(0.13)	(0.26)	
Electrification (No=0; Yes=1)	0.89	0.89	0.00	0.01
	(0.03)	(0.02)	(0.04)	
Improved Toilet (No=0; Yes=1)	0.28	0.26	0.02	0.35
	(0.03)	(0.05)	(0.06)	
Floor†	1.63	1.86	-0.23	-1.71
	(0.08)	(0.11)	(0.14)	
Walls†	1.77	1.81	-0.03	-0.25
	(0.08)	(0.10)	(0.13)	

†Impermeable=1; semi-permeable=2; permeable=3

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.4: Basic Characteristics of Treated and Untreated Districts Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Variables	Untreated	Treated	Difference	t-test
Demographics				
Own-to-husband's age	0.85	0.85	-0.03	-0.17
	(0.01)	(0.01)	(0.02)	
Age at Marriage	19.76	18.69	1.08	1.33
	(0.05)	(0.54)	(0.81)	
Age of Sons	6.96	9.03	-2.07	-1.66
	(0.84)	(0.76)	(1.25)	
Age of Daughters	5.45	6.98	-1.52	-1.78
	(0.46)	(0.84)	(1.29)	
Number of Sons	1.09	1.38	-0.29	-2.27*
	(0.04)	(0.08)	(0.13)	
Number of Daughters	0.99	1.13	-0.14	-1.29
	(0.05)	(0.07)	(0.11)	
Own-to-husband's education	0.65	0.61	0.03	0.35
	(0.12)	(0.04)	(0.09)	
Respondent Lives with Husband	0.83	0.76	0.07	0.42
	(0.09)	(0.09)	(0.04)	
Respondent Lives with In-laws	0.56	0.45	0.11	1.18
	(0.11)	(0.04)	(0.09)	
Respondent Works	0.45	0.65	-0.08	-1.11
	(0.07)	(0.12)	(0.18)	
Brahmin	0.21	0.14	0.07	0.45
	(0.21)	(0.06)	(0.16)	
Time to water source	23.51	24.14	-0.63	-0.11
	(3.43)	(3.18)	(5.63)	
Wealth Indicators				
Number of Rooms	3.58	3.07	0.51	0.96
	(0.49)	(0.29)	(0.53)	
Electrification (No=0; Yes=1)	0.90	0.88	0.02	0.21
	(0.004)	(0.05)	(0.08)	
Improved Toilet (No=0; Yes=1)	0.18	0.21	0.04	-0.30
	(0.07)	(0.07)	(0.05)	
Floor†	1.41	1.55	-0.14	-0.43
	(0.41)	(0.14)	(0.33)	
Walls†	1.39	1.76	-0.37	-1.85
	(0.18)	(0.11)	(0.19)	

†Impermeable=1; semi-permeable=2; permeable=3

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.5: The Estimated Effect of *Mahila Samakhya* Participation on Measures of Female Empowerment Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	Non-Participants vs. the Untreated				
Unmatched	Spousal Age Ratio	Has NREGS Card	Can Go Out W/o Permission	Council Meetings	Respondent Works
Non-participants	0.835	0.719	0.671	0.152	0.641
Untreated	0.849	0.256	0.578	0.0986	0.523
Difference	-0.015	0.463	0.093	0.053	0.118
	(0.014)	(0.071)***	(0.081)	(0.055)	(0.097)
Matched	Spousal Age Ratio	Has NREGS Card	Can Go Out W/o Permission	Council Meetings	Respondent Works
Non-participants	0.835	0.719	0.671	0.152	0.641
Untreated	0.839	0.634	0.747	0.089	0.297
Difference	-0.004	0.085	-0.076	0.063	0.344
	(0.033)	(0.213)	(0.221)	(0.148)	(0.031)
Observations	160	160	143	150	108
	Participants vs. the Untreated				
Unmatched	Spousal Age Ratio	Has NREGS Card	Can Go Out W/o Permission	Council Meetings	Respondent Works
Participants	0.862	0.808	0.793	0.505	0.613
Untreated	0.849	0.183	0.644	0.212	0.425
Difference	0.0119	0.625	0.149	0.292	0.188
	(0.009)	(0.045)***	(0.052)***	(0.06)***	(0.07)**
Matched	Spousal Age Ratio	Has NREGS Card	Can Go Out W/o Permission	Council Meetings	Respondent Works
Participants	0.862	0.808	0.793	0.505	0.613
Untreated	0.843	0.145	0.493	0.206	0.241
Difference	0.019	0.664	0.299	0.299	0.372
	(0.024)	(0.118)***	(0.149)*	(0.129)**	(0.243)
Observations	336	334	308	327	271

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.6: The Estimated Effect of *Mahila Samakhya* Participation on Measures of Female Empowerment of Women Who Do Not Work Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	Participants vs. the Untreated		
Unmatched	Has NREGS Card	Can Go Out W/o Permission	Council Meetings
Participants	0.727	0.663	0.421
Untreated	0.182	0.702	0.321
Difference	0.545	-0.039	0.099
	$(0.073)^{***}$	(0.086)	(0.085)
Matched	Has NREGS Card	Can Go Out W/o Permission	Council Meetings
Participants	0.727	0.663	0.421
Untreated	0.136	0.337	0.205
Difference	0.591	0.325	0.216
	$(0.158)^{***}$	$(0.195)^{*}$	(0.175)
Observations	143	130	130

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 4

STANDING TOGETHER: PEER NETWORKS, FEMALE EMPOWERMENT, AND CHILD WELFARE

4.1 Introduction

4.1.1 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 al., 2002; Quisumbing and de la Brière, 2000). In this paper, I quantify the impact of network-based learning and influence on measures of female empowerment and child nutrition using primary data from India.

A woman's ability to influence household resource allocation depends on her notion of identity and the utility she receives from it,[1] her bargaining power, and the social norms,[2] as well as the interaction of these three forces. Bargaining power is affected by her identity and the social norms, which in turn are influenced by local culture (Akerlof and Kranton, 2010). Identity and norms 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, I argue peer networks are an effective way to change social norms, bargaining power, and hence child nutrition.

[1]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).

[2]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" (Young, 2008).

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, therefore reinforcing social norms. Conservative social norms will reinforce current bargaining power, which is often skewed to the male in the household. Strengthening the women within a social network can influence the social norms within that network to withstand norms; policy-makers can thus harness network-based learning and influence to improve child welfare.

To study whether peer networks influence bargaining power and therefore child welfare, I 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?

To answer these questions, I use primary data collected from India. 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 (Gragnolati 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.

I present a utility maximization model in which consumption smoothing gives parents an economic incentive to invest in their children, where that incentive is larger for women who face lower future income prospects. 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.[3] 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 gain utility from mimicking their actions.

I 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 3.1). I identify 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 3.1). My survey area covers six randomly-chosen Uttarakhand districts, four with the program and two without. (The survey districts are represented in Figure 3.1 with a dotted pattern. The four districts with a thick border and dotted patterns are program districts. The two dotted districts without a thick border are non-program districts.)

The contributions of this paper are four-fold: first, I quantify the effect of peer networks on female empowerment and child welfare; second, I decompose the total peer effect into its component mechanisms. Third, I develop a theoretical framework describing the interaction of networks and female bargaining power that synthesizes standard economic theory (in the form of the Nash bargaining framework) with the demographic diffusion literature, and identity economics. Fourth, I identify shocks to networks using the unique *Mahila Samakhya* program, which expands and diversifies networks, and has strong potential to replicated elsewhere in the developing world. I use primary data on self-reported networks, as well as an innovative empirical technique that combines elements

[3]Disagreement or threat-point utility refers to the utility each adult receives if the household bargain fails and cooperation breaks down (Mas Colell et al., 1995, p. 839).

from spatial econometrics with a 3SLS approach.

Studying the links among networks, female empowerment, and child welfare helps us understand how best to target development programs aimed at empowering women or improving child welfare. While it has been shown that empowering women can improve child outcomes, the factors determining female bargaining power are not completely understood. If peer networks affect bargaining power and child outcomes, they need to be taken into account when designing and evaluating development programs. Understanding this relationship between female empowerment and child welfare will allow better targeting of development programs. For instance, 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 sizable marginal impact on child malnutrition, child welfare policies should also account for female empowerment.

4.2 Literature Review

Economists often argue that since mothers invest more in their children than do fathers, men and women have inherently different preferences with regard to household resource allocation, and that as a result bargaining power affects the allocation of household resources as well as labor supply decisions (Ghosh and Kanbur, 2008; Agarwal, 2001; Sahn and Stifel, 2002; Quisumbing and de la Brière, 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). Rather than assume that women are more altruistic than men, my causal model provides women

an economic incentive to invest in their children. Second, my model explicitly measures the effect of peer networks on bargaining power and child welfare.

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 identity, providing 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. To my knowledge no other paper has used self-reported networks in studying the determinants of female power and child welfare. Second, to my knowledge, no other paper has empirically explored the mechanisms through which self-reported peer networks affect female bargaining power. Can peer networks increase women's bargaining power and thereby improve child welfare? In this paper, I examine the impact of more empowered peers on a woman's say in household decision making, and thus on the food intake of her children.

4.3 Uttarakhand and The *Mahila Samakhya* Program

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. 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. However, the state is also relative wealthy: in 2005-06, only eight percent of Uttarakhand households fell in the poorest wealth quintile nationally (IIPS and Macro, 2007).

Uttarakhand has a large Hindu population— 85 percent as compared to 80 percent for the entire country (of the Registrar General and Census Commissioner, 2001), with 18 percent belonging to Scheduled Castes and Tribes.[4] Caste hierarchy is strictly maintained in Uttarakhandi villages, and most interactions are limited to members of the same caste. Villages are clusters of houses that are isolated from other villages by 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 example in which Uttarakhandi villagers, and women in particular, literally hugged trees to prevent felling.[5] Villagers have also protested the development of resorts and the diversion of water sources to richer communities.

[4]The 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.

[5]The Hindi word *Chipko* means to stick.

4.3.2 The Status of Uttarakhandi Women

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 experienced physical violence (IIPS and Macro, 2007). Only 18 percent of these women— or about five percent of the overall population— 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 few social interactions outside the immediate family. 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 (IIPS and Macro, 2007). Field tests and the data suggest that women's lives are 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.

4.3.3 *Mahila Samakhya* in Uttarakhand

Mahila Samakhya is a women's empowerment program that started in what is now Uttarakhand in 1995. The program covers 2,416 villages in six of thirteen of Uttarakhandi districts. More than 42,000 women participate in this program, and over 2,500 girls have been educated in its centers. The program focuses on formal and informal education as the means to empowerment. Literacy camps, adult education centers, and vocational training enable participants to earn an income primarily through artisanry and store-keeping. In

addition, the program provides special education on resolving domestic disputes and conflicts within the community. However, program rollout is not always straightforward. Local men sometimes resist the program and prevent their wives from participating. As a result, 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. Further, as the family— chiefly husbands and in-laws— see the benefits from participation, particularly through enhanced employability and increases in household income, they reduce opposition to the program over time.

Village- and district-level meetings allow participants to step outside their homes and villages, making their lives less solitary. Participants meet women from other castes and religions, which expands their peer networks and lets them engage in conversation not pertaining to domestic chores and family. The semi-formal and well-structured nature of these interactions facilitates dialogue. The information provided by *Mahila Samakhya* as well as that exchanged within the newly-expanded networks may help change social norms. The learned vocational skills allow participants to engage in income-generating activities. In particular, respondents are encouraged to acquire identification cards that enable them to participate in the government's National Rural Employment Guarantee Scheme (NREGS). NREGS guarantees at least a hundred days of paid work to the rural poor. Participation in NREGS provides these women an income, which can increase household bargaining power. Changed social norms and the ability to earn an income also enable these women to have greater physical mobility.

4.4 The Causal Mechanisms

I hypothesize that *Mahila Samakhya* has two effects on female empowerment: one the intended treatment effect of the program, and one the peer effect. The program treatment effect works through education, while the peer effect works through the spillovers of social

networks of both participants and their non-participant friends. 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. In addition, peer networks enable women to allocate more resources to their children. And finally, *Mahila Samakhya* changes the norm faced by participants as well as their identity utility.

The peer effect of participation in *Mahila Samakhya* can thus be summarized as follows: the program (1) exposes her to new information, leading to social learning, (2) works through social influence to ease constraints placed by norms, (3) increases the identity utility received from belonging to a group, and (4) changes social norms.

4.4.1 Peer Effect

Social Learning

Participation 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* introduces them to many more women, and through them to information on the opportunities and facilities available to women. 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, 1973), such as the ties with program participants from other villages.

Information about new opportunities can also be valuable for it's 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 the finding that urban Indian women with access to cable television were more empowered than those without cable television (Jensen and Oster, 2009).

Social Influence

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. 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 may remain in the status quo for fear of being ostracized.

By organizing women into support groups, the program can increase 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. In field tests, 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.

Identity Utility

As well as improving connections with existing peers, *Mahila Samakhya* alters peer sets by expanding networks. 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. In initial interviews, 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. 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.

However, for non-participants, the constraints placed by social norms and identity utility are likely unchanged by the program because the village continues to be their reference group, until a critical mass of participants is achieved and the social norms themselves change.

Effects on Social Norms

More empowered, educated, and mobile women can change the 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.

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." However, the program provided them an in-built support group to help them challenge the status quo.

4.5 Model

In this section, I present a theoretical model that concretizes the causal mechanisms described above. To start, I 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. The disagreement utility is simply each spouse's intertemporal utility if they remained single or if they were non-cooperating in marriage, and depends on the spouse's own earning potential and the partner's earning potential as well as on the non-cooperative equilibrium outcome of investment in children.

To incorporate networks into the Nash bargaining model, first, I model the adults as making a joint decision by maximizing the generalized Nash product, $\mathbf{x}$, comprising a private good c, leisure l, and a public good reflected by investment in children r. Each adult's say in the household represented by the exponents α and β, which sum to one and reflect the relative levels of bargaining power captured by husband and wife. These exponents can depend on social norms, and can change over time to reflect more equitable

norms. The bargain leads to optimal values of the bundle for each adult, $\mathbf{x}^*$. 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 social norms, I 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.[6] The more diverse a woman's network, the larger is X_N, and the more empowered her peers, the greater is her set of high-utility (to her) options in the choice set. Therefore, the social norm is less constraining on women with diverse networks that include some highly empowered peers.

Second, I represent the influence of networks by assuming individuals receive utility by being better off than their peers, and a 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. I thus add identity utility U_r from the relative set or network N, to each utility function. Since male and female networks are different, I 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 and limit the potential for social sanction.

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

[6]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, I assume only the observed $\mathbf{x}^*$ matters. Although women with access to televisions may see women on cable shows being employed as lawyers, etc., actually meeting a woman engaged in professional employment is likely more salient and has a greater impact.

$$\max_{\mathbf{x_f},\mathbf{x_m}} [U_f(\mathbf{x_{f,1}}) + EU_f(\mathbf{x_{f,2}}) + U_r(N_f, \mathbf{x}^*_{\mathbf{N_f}}) - V_f(N_f)]^\alpha$$
$$[U_m(\mathbf{x_{m,1}}) + EU_m(\mathbf{x_{m,2}}) + U_r(N_m, \mathbf{x}^*_{\mathbf{N_m}}) - V_m(N_m)]^\beta \quad (4.1)$$
$$\text{s.t. } 4.2, 4.3, 4.4, 4.7$$

$$\mathbf{x} \in \{X\} \quad (4.2)$$

$$X = f(X_N) \quad (4.3)$$

$$X_N = \bigcup \mathbf{x}^*_{\mathbf{N}} \quad (4.4)$$

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, including wages. 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. I model the public good r as the numeraire, hence the associated price is one. Since women have a lower expected wage and a longer life expectancy, they have an economic incentive to invest more in their children. Hence, the woman's optimal choice of r is greater than the man's optimal choice. The woman's share of the household's resources, θ, is parametrically defined by α and β; these shares are given by norms and are not a bargaining outcome. The woman's FIBC looks as follows:

$$\mathbf{p_f}(\mathbf{x_{f,1}} + \mathbf{x_{f,2}}) \leq \theta(\alpha, \beta) \left[\sum_{t=1,2} Y_{f,t} + (Y_{m,1} + \rho Y_{m,2}) + E(T_f) + \rho E(T_m) \right] \quad (4.5)$$

where ρ represents the probability that the woman is married in period 2. $E(T)$ refers to

the expected transfers from children. The man's FIBC looks as follows:

$$\mathbf{p_m}(\mathbf{x_{m,1}} + \mathbf{x_{m,2}}) \leq (1 - \theta(\alpha, \beta)) \left[\sum_{t=1,2} Y_{m,t} + (Y_{f,1} + \rho Y_{f,2}) + E(T_m) + \rho E(T_f) \right] \tag{4.6}$$

Adding up the constraints in equation 4.5 and equation 4.6 yields the full-income budget constraint faced by the household (equation 4.7).

$$\begin{aligned} &\mathbf{p_f}(\mathbf{x_{f,1}} + \mathbf{x_{f,2}}) + \mathbf{p_m}(\mathbf{x_{m,1}} + \mathbf{x_{m,2}}) \leq \\ &\sum_{t=1,2} Y_{m,t} + \theta(\alpha, \beta) \left[\sum_t Y_{f,t} - \sum_t Y_{m,t} \right] + \theta(\alpha, \beta)(Y_{m,1} + \rho Y_{m,2} - Y_{f,1} - \rho Y_{f,2}) \\ &+ (Y_{f,1} + \rho Y_{f,2}) + [E(T_m) + \rho(E(T_f) - \theta(\alpha, \beta) E(T_m) - \theta(\alpha, \beta) \rho E(T_f))] \end{aligned} \tag{4.7}$$

In this model, parents invest in children for consumption smoothing purposes. An increase in education raises bargaining power, and potential household and individual income, which have different effects on investments in children. Education raises investment in children only so far as higher bargaining power outweighs the countervailing effect of increased potential individual income. Education no longer increases investment in children once the increase in bargaining power is smaller than the increase in potential income. However, due to consumption smoothing, the increased differential in current versus future household income increases demand for future transfers, and thus investment in children. As long as women live longer than men and have lower average income, an increase in women's educational attainment will thus increase investment in children.

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. Following the earlier

discussion, the model yields four ways in which networks affect female empowerment: (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) 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 the whole household, but women differentially than women so they do 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. (4) Over time, the social norms might change as a result of more women participating in *Mahila Samakhya*.

4.5.1 Social Learning

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 4.1 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 ($U_B^m < U_A^m$). While this discussion treats the bargain as a zero-sum game, newly-expanded networks can in fact improve the entire household's utility

by empowering the woman to earn an income and thus expanding the household UPF.

4.5.2 Social Influence

Figure 4.2 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 a woman near the disagreement utility 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.

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 illustrates 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 because knowing about better job prospects and having more marketable skills raise her expected wages and thus increase her bargaining power. Note that the observed outcomes in the event of a breakdown in the bargain depends on social norms, as reflected by parameters α and β as well. Participation in *Mahila Samakhya* changes both the level of disagreement utility as well as α and β.

4.5.3 Identity Utility

The third effect of networks might be to shift the UPF available to the household. The woman's utility is a function of the attitude or actions of her relative set of peers that she observed in the previous period. 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 4.3, without accounting for identity utility, the woman receives U_A^f in utility. However, her peers have some arbitrarily chosen 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.

4.5.4 Social Norms

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 social norms. 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 norms. 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.

In this framework, the peer 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 testable hypotheses.

4.6 Data

Household data from India do not include information on self-reported networks, and preclude an analysis of the effect of networks on child welfare. 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. As a result, I collect data from the north Indian state of Uttarakhand on instruments for social learning, influence, female power, and their role on child nutrition outcomes. In addition, I

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 me to use time-variation in exposure to the program to identify its impact on networks and child nutrition.

The data are from six of thirteen Uttarakhand districts, four with the program and two without. The sample size is 487 women. When field testing the questionnaire, most participants reported regularly communicating with fewer than five people outside their families, particularly prior to program participation. As a result, five appeared to be an effective upper limit on network size in my sample. Hence, I employ restricted snowball sampling where I interviewed a randomly-chosen woman and asked her to list her five closest friends. I then conducted follow-up interviews with two randomly-selected women from these five friends. Thus, starting with one woman, my sampling strategy gave me a network of seven. My 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? Do your closest friends participate?
  - How important is it to you and your husband what your friends and the community think of you?
- Proxies for Female Empowerment:
  - At what age did you (first) get married? What is your husband's age? (These questions allow me to compute the spouses' age ratio, and determine whether the woman was married before the legal limit of eighteen.)
  - What is your level of education? What is your husband's level of education? (These questions allow me to compute the spouses' education ratio.)

- Investment in Children:
  - How much food has each child eaten in the past 24 hours? (Enumerators carried standard bowls and asked respondents to estimate how many bowls of food each child ate.)
  - How much do you spend each month on your children's education?

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

4.6.1 Summary Statistics

As Table 4.1 shows, the average woman in my sample was 32 years old, while her husband is 38 years old. She married at age 19 and has 9 years of education, while her husband has an additional year of education. The average age of her sons is 8, and that of her daughters is 6. The average woman's house has three rooms and electricity. Table 4.2 tells us that 78.17 percent of the program participants but only 58.82 percent of non-participants could leave the house without permission. Similarly, while 68.02 percent of participants have NREGS identification cards, only 48.94 percent of non-participants do. Table 4.3 shows that participants' children also consume more rice, lentils, and dairy than non-participants children.

As established in Chapter 3 of this dissertation, participants might select into *Mahila Samakhya*, but evidence suggests that the program is not targeted by geographic area in any meaningful way. Further, poorer participants neither select into the program nor are they targeted based on indicators of wealth (number of rooms, electrification, access to improved toilet facilities, and nature of the construction materials used for the floor and walls of the house). As a result, my identification strategy involves accounting for endogenous program participation.

4.7 Identification Strategy

The empirical analysis occurs in two steps: first, I identify causal peer effects. I instrument for the endogeneity of program participation using exposure to the program, and for the endogeneity of networks using the number of other women in the village with a similar time to collect water and the number of other women in the village of the same caste. Second, I study the mechanisms through which the peer effects work: social learning, social influence, identity utility, and changing social norms. Note that peer effects can work directly on participants themselves, and also indirectly through the friends of participants. As a result, the change in reference group afforded by the program is essentially a peer effect.

4.7.1 Endogeneity of Program Participation

Because participation in *Mahila Samakhya* is most likely endogenous, I consider the number of years a participant has lived in a village with *Mahila Samakhya* as an adult. I use the threshold of 16 for adulthood because program participants can be no younger than 16 years of age. This variable tells us the potential years of exposure of an adult to the program, and is thus correlated with participation. Further, any effect of this variable on female empowerment likely works through participation in the program, rather than directly. This variable is driven by the year the program started as there is little migration among married women in the region. Since women often migrate at the time of marriage, the exposure to the program might have started in their natal village through a participant friend or parent. I do not know whether the woman's natal village had the program, so migration at the time of marriage might lead to measurement error, which in turn would bias results downwards. However, as noted earlier, unmarried women do not participate in the program, so exposure would have to be indirect, and thus the resultant bias would be small.

4.7.2 Identifying Peer Effects

The reflection problem confounds identification of causal peer effects (Manski, 1993). 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 describe the fact that individuals are more likely to act in a given way depending on the distribution of group members' characteristics. (3) Endogenous effects represent the phenomenon where the group affects individual behavior through social interaction. The third effect is key to identifying the causal network effect.

Much of the literature following Manski has focused on the econometric issue of separating the causal peer effect from that of correlated unobservables (Conley and Udry, 2010; 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). The *Mahila Samakhya* intervention is not randomized, so my identification strategy combines an instrumental variables approach with a spatial weighting technique (Kelejian and Prucha, 1998).

Recent extensions of spatial econometrics to networks have relied on the Generalized Spatial 2SLS estimator by using partially overlapping networks (Bramoullè et al., 2009; Giorgi et al., 2010). A limitation of our data (and most available datasets, including those used earlier) is that I do not know entire networks, simply five of the woman's friends. Rather than assume that these five friends comprise the woman's entire network, I use information on caste and time to collect water to instrument for the endogeneity of networks, in addition to instrumenting for own participation. As a result, my estimation is conducted using a 3SLS estimator with network-weighted independent variables.

Water collection tends to take about 24 minutes each day, for participants and non-participants alike. Villages in the survey region tend to have multiple water sources.

Since the houses within a village are clustered, women face very similar times to collect water, with the variation being driven by topography: some women choose to go to more proximate water sources, which maybe involve a steeper climb, while other walk a longer distance if the walk is less hilly. Thus, for any given village, women with similar times to collect water are likely to go to the same source. So, I treat women with times to collect water within one standard deviation of each other as potential friends. I also treat women of the same caste within a village as potential friends. I then generate two network weights matrices: one which identifies all self-reported friends, and a second that identifies all potential friends using caste and time to collect water. I multiply the caste- and water-time-based weights matrices with the vectors of average age of sons and time to collect fuel to generate instruments for the true weighted participation of friends. These network-weighted instruments thus reflect the average number of years all potential friends have lived, as adults, in a village with the program.

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 measurement error due to proxy reports. The combination of snowball sampling and the use of instruments for the endogeneity of social networks allows us to isolate the effect of interactions from that of the individual group shock.

4.7.3 Decomposing the Mechanisms

In the section on causal mechanisms, I described four major channels through which peer networks and *Mahila Samakhya* affect female bargaining power and child welfare: social learning, social influence, identity utility, and social norms. Below I describe the proxies that use to measure each of these mechanisms (summarized in Table 4.4), and the expected signs on the corresponding right-hand side variables (summarized in Table 4.5). Since I measure the mechanisms using proxies, I cannot rule out that the proxies for a mechanism

might be contaminated by observables or unobservables correlated with one of the other mechanisms. However, as outlined below, I posit that these proxies primarily pick up the mechanism they are intended to measure. Further, I tested the robustness of results using different proxies for the mechanisms; results are robust.

Social learning removes constraints on PPF: Intuitively, these constraints will be more binding on women who do not have much access to information before the program. My hypothesis is that women with little education are less exposed to information than those with five or more years of education, and thus have more to gain through social learning. Hence, I measure this effect using low education, and interaction with own participation and friends' participation in *Mahila Samakhya*. I define low education as four or fewer years of education. Most women in our sample (72.24 percent) had at least five years of education. As a result, I expect the interactions of low education with own and friends' participation to have positive effects on female bargaining power and child food intake outcomes, while low education by itself is likely to have a negative effect on the outcomes.

I model social influence as increasing disagreement utility, which most affects women whose agreement utility is close to their actual disagreement utility in the event of a bargaining breakdown. These women are likely those with particularly low initial bargaining power, which I proxy for using the spouses' age ratio. Women become part of strong support groups when they participate in *Mahila Samakhya*, which increases their disagreement utility in the event that they do not reach a successful bargain with their husband. Women who have very low initial bargaining power, but now participate in *Mahila Samakhya* may gain more from social influence than those with higher initial bargaining power. However, since bargaining power itself is an outcome of program participation, I need to use a measure of bargaining power that is likely to remain unchanged by participation. I use the spousal age ratio to capture this initial bargaining power effect. I expect the interaction of program participation and the spousal age ratio proxy to have a positive effect on our outcome variables.

Identity utility from belonging to a group shifts out the PPF. Presumably the degree to which a woman cares about her social group's opinion will affect the potential utility gains from associating more closely with the group. I capture this effect of identity utility using whether a woman cares a lot about her friends' opinion of her (referred to here on as Friends' Opinion (Women)), and interacting this degree of care with her own participation and weighed participation. The more a woman cares, the greater the identity utility she gains from being part of her group of friends. Since I argue that participation in *Mahila Samakhya* increases a woman's identity utility, I expect the interaction terms between own and friends' program participation and caring about friends' opinions to have a positive effect on outcomes.

Social norms constrain women's behavior and their choice sets. The greater the influence of norms on the household, presumably the more are women bound by these constraints. I proxy for the strength of the norms faced by a woman via whether the husband cares a lot about villagers' opinion of him (referred to here on as Villagers' Opinion (Men)), interacted with both her own and friends' participation. The more the husband cares about villagers' opinion, the more constraining are social norms, and so I expect a negative direct effect on outcomes. However, I expect own and friends' program participation to somewhat mitigate the effect of constraining social norms on individuals. Increasing the number of empowered women in the village also directly changes social norms if the norm is for women not to be empowered. Hence, the interaction terms with husbands caring about villagers opinion should have positive effects on outcome variables.

4.7.4 Dependent variables and mechanisms

I use two dependent variables for female bargaining power: whether the woman owns an NREGS identification card, and whether she is able to leave the house without permission. Here, I describe which of the mechanisms I expect to be significant determinants of these measures of bargaining power. I also describe the effect of empowerment and peer networks

on children's food intake since this paper also studies whether more empowered women in fact invest more in their children.

NREGS: I expect participation in NREGS to be primarily affected by social learning and influence. The women might not know it is possible for them to work, particularly in the predominantly construction/ manual labor jobs offered by the NREGS. However, learning alone does not tell a complete story; even after learning that they can participate in NREGS, women often need *Mahila Samakhya* support in order to get the necessary identification cards to work in the program.

Being able to leave the house without permission: I expect social influence to be the dominant mechanism here, although social learning and identity utility are likely important as well. Women who participate in *Mahila Samakhya* have support groups so they do not fear ostracism by the local community for going out without permission. However, they also may not have realized that they could leave the house without permission, and only learned that they could from participating in the program. Finally, identifying as a "*Mahila Samakhya* participant" and identifying with the other (more mobile than average) participants might empower a woman to leave the house without permission.

Children's food intake: I consider the natural logs of rice, lentil, and dairy consumption in the past day. For food consumption, I expect learning to be the most important because women, particularly those with low education, may not know how much to feed young children. However, for the relatively expensive non-staples such as dairy, identity utility might have a more significant effect. Allocating more lentils or dairy to children might mean the husband gets less food, which is more likely to happen if the woman identifies herself with a more empowered group of peers. I also expect norms to be important because how much one's children eat is likely affected by what other, perhaps older people in the village feed their children. The more the husband cares about the villagers' opinion of him, the more likely children are to be well-fed.

4.8 Results

The female empowerment and child welfare results presented below come from one of two sets of regressions. The first, a "base" regression, does not include any of the interaction terms outlined in Table 4.5, and simply tells us whether own and friends' participation in the program increase female empowerment or improve child welfare, while controlling for (1) the woman's personal characteristics, such as low educational attainment, age, opinion 1 and 2, (2) household demographic characteristics: the number and average age of the woman's children, whether the household is Brahmin, and whether the parents in-law live in the household, and (3) measures of household wealth, such as the number of rooms and electrification. The second, a "mechanism" regression, includes, in addition to the above three characteristic sets, the interaction terms from Table 4.5. The mechanism regression thus disentangles the components effects of peer networks.

Table 4.6 presents the program-related OLS results of the effect of own and friends' participation in *Mahila Samakhya* on female empowerment (full regression results are presented in table 4.13 in the Ancillary Tables section). When compared with the program-related 3SLS results in Table 4.7, these results highlight the bias introduced by endogenous program participation, and the importance of correcting for such bias (full regression results are presented in table 4.14 in the Ancillary Tables section). The outcomes of female empowerment used are those presented in Table 4.2: owning NREGS identification card and going out without permission. The first and third columns of results in Table 4.6 present the base OLS results. These results suggest that *Mahila Samakhya* participants are more empowered than non-participants: they are significantly more likely to own an NREGS identification card, and to leave the house without permission. However, friends' participation does not appear to be significantly correlated with empowerment. In the mechanism regressions (columns two and four of results), the only significant mechanism is that of changing norms: women with more participant friends are less constricted by their husbands' caring about the villagers' opinion of him.

Table 4.7 presents the 3SLS (and thus instrumented) results for a regression of own and peers' participation in *Mahila Samakhya* on the female bargaining power outcomes (full regression results are presented in table 4.14 in the Ancillary Tables section). These results show that participants are significantly more likely to leave the house without permission, and close-to-significantly (t-stat of 1.43) more likely to have NREGS cards. The differences between these effects and those from the OLS regression highlight the endogeneity problem. The mechanism regression also tells us that friends' participation makes a woman significantly more likely to leave without permission; this effect is lower for women who are themselves participants. The greater a woman's identity utility—the more she cares about her peers' opinion of her (Friends' Opinion (Women))— the less likely she is to have an NREGS card. The more the husband cares about villagers' opinion (the more constraining are social norms on the husband and therefore on the wife), the less likely women are to have NREGS identification cards or to leave without permission. These results also tell us that richer women (those with electricity) are less likely to go out without permission, and that Brahmin women are less likely to have NREGS cards.

To interpret the mechanism regression results, Table 4.8 presents marginal effects. Overall, participants are significantly more likely to go out without permission, but the total direct effect on owning an NREGS card is not significantly different from zero. However, the effect of own participation on participants is negative for both outcome variables. A result that highlights the importance of peer networks is that, for non-participants, friends' participation significantly increases a woman's ability to leave the house without permission. Of the mechanisms, social learning and social influence play the most important roles in female empowerment. Social learning is a key mechanism: women with low education are significantly more likely to go out without permission as a result of own and friends' participation. These are the women who stand to gain the most from the informational content of networks, and the fact that the program benefits them the most suggests that social learning is an important component of the peer effect.

Social influence also plays a major role in determining female empowerment, as own participation significantly improves both outcomes for women with greater initial bargaining power as measured by the spousal age ratio. In other words, program participation significantly increases the disagreement utilities of the participating women and empowers them. Identity utility and changing norms, while insignificant for NREGS card ownership, significantly improve empowerment as measured by the permission variable. Identity utility through own and friends' participation, in particular, increases the likelihood of a woman leaving the house without permission for the average woman, and for participants alone. Friends' participation also interacts significantly with the identity utility measure (importance of friends' opinion) for the average woman and the average participant. In summary, peer networks work through social influence and learning to significantly empower women.

Table 4.9 presents the program-related OLS results of own and friends' participation in *Mahila Samakhya* on children's food intake (full regression results are presented in table 4.15 in the Ancillary Tables section). The three categories of food are rice, lentils (dal), and dairy. In addition to the woman's personal characteristics, household demographic characteristics, and measures of household wealth described above, the right hand side variables for these outcomes include the husband and wife's consumption of the corresponding food group. Base results imply that participation significantly increases children's rice and dairy consumption. Older women, and women closer in age to their husbands have significantly better-fed children, while Brahmin children eat smaller amounts of rice and lentils. Children of women who care more about their friends' opinion consume significantly more dairy. Women with more participant friends have a greater impact of caring about those friends' opinion. Similarly, the effect of a husband caring about villagers' opinion is smaller for participants than non-participants. The wife's lentil and dairy consumption are associated with significant increases in the child's consumption. Although insignificant, the husband's food consumption is negatively correlated with

children's consumption in all but the dairy mechanism regression, suggesting perhaps substitution in food allocation.

Table 4.10 presents the program-related base 3SLS results of the effect of own and friends' participation in *Mahila Samakhya* on children's food intake (full regression results are presented in table 4.16 in the Ancillary Tables section). That the OLS results are stronger than these instrumented ones tells us that more empowered women likely select into the program and feed their children better. These results suggest that neither own nor friends' participation has any direct effect on children's consumption of rice, lentils, or dairy. However, older women and women closer in age to their husbands have significantly better-fed children for all three food types. As with the OLS results, the wife's lentil and dairy consumption increase children's consumption of these foods, while the husband's consumption levels are always negatively related with those by his children. Table 4.11 presents the corresponding mechanism 3SLS results (full regression results are presented in table 4.17 in the Ancillary Tables section). These results show that own participation significantly increases children's intake of rice and dairy. Children born to women with less education eat smaller quantities of rice and dairy, while children of older women eat more. Children of a woman closer in age to her husband eat significantly more rice and dairy.

Of the mechanisms, social influence through the program appears to be most important in the food intake regressions: children of women with low initial bargaining power (those with a low age ratio) eat more rice and dairy due to their mothers' participation in the program. Identity utility significantly influences the intake of rice as the effect of caring about the friends' opinion is greatest for women with more participant friends. Binding social norms actually appear to improve child welfare, as the more the husband cares about the villagers' opinion of him, the more rice and dairy his children eat. The signs and significance levels of the husband and wife's rice, lentil, and dairy consumption is consistent with the OLS and base 3SLS results presented above.

The marginal effects presented in Table 4.12 tell us that on average, participation

significantly increases rice and dairy consumption by children, although friends' participation appears to slightly decrease lentil consumption. Both social learning and influence have significant positive effects on dairy consumption, suggesting that for relatively expensive non-staples, peer networks can have a sizable impact on children's food consumption. Social learning is also a significant determinant of rice consumption. Identity utility, through own participation also significantly improves rice and dairy intake for the average woman's child. Finally, as suggested by the base and mechanism regressions, social norms appear to help improve child food intake. In summary, social learning, identity utility, and social norms play important roles in improving child food intake.

First stage results of the 3SLS regressions for empowerment and child food intake are reported in the Ancillary Tables section. As described above, I instrument for own participation using potential exposure to the *Mahila Samakhya* program, and friends' participation using the number of women in the village with similar time to water source and same caste interacted with the participation instrument. Table 4.18 presents the first stage results for the empowerment regressions, while Table 4.19 presents the first stage for the base regressions on children's food intake, and Table 4.20 the mechanism regressions for children's food intake.

The first stage results from the two sets of regressions (empowerment and children's food intake) are very similar on some counts: the regressions instrumenting for own participation tell us that exposure to the program is significantly negatively associated with participation, perhaps because older women tend not to participate in the program and have lived in the village for several years. As expected, women who live with their in-laws are less likely to participate in both sets of first stage regressions.

However, then some differences emerge in the two sets of first stage regressions: in the first stage of the empowerment outcomes regressions, women with higher spousal age ratios (and thus higher initial bargaining power) are significantly likely to participate, as are Brahmins, and women who care more about their friends' opinion. In the first stage of the

food outcomes regressions, Brahmins continue to be more likely to participate, and the spousal age ratio is still positively correlated with own participation, but the estimate is just shy of significance at the ten percent level except in the rice regression. However, caring about one's friends' opinion is no longer near significance. In the food regressions, we also find that older women are significantly more likely to participate, while the coefficient was insignificant in the empowerment regressions. Finally, friends' participation is associated with an increase in own participation for the empowerment outcome regressions, although the coefficient is only significant in the mechanism regressions. However, the effect of friends' participation is negative on own participation for the food intake regressions.

In all the first stage regressions for friends' participation, the time to collect water and caste instruments are both highly significantly correlated with participation. However, the interaction of the time to collect water with the participation instrument is always negatively correlated with the number of friends' participating, while the weighted caste instrument is always positively correlated with the number of participant friends. In the regressions instrumenting for the interaction proxies that aim to capture mechanisms, the instruments (predicted own/friends' participation times the mechanism proxy) are also significantly and positively correlated with the instrumented interaction term.

4.8.1 Sensitivity Analyses

Alternative Instrumental Variables for Participation

Initial interviews revealed that program participants often have older sons, and a longer time to collect firewood. As a result, I tried the age of sons[7] and time to collect fuel as alternative instruments. Parents in-law and the husband can perceive leaving a young son at home as neglecting one's duties, so women with young children are often unable to leave the house for extended periods of time, such as to attend program meetings. On the other

[7]For women with no sons, I set the age of sons to zero. I separately controlled for number of sons in all regressions.

hand, women who spend more time in the forest collecting firewood may feel more isolated and may be more interested in the community-building activities of the program. The 3SLS results using age of sons and time to collect firewood as instruments were qualitatively very similar to the ones presented above. However, I choose to highlight the results using the alternative instrument described above because it relies on program rules, and satisfies the exclusion restriction more clearly.

Interaction Terms with Brahmin Dummy

I tried several specifications that included interaction terms of the Brahmin caste dummy with other right hand side variables. In the specifications using age of sons and time to collect firewood as instruments for participation, these interaction terms improved the Akaike Information Criterion (AIC), although the terms were never significantly different from zero. In the specification using the exposure to the program instrument, the interaction terms increased the AIC and remained insignificant. As a result, the specification I report below does not include the interaction terms.

Tobit Approach

Since the dairy consumption variable has 240 zeros, I tried an IV Tobit specification. In addition to the own participation instruments, I used predicted friends' participation and predicted interaction terms as instrument for the remaining endogenous variables. The results were qualitatively similar to the 3SLS results presented above. I focus on the 3SLS results because the 3SLS does not require estimating all instrumented variables on the same set of regressors.

4.9 Conclusion

This paper is the first to study how peer networks affect female bargaining power and child welfare. I do so using primary data that map self-reported networks; the data were

collected in rural north India. I use a community-level women's empowerment program, *Mahila Samakhya*, to identify shocks to female bargaining power and networks. Using a 3SLS approach and network-weighted instrumental variables, I find that participation in the community-level intervention empowers women, and that more empowered women have better-fed children. I further decompose the peer effect into its component mechanisms of social learning, social influence, identity utility, and social norms. I find that social learning and social influence increase participation in a national rural employment guarantee scheme, and the ability to travel without permission. I also find that social learning, identity utility, and social norms significantly improve children's consumption of rice and dairy.

These results highlight the importance of peer networks, and suggest that female empowerment and child nutrition interventions may benefit from accounting for social learning and influence. Programs that harness the power of networks may be effective at removing cultural barriers, such as constricting social norms, to development goals. Further, programs that take into account the peer effect may benefit from differentiating between the different mechanisms through which peer networks work. For example, programs that rely on social learning, i.e. ones that target lower educated women through their weak ties could just target a small number of well-placed women in a village. Such programs might include interventions aimed at increasing female labor force participation or improving children's food consumption or health outcomes. On the other hand, programs that rely on social influence or identity utility, such as interventions aimed at improving female mobility or physical independence may target clusters of villages to build up critical mass.

This analysis is, of course, not without caveats. The paper would benefit from panel data tracking women and their peer networks. Ideally, I would be able to randomize an intervention such as a literacy camp or support group participation at the friend level, and follow their effect on individuals across time. Further, the limited snowball sampling

strategy employed in data collection means that the results are not representative of the average Indian woman, or even the average Uttarakhandi. Generalizations of these results must therefore involve caution.

4.10 Figures and Tables

Figure 4.1: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

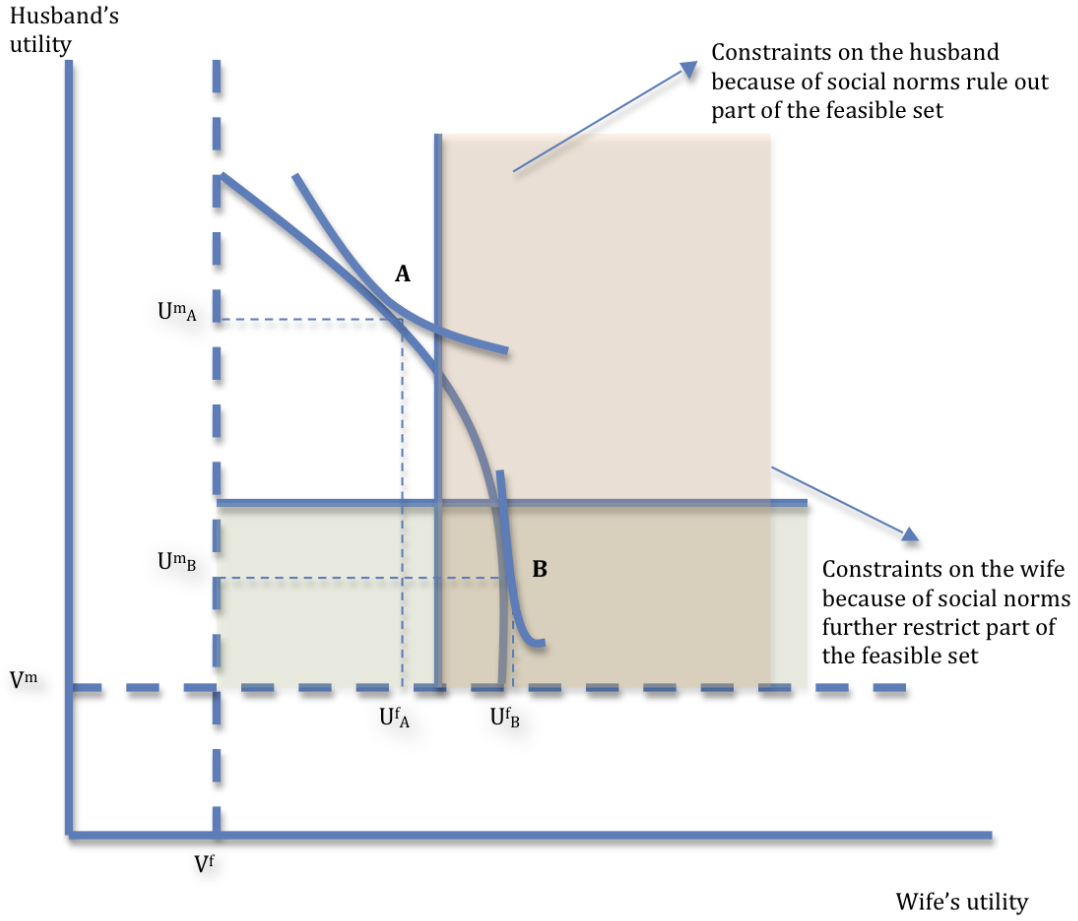


Figure 4.2: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

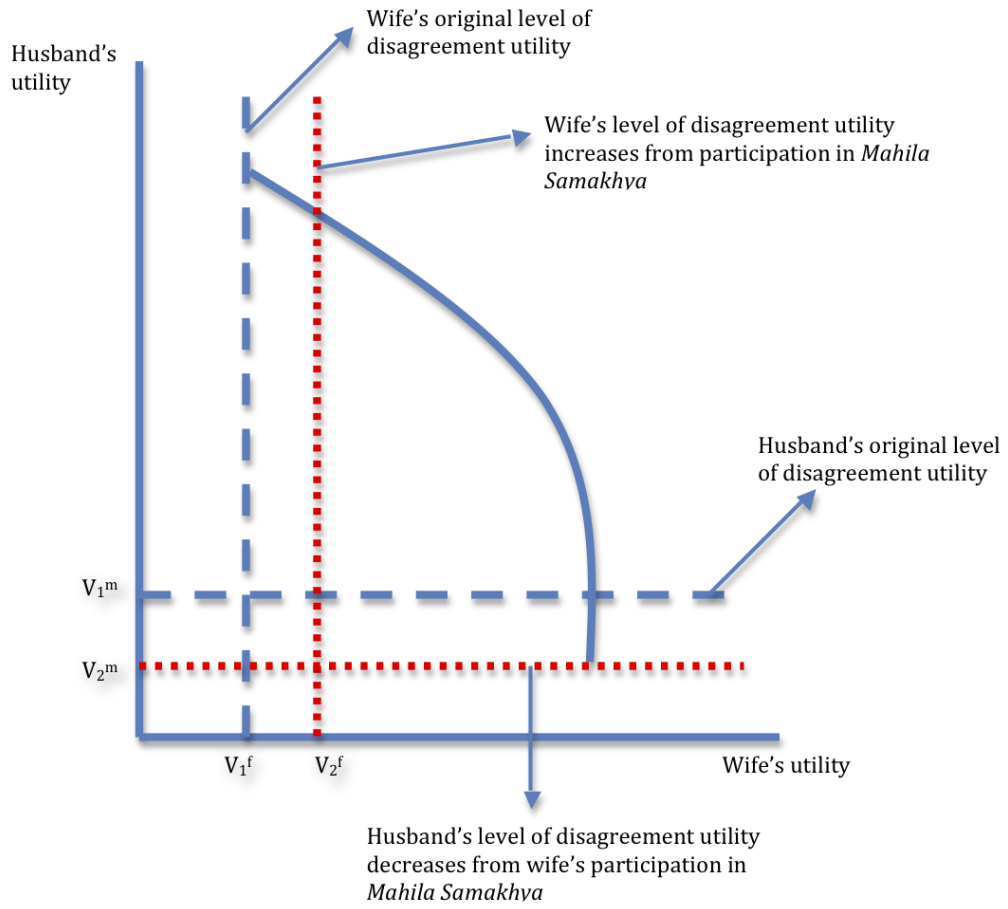


Figure 4.3: Inefficiencies Can Constrain and Lower the Household Production Possibilities Frontier

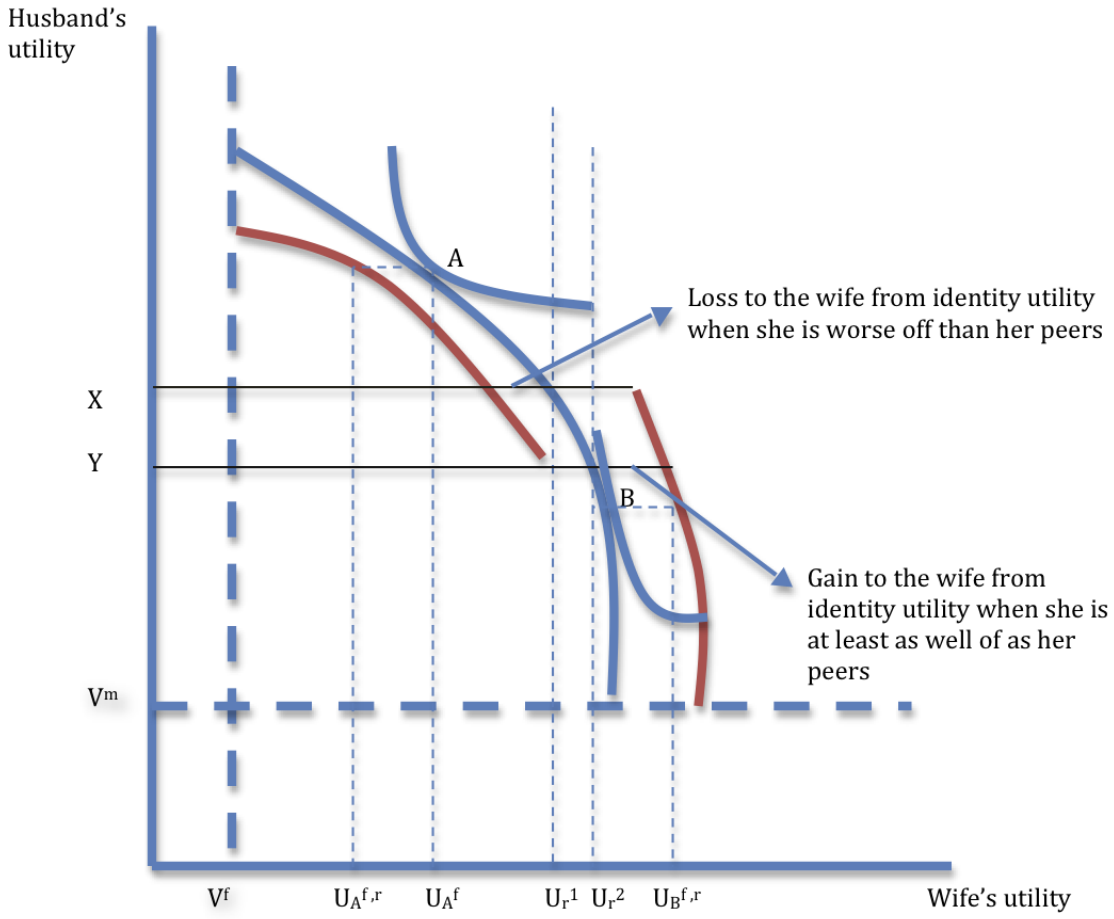


Table 4.1: Summary Statistics Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Variables	Observations	Mean	Std. Dev	Min	Max
Respondent's Age	472	32.18	8.11	20	65
Husband's Age	437	37.89	9.25	23	80
Respondent's Age at Marriage	463	19.25	3.34	1	30
Average age of sons	487	8.05	7.79	0	36
Average age of daughters	487	6.18	6.70	0	30
Respondent's Years of Education	397	8.82	4.06	0	17
Husband's Years of Education	414	10.13	3.68	1	17
Sons' Years of Education	443	7.04	4.34	1	17
Daughters' Years of Education	355	6.73	4.23	1	17
Number of Rooms	487	3.33	2.12	0	19
Electrification	487	0.89	0.31	0	1

Table 4.2: Female Bargaining Power: Dependent Variables from a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Dependent Variables	Percent Answering Yes
Respondent Has NREGS ID Card	
All	60.62
Non-participants	48.94
Participants	68.02
Respondent Can Go Out Without Permission	
All	70.89
Non-participants	58.82
Participants	78.17

Table 4.3: Child Food Intake in Past Day: Dependent Variables Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

Dependent Variables	Mean	Std. Dev.	Min	Max
Rice				
All	1.00	1.42	0	7
Non-participants	0.83	1.34	0	6
Participants	1.11	1.46	0	7
Lentil				
All	0.78	1.29	0	5.5
Non-participants	0.59	1.11	0	4
Participants	0.89	1.38	0	5.5
Dairy				
All	1.03	1.72	0	16
Non-participants	0.79	1.41	0	10
Participants	1.17	1.88	0	16

Table 4.4: Summary of Mechanism Identification Strategy

Mechanism	Proxy	Interactions
Social Learning	Less than four years of education	Own Part.; Friends' Part.
Social Influence	Spousal Age Ratio	Own Participation
Identity Utility	Friends' Opinion (Women)	Own Part.; Friends' Part.
Norms	Villagers' Opinion (Men)	Own Part.; Friends' Part.

Table 4.5: Expected Signs on on Key Independent Variables

Independent Variable	Learning	Influence	Identity Utility	Norms	Expected Sign
Low Education	Yes	No	No	No	Negative
Low Educ.* Own Part.	Yes	No	No	No	Positive
Low Educ.* Friends' Part.	Yes	No	No	No	Positive
Spousal Age Ratio	No	Yes	No	No	Negative
Age Ratio* Own Part.	No	Yes	No	No	Positive
Friends' Opinion (Women)	No	No	Yes	No	Positive
Friends' Opinion*Own Part.	No	No	Yes	No	Positive
Friends' Opinion*Friends' Part.	No	No	Yes	No	Positive
Villagers' Opinion (Men)	No	No	No	Yes	Negative
Villagers' Opinion*Own Part.	No	No	No	Yes	Negative
Villagers' Opinion*Friends' Part.	No	No	No	Yes	Positive

Table 4.6: Female Bargaining Power: Program-related OLS Results Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Participation	0.197***	0.718**	0.107*	-0.137
	(3.16)	(2.12)	(1.76)	(-0.40)
Friends' Participation	-0.015	-0.005	0.0004	0.006
	(-1.29)	(-0.40)	(0.03)	(0.43)
Own*Friends' Part.	0.015	0.018	0.006	0.0166
	(1.02)	(1.21)	(0.40)	(1.03)
Low Education	0.045	0.090	0.065	0.153
	(0.81)	(0.91)	(1.19)	(1.52)
Spousal Age Ratio	0.071	0.364	-0.489*	-0.661*
	(0.26)	(1.03)	(-1.72)	(-1.77)
Friends' Opinion (Women)	0.076	-0.048	0.258***	0.201*
	(0.98)	(-0.44)	(3.39)	(1.86)
Villagers' Opinion (Men)	-0.230***	-0.162	-0.235***	-0.149
	(-3.03)	(-1.59)	(-3.13)	(-1.48)
Own Part.*Low Ed.		0.044		-0.093
		(0.35)		(-0.70)
Friends' Part*Low Ed.		-0.022		-0.014
		(-1.15)		(-0.66)
Own Part.*Age Ratio		-0.693*		0.244
		(-1.76)		(0.62)

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Table 4.6 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Part*Friends' Opinion (Women)		0.078		-0.035
		(0.52)		(-0.21)
Friends' Part*Friends' Opinion (Women)		0.029		0.037
		(1.19)		(1.23)
Own Part*Villagers' Opinion (Men)		0.084		0.099
		(0.59)		(0.65)
Friends' Part*Villagers' Opinion (Men)		-0.044*		-0.059*
		(-1.70)		(-1.96)

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.7: Female Bargaining Power: Program-related 3SLS Results Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Participation	0.583	-1.397	0.641*	5.558***
	(1.43)	(-0.71)	(1.90)	(3.33)
Friends' Participation	-0.064	-0.005	0.025	0.072***
	(-1.49)	(-0.17)	(0.51)	(2.65)
Own*Friends' Participation	0.085	-0.095	-0.046	-0.181***
	(1.00)	(-1.42)	(-0.55)	(-2.85)
Low Education	0.007	-0.348*	0.029	-0.338
	(0.12)	(-1.86)	(0.47)	(-1.50)
Spousal Age Ratio	-0.179	-1.993*	-0.615*	2.062**
	(-0.61)	(-1.76)	(-1.88)	(2.07)
Friends' Opinion (Women)	0.042	-0.715***	0.189**	0.252
	(0.43)	(-3.57)	(2.10)	(1.19)
Villagers' Opinion (Men)	-0.212***	-0.114	-0.193**	-0.0779
	(-2.43)	(-0.80)	(-2.31)	(-0.45)
Own Part.* Low Educ.		0.417		0.462
		(0.95)		(0.87)
Friends' Part.* Low Educ.		0.009		-0.008
		(0.19)		(-0.13)
Own Part.* Age Ratio		2.836		-4.959***
		(1.30)		(-2.70)

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Table 4.7 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Part.*Friends' Op.		1.217**		-0.507
		(2.44)		(-0.67)
Friends' Part.*Friends' Op.		0.009		0.103
		(0.16)		(1.03)
Own Part.* Villagers' Op.		-0.378		-0.083
		(-0.75)		(-0.10)
Friends' Part.* Villagers' Op.		0.014		-0.0376
		(0.20)		(-0.35)

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.8: Female Bargaining Power: Marginal Effects Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS	Permission
Base Effects		
Effect of Own Participation on Average Respondent	-1.717	4.946***
	(1.91)	(1.61)
Effect of Friends' Participation on Average Respondent	-0.063**	-0.040*
	(0.023)	(0.02)
Effect of Friends' Participation on Participants	-0.099**	-0.110**
	(0.05)	(0.05)
Effect of Friends' Participation on Non-participants	-0.005	0.072**
	(0.03)	(0.03)
Social Learning		
Effect of Own Participation on Women with Low Education	-1.283	5.684***
	(1.99)	(1.71)
Effect of Friends' Participation on Women with Low Education	-0.002	0.069**
	(0.03)	(0.03)
Effect of Friends' Participation on Participants with Low Education	-0.002	0.069**

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Table 4.8 – Continued

	NREGS	Permission
	(0.03)	(0.03)
Effect of Friends' Participation on Non-participants with Low Education	-0.003	0.069**
	(0.03)	(0.03)
Social Influence		
Effect of Own Participation on Average Respondent (Age Ratio)	1.024**	1.326**
	(0.46)	(0.43)
Identity Utility		
Effect of Own Participation on Friends' Opinion (Average Respondent)	-0.986	5.387***
	(1.97)	(1.66)
Effect of Friends' Participation on Friends' Opinion (Average Respondent)	-0.002	0.106**
	(0.03)	(0.04)
Effect of Friends' Participation on Friends' Opinion (Participants)	-0.002	0.107**
	(0.03)	(0.04)
Effect of Friends' Participation on Friends' Opinion (Non-participant)	-0.002	0.105**
	(0.03)	(0.04)

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Table 4.8 – Continued

	NREGS	Permission
Norms		
Effect of Own Participation on Villagers' Opinion (Avg. Resp.'s husband)	-1.543	5.526***
	(1.96)	(1.69)
Effect of Friends' Participation on Villagers' Opinion (Avg. Resp.'s husband)	0.0004	0.057
	(0.05)	(0.05)
Effect of Friends' Participation on Villagers' Opinion (Avg. Part.'s husband)	0.0003	0.057
	(0.05)	(0.05)
Effect of Friends' Participation on Villagers' Opinion (Avg. Non-part.'s husband)	0.001	0.056
	(0.05)	(0.05)

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.9: Child Food Intake: Program-related OLS Results Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)		LN(Lentil)		LN(Dairy)	
	Base	Mech.	Base	Mech.	Base	Mech.
Own Part.	0.125*	0.478	0.0838	0.611	0.157**	0.616
	(1.91)	(1.11)	(1.31)	(1.43)	(2.45)	(1.42)
Friends' Part.	0.005	0.007	0.009	0.019	-0.000	-0.001
	(0.58)	(0.38)	(1.13)	(1.14)	(-0.03)	(-0.04)
Low Educ.	0.027	-0.089	0.065	0.023	-0.057	-0.089
	(0.38)	(-0.70)	(0.92)	(0.18)	(-0.82)	(-0.69)
Age Ratio	0.927***	1.006**	0.656*	0.862*	0.665*	0.779*
	(2.63)	(2.24)	(1.86)	(1.93)	(1.88)	(1.72)
Friends' Op. (Women)	0.111	-0.173	0.085	-0.125	0.207**	0.031
	(1.17)	(-1.28)	(0.89)	(-0.94)	(2.17)	(0.23)
Villagers' Op. (Men)	0.147	0.268**	0.105	0.145	0.126	0.339***
	(1.55)	(2.13)	(1.11)	(1.15)	(1.33)	(2.64)
Own Part.*		0.048		-0.114		-0.062
Low Educ.		(0.29)		(-0.70)		(-0.37)
Friends' Part.*		0.0154		0.0212		0.0150
Low Educ.		(0.61)		(0.85)		(0.60)
Own Part.		-0.547		-0.594		-0.569
Age Ratio		(-1.09)		(-1.19)		(-1.13)
Own Part.*		0.183		-0.025		0.131
Friends' Op. (Women)		(0.97)		(-0.13)		(0.69)

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Table 4.9 – Continued

	LN(Rice)		LN(Lentil)		LN(Dairy)	
	Base	Mech.	Base	Mech.	Base	Mech.
Friends' Part. *		0.068**		0.065**		0.0491
Friends' Op. (Women)		(2.12)		(2.06)		(1.52)
Own Part.*		0.094		0.231		-0.110
Villagers' Op. (Men)		(0.54)		(1.32)		(-0.62)
Friends' Part.*		-0.074**		-0.057*		-0.064*
Villagers' Opinion (Men)		(-2.17)		(-1.68)		(-1.88)
Own*Friends' Part.		0.0002		-0.026		0.008
		(0.01)		(-1.38)		(0.45)

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.10: Child Food Intake: Program-related 3SLS Base Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation	0.129	-0.036	-0.135
	(0.60)	(-0.20)	(-0.72)
Friends' Participation	0.006	0.009	-0.009
	(0.38)	(0.67)	(-0.59)
Low Education	0.011	0.056	-0.052
	(0.15)	(0.75)	(-0.69)
Spousal Age Ratio	0.845**	0.582	0.655*
	(2.35)	(1.64)	(1.81)
Friends' Opinion (Women)	0.109	0.088	0.226**
	(1.14)	(0.92)	(2.33)
Villagers' Opinion (Men)	0.140	0.086	0.102
	(1.47)	(0.89)	(1.05)

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Friends' Opinoin (Women): importance of friends' opinion to woman. Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.11: Child Food Intake: Program-related 3SLS Mechanisms Results Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation	5.750*	1.121	11.74***
	(1.70)	(0.32)	(2.91)
Friends' Participation	0.014	-0.016	0.031
	(0.30)	(-0.34)	(0.57)
Low Education	-0.514**	-0.208	-0.670**
	(-2.16)	(-0.86)	(-2.45)
Own Part.* Low Educ.	0.796	-0.132	1.057
	(1.33)	(-0.22)	(1.53)
Friends' Part.* Low Educ.	-0.027	0.080	-0.065
	(-0.39)	(1.11)	(-0.79)
Spousal Age Ratio	3.473*	0.683	6.474***
	(1.88)	(0.36)	(2.87)
Own Age	0.022***	0.017***	0.009*
	(4.96)	(3.93)	(1.73)
Own Part. * Age Ratio	-5.915*	-0.406	-12.04***
	(-1.68)	(-0.11)	(-2.80)
Friends' Opinion (Women)	-0.200	-0.154	0.311
	(-0.83)	(-0.65)	(1.10)
Own Part. *Friends' Opinion (Women)	-0.0632	0.170	-0.335
	(-0.09)	(0.26)	(-0.44)
Friends' Part. *Friends' Opinion (Women)	0.137*	0.042	0.098

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Table 4.11 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(1.74)	(0.53)	(1.09)
Villagers' Opinion (Men)	0.335*	0.244	0.602***
	(1.84)	(1.40)	(2.95)
Own Part. *Villagers' Opinion (Men)	0.231	-0.513	-0.840
	(0.36)	(-0.81)	(-1.14)
Friends' Part. *Villagers' Opinion (Men)	-0.118	0.035	-0.034
	(-1.26)	(0.38)	(-0.32)
Own*Friends' Part.	-0.061	-0.062	-0.127
	(-0.64)	(-0.66)	(-1.14)
Observations	383	383	383

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.12: Child Food Intake: Marginal Effects

	LN(Rice)	LN(Lentil)	LN(Dairy)
Base Effects			
Effect of Own Participation on Average Respondent	5.543*	0.912	11.32***
	(3.18)	(3.28)	(3.82)
Effect of Friends' Participation on Average Respondent	-0.24	-0.054**	-0.048
	(0.03)	(0.03)	(0.03)
Effect of Friends' Participation on Participants	-0.047	-0.078	-0.097
	(0.06	(0.06)	(0.07)
Effect Friends' Participation on Non-participants	0.014	-0.016	0.031
	(0.05)	(0.05)	(0.05)
Social Learning			
Effect of Own Participation on Women with Low Education	5.971*	1.085	12.03***
	(3.41)	(3.52)	(4.09)
Effect of Friends' Participation on Women with Low Education	0.007	0.006	0.013
	(0.05)	(0.05)	(0.06)
Friends' Participation on Participants with Low Educ.	0.006	0.009	0.011

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Table 4.12 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(0.05)	(0.05)	(0.06)
Friends' Participation on Non-participants with Low Educ.	0.008	0.003	0.016
	(0.05)	(0.05)	(0.06)
Social Influence			
Effect of Own Participation on Average Respondents (Age Ratio)	0.703	0.775	1.474***
	(0.63)	(0.59)	(0.73)
Identity Utility			
Effect of Own Participation on Friends' Opinion (Avg. Resp.)	5.729*	-0.001	11.63***
	(3.39)	(0.05)	(4.05)
Effect of Friends' Participation on Friends' Opinion (Avg. Resp.))	0.060	1.179	0.064
	(0.09)	(3.46)	(0.05)
Effect of Friends' Participation on Friends' Opinion (Participants)	0.062	-0.001	0.065
	(0.05)	(0.05)	(0.06)
Effect of Friends' Participation on Friends' Opinion (Non-participants)	0.058	-0.002	0.062
	(0.05)	(0.05)	(0.05)

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Table 4.12 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
Norms			
Effect of Own Participation on Villagers' Opinion (Avg. Resp.'s husband)	5.839*	0.922	11.42***
	(3.33)	(3.44)	(3.99)
Effect of Friends' Participation on Villagers' Opinion (Avg. Resp.'s husband)	-0.032	-0.002	0.017
	(0.07)	(0.07)	(0.08)
Effect of Friends' Participation on Villagers' Opinion (Participants' husbands)	-0.031	-0.002	0.017
	(0.07)	(0.06)	(0.08)
Effect of Friends' Participation on Villagers' Op. (Non-part.'s husbands)	-0.032	-0.002	0.017
	(0.07)	(0.07)	(0.08)

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

4.11 Ancillary Tables

Table 4.13: Female Bargaining Power: OLS Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Participation	0.197***	0.718**	0.107*	-0.137
	(3.16)	(2.12)	(1.76)	(-0.40)
Friends' Participation	-0.015	-0.005	0.0004	0.006
	(-1.29)	(-0.40)	(0.03)	(0.43)
Own*Friends' Part.	0.015	0.018	0.006	0.0166
	(1.02)	(1.21)	(0.40)	(1.03)
Low Education	0.045	0.090	0.065	0.153
	(0.81)	(0.91)	(1.19)	(1.52)
Spousal Age Ratio	0.071	0.364	-0.489*	-0.661*
	(0.26)	(1.03)	(-1.72)	(-1.77)
Own Age	-0.001	0.001	-0.002	-0.002
	(-0.16)	(0.17)	(-0.58)	(-0.68)
Friends' Opinion (Women)	0.076	-0.048	0.258***	0.201*
	(0.98)	(-0.44)	(3.39)	(1.86)
Villagers' Opinion (Men)	-0.230***	-0.162	-0.235***	-0.149
	(-3.03)	(-1.59)	(-3.13)	(-1.48)
Number of Children	-0.002	-0.008	0.038	0.029
	(-0.05)	(-0.17)	(0.88)	(0.65)
Age of Children	0.007	0.006	0.0015	0.003

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Table 4.13 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
	(1.43)	(1.17)	(0.31)	(0.60)
Brahmin	-0.217***	-0.229***	0.041	0.068
	(-3.65)	(-3.63)	(0.69)	(1.06)
Lives with In-laws	0.033	0.015	-0.058	-0.067
	(0.65)	(0.29)	(-1.13)	(-1.25)
Number of Rooms	0.004	0.008	-0.018	-0.019*
	(0.34)	(0.68)	(-1.64)	(-1.65)
Electricity	0.033	0.006	0.205***	0.177**
	(0.47)	(0.09)	(3.04)	(2.55)
Own Part.*Low Ed.		0.044		-0.093
		(0.35)		(-0.70)
Friends' Part*Low Ed.		-0.022		-0.014
		(-1.15)		(-0.66)
Own Part.*Age Ratio		-0.693*		0.244
		(-1.76)		(0.62)
Own Part*Friends' Opinion (Women)		0.078		-0.035
		(0.52)		(-0.21)
Friends' Part*Friends' Opinion (Women)		0.029		0.037
		(1.19)		(1.23)
Own Part*Villagers' Opinion (Men)		0.084		0.099
		(0.59)		(0.65)

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Table 4.13 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Friends' Part*Villagers' Opinion (Men)		-0.044*		-0.059*
		(-1.70)		(-1.96)
Constant	0.365	0.128	0.996***	1.162***
	(1.43)	(0.40)	(3.83)	(3.45)
Observations	419	403	390	375

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.14: Female Bargaining Power: 3SLS Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Participation	0.583	-1.397	0.641*	5.558***
	(1.43)	(-0.71)	(1.90)	(3.33)
Friends' Participation	-0.064	-0.005	0.025	0.072***
	(-1.49)	(-0.17)	(0.51)	(2.65)
Own*Friends' Participation	0.085	-0.095	-0.046	-0.181***
	(1.00)	(-1.42)	(-0.55)	(-2.85)
Low Education	0.007	-0.348*	0.029	-0.338
	(0.12)	(-1.86)	(0.47)	(-1.50)
Spousal Age Ratio	-0.179	-1.993*	-0.615*	2.062**
	(-0.61)	(-1.76)	(-1.88)	(2.07)
Own Age	-0.001	0.003	-0.003	0.001
	(-0.24)	(0.82)	(-0.89)	(0.23)
Friends' Opinion (Women)	0.042	-0.715***	0.189**	0.252
	(0.43)	(-3.57)	(2.10)	(1.19)
Villagers' Opinion (Men)	-0.212***	-0.114	-0.193**	-0.0779
	(-2.43)	(-0.80)	(-2.31)	(-0.45)
Number of Children	-0.017	-0.021	0.033	0.047
	(-0.37)	(-0.40)	(0.69)	(0.87)
Age of Children	0.007	0.003	0.001	-0.001
	(1.41)	(0.46)	(0.13)	(-0.21)

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Table 4.14 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Brahmin	-0.312***	-0.363***	-0.053	-0.073
	(-4.39)	(-4.04)	(-0.73)	(-0.78)
Lives with In-laws	0.083	0.074	-0.019	-0.079
	(1.54)	(1.08)	(-0.34)	(-1.14)
Number of Rooms	0.002	0.009	-0.016	-0.029**
	(0.14)	(0.61)	(-1.34)	(-2.09)
Electricity	0.076	-0.014	0.220***	0.212***
	(0.97)	(-0.17)	(2.86)	(2.81)
Own Part.* Low Educ.		0.417		0.462
		(0.95)		(0.87)
Friends' Part.* Low Educ.		0.009		-0.008
		(0.19)		(-0.13)
Own Part.* Age Ratio		2.836		-4.959***
		(1.30)		(-2.70)
Own Part.*Friends' Op.		1.217**		-0.507
		(2.44)		(-0.67)
Friends' Part.*Friends' Op.		0.009		0.103
		(0.16)		(1.03)
Own Part.* Villagers' Op.		-0.378		-0.083
		(-0.75)		(-0.10)

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Table 4.14 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Friends' Part.* Villagers' Op.		0.014		-0.0376
		(0.20)		(-0.35)
Constant	0.314	1.915*	0.897***	-1.544*
	(1.10)	(1.92)	(2.84)	(-1.71)
Own*Friends' Part.				
Pred. Own*Friends' Part.	0.347***	0.396***	0.552***	0.581***
	(4.99)	(6.92)	(7.30)	(8.94)
Constant	2.126***	2.047***	1.804***	1.768***
	(9.90)	(10.15)	(8.16)	(8.44)
Observations	419	403	390	375

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.15: Child Food Intake: OLS Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)		LN(Lentil)		LN(Dairy)	
	Base	Mech.	Base	Mech.	Base	Mech.
Own Part.	0.125*	0.478	0.0838	0.611	0.157**	0.616
	(1.91)	(1.11)	(1.31)	(1.43)	(2.45)	(1.42)
Friends' Part.	0.005	0.007	0.009	0.019	-0.000	-0.001
	(0.58)	(0.38)	(1.13)	(1.14)	(-0.03)	(-0.04)
Low Educ.	0.027	-0.089	0.065	0.023	-0.057	-0.089
	(0.38)	(-0.70)	(0.92)	(0.18)	(-0.82)	(-0.69)
Age Ratio	0.927***	1.006**	0.656*	0.862*	0.665*	0.779*
	(2.63)	(2.24)	(1.86)	(1.93)	(1.88)	(1.72)
Own Age	0.019***	0.021***	0.016***	0.018***	0.008*	0.008*
	(4.58)	(4.81)	(3.90)	(4.14)	(1.79)	(1.78)
Friends' Op. (Women)	0.111	-0.173	0.085	-0.125	0.207**	0.031
	(1.17)	(-1.28)	(0.89)	(-0.94)	(2.17)	(0.23)
Villagers' Op. (Men)	0.147	0.268**	0.105	0.145	0.126	0.339***
	(1.55)	(2.13)	(1.11)	(1.15)	(1.33)	(2.64)
No. of Children	-0.029	-0.028	0.033	0.034	0.035	0.028
	(-0.50)	(-0.47)	(0.58)	(0.58)	(0.61)	(0.46)
Age of Children	-0.003	-0.004	-0.005	-0.004	-0.013*	-0.012
	(-0.40)	(-0.45)	(-0.71)	(-0.52)	(-1.75)	(-1.58)
Brahmin	-0.225***	-0.202***	-0.143*	-0.126	-0.018	0.034
	(-3.02)	(-2.60)	(-1.93)	(-1.63)	(-0.25)	(0.43)

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Table 4.15 – Continued

	LN(Rice)		LN(Lentil)		LN(Dairy)	
	Base	Mech.	Base	Mech.	Base	Mech.
In-laws	0.048	0.034	0.085	0.084	0.018	0.007
	(0.76)	(0.52)	(1.34)	(1.30)	(0.28)	(0.10)
No. of Rooms	0.027*	0.027*	0.015	0.007	0.022	0.020
	(1.96)	(1.86)	(1.06)	(0.44)	(1.60)	(1.35)
Electrification	-0.144	-0.186**	-0.138	-0.167*	-0.064	-0.096
	(-1.61)	(-2.06)	(-1.55)	(-1.86)	(-0.71)	(-1.05)
Own Part.*		0.048		-0.114		-0.062
Low Educ.		(0.29)		(-0.70)		(-0.37)
Friends' Part.*		0.0154		0.0212		0.0150
Low Educ.		(0.61)		(0.85)		(0.60)
Own Part.		-0.547		-0.594		-0.569
Age Ratio		(-1.09)		(-1.19)		(-1.13)
Own Part.*		0.183		-0.025		0.131
Friends' Op. (Women)		(0.97)		(-0.13)		(0.69)
Friends' Part. *		0.068**		0.065**		0.0491
Friends' Op. (Women)		(2.12)		(2.06)		(1.52)
Own Part.*		0.094		0.231		-0.110
Villagers' Op. (Men)		(0.54)		(1.32)		(-0.62)
Friends' Part.*		-0.074**		-0.057*		-0.064*
Villagers' Opinion (Men)		(-2.17)		(-1.68)		(-1.88)
Own*Friends' Part.		0.0002		-0.026		0.008

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Table 4.15 – Continued

	LN(Rice)		LN(Lentil)		LN(Dairy)	
	Base	Mech.	Base	Mech.	Base	Mech.
		(0.01)		(-1.38)		(0.45)
Wife's Rice Cons.	0.001	-0.002				
	(0.04)	(-0.10)				
Husb.'s Rice Cons.	-0.004	-0.003				
	(-0.32)	(-0.20)				
Wife's Lentil Cons.			0.031**	0.039***		
			(2.04)	(2.52)		
Husb.'s Lentil Cons.			-0.016	-0.019		
			(-0.92)	(-1.08)		
Wife's Dairy Cons.					0.038*	0.032
					(1.77)	(1.43)
Husb.'s Dairy Cons.					-0.008	0.002
					(-0.34)	(0.07)
Constant	-1.048***	-1.027**	-0.935***	-1.067***	-0.580*	-0.655
	(-3.20)	(-2.50)	(-2.85)	(-2.59)	(-1.78)	(-1.57)
Observations	398	383	398	383	398	383

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.16: Child Food Intake: 3SLS Base Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation	0.129	-0.036	-0.135
	(0.60)	(-0.20)	(-0.72)
Friends' Participation	0.006	0.009	-0.009
	(0.38)	(0.67)	(-0.59)
Low Education	0.011	0.056	-0.052
	(0.15)	(0.75)	(-0.69)
Spousal Age Ratio	0.845**	0.582	0.655*
	(2.35)	(1.64)	(1.81)
Own Age	0.020***	0.017***	0.009**
	(4.73)	(4.07)	(2.04)
Friends' Opinion (Women)	0.109	0.088	0.226**
	(1.14)	(0.92)	(2.33)
Villagers' Opinion (Men)	0.140	0.086	0.102
	(1.47)	(0.89)	(1.05)
Number of Children	-0.027	0.033	0.038
	(-0.45)	(0.56)	(0.62)
Age of Children	-0.003	-0.004	-0.013*
	(-0.34)	(-0.50)	(-1.75)
Brahmin	-0.213**	-0.086	0.069
	(-2.07)	(-0.93)	(0.73)
Lives with In-laws	0.051	0.069	-0.018

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Table 4.16 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(0.71)	(1.02)	(-0.26)
Number of Rooms	0.029**	0.010	0.022
	(1.98)	(0.70)	(1.51)
Electrified	-0.166*	-0.170*	-0.113
	(-1.76)	(-1.87)	(-1.22)
Wife's Rice Consumption	-0.004		
	(-0.16)		
Husband's Rice Consumption	-0.002		
	(-0.09)		
Wife's Lentil Consumption		0.037**	
		(2.40)	
Husband's Lentil Consumption		-0.016	
		(-0.90)	
Wife's Dairy Consumption			0.036*
			(1.66)
Husband's Dairy Consumption			-0.001
			(-0.04)
Constant	-0.986***	-0.794**	-0.357
	(-2.93)	(-2.31)	(-1.04)
Observations	383	383	383

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Friends' Opinoin (Women): importance of friends' opinion to woman. Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.17: Child Food Intake: 3SLS Mechanisms Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation	5.750*	1.121	11.74***
	(1.70)	(0.32)	(2.91)
Friends' Participation	0.014	-0.016	0.031
	(0.30)	(-0.34)	(0.57)
Low Education	-0.514**	-0.208	-0.670**
	(-2.16)	(-0.86)	(-2.45)
Own Part.* Low Educ.	0.796	-0.132	1.057
	(1.33)	(-0.22)	(1.53)
Friends' Part.* Low Educ.	-0.027	0.080	-0.065
	(-0.39)	(1.11)	(-0.79)
Spousal Age Ratio	3.473*	0.683	6.474***
	(1.88)	(0.36)	(2.87)
Own Age	0.022***	0.017***	0.009*
	(4.96)	(3.93)	(1.73)
Own Part. * Age Ratio	-5.915*	-0.406	-12.04***
	(-1.68)	(-0.11)	(-2.80)
Friends' Opinion (Women)	-0.200	-0.154	0.311
	(-0.83)	(-0.65)	(1.10)
Own Part. *Friends' Opinion (Women)	-0.0632	0.170	-0.335
	(-0.09)	(0.26)	(-0.44)
Friends' Part. *Friends' Opinion (Women)	0.137*	0.042	0.098

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Table 4.17 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(1.74)	(0.53)	(1.09)
Villagers' Opinion (Men)	0.335*	0.244	0.602***
	(1.84)	(1.40)	(2.95)
Own Part. *Villagers' Opinion (Men)	0.231	-0.513	-0.840
	(0.36)	(-0.81)	(-1.14)
Friends' Part. *Villagers' Opinion (Men)	-0.118	0.035	-0.034
	(-1.26)	(0.38)	(-0.32)
Own*Friends' Part.	-0.061	-0.062	-0.127
	(-0.64)	(-0.66)	(-1.14)
Number of Children	0.005	0.032	0.084
	(0.07)	(0.44)	(0.99)
Age of Children	-0.009	-0.007	-0.022*
	(-0.96)	(-0.79)	(-1.96)
Brahmin	-0.322***	-0.187*	-0.115
	(-2.83)	(-1.78)	(-0.87)
Lives with In-laws	0.034	0.095	-0.036
	(0.41)	(1.15)	(-0.36)
Number of Rooms	0.006	0.006	-0.018
	(0.33)	(0.34)	(-0.80)
Electrification	-0.128	-0.151	0.030
	(-1.32)	(-1.63)	(0.26)

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Table 4.17 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
Wife's Rice Cons.	-0.023		
	(-0.96)		
Husband's Rice Cons.	0.011		
	(0.61)		
Wife's Lentil Cons.		0.044*	
		(1.93)	
Husband's Lentil Cons.		-0.020	
		(-1.08)	
Wife's Dairy Cons.			0.081**
			(2.42)
Husband's Dairy Cons.			-0.034
			(-0.91)
Constant	-3.353**	-1.062	-6.005***
	(-1.97)	(-0.59)	(-2.89)
Observations	383	383	383

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.18: Female Bargaining Power: First Stage Results of 3SLS Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Own Participation				
Participation IV	-0.019***	-0.013***	-0.015***	-0.015***
	(-6.14)	(-11.00)	(-4.43)	(-11.28)
Friends' Participation	0.001	0.034***	0.009	0.0358***
	(0.17)	(13.89)	(1.42)	(14.45)
Spousal Age Ratio	0.320	0.409***	0.397*	0.453***
	(1.47)	(4.72)	(1.73)	(4.97)
Own Age	0.007**	-0.00004	0.005*	-0.00004
	(2.40)	(-0.06)	(1.62)	(-0.05)
Friends' Opinion (Women)	0.116*	0.051***	0.131***	0.058***
	(1.91)	(3.46)	(2.09)	(3.49)
Villagers' Opinion (Men)	-0.036	-0.005	-0.038	-0.004
	(-0.59)	(-0.34)	(-0.62)	(-0.27)
Low Education	0.040	0.049***	0.054	0.052***
	(0.88)	(4.26)	(1.19)	(4.02)
Number of Sons	-0.014	-0.002	-0.019	0.001
	(-0.61)	(-0.25)	(-0.83)	(0.12)
Age of Sons	0.002	0.0001	0.002	0.0002
	(0.49)	(0.09)	(0.65)	(0.26)
Brahmin	0.186***	0.170***	0.192***	0.184***

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Table 4.18 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
	(3.90)	(10.65)	(3.92)	(10.80)
Lives with In-laws	-0.077*	-0.080***	-0.081*	-0.0827***
	(-1.88)	(-7.21)	(-1.92)	(-6.78)
Number of Rooms	-0.002	0.003	-0.004	0.002
	(-0.22)	(1.29)	(-0.46)	(0.82)
Electricity	-0.007	-0.008	-0.007	-0.009
	(-0.13)	(-0.58)	(-0.13)	(-0.63)
Constant	0.273	0.232***	0.216	0.205**
	(1.36)	(2.89)	(1.02)	(2.43)
Friends' Participation				
W_{water}*Part. IV	-0.047***	-0.061***	-0.060***	-0.067***
	(-4.89)	(-7.89)	(-5.31)	(-7.68)
W_{caste}*Part. IV	0.029***	0.027***	0.030***	0.027***
	(11.74)	(14.03)	(10.08)	(11.76)
Constant	2.543***	3.046***	2.699***	3.151***
	(10.76)	(13.96)	(10.47)	(13.39)
Own*Friends' Part.				
Pred. Own*Friends' Part.	0.347***	0.396***	0.552***	0.581***
	(4.99)	(6.92)	(7.30)	(8.94)
*Own Part.*Low Educ.*				
Pred. Own Part.* Low Educ.		0.944***		0.978***

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Table 4.18 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
		(31.47)		(31.78)
Constant		0.006		0.006
		(0.55)		(0.51)
*Own Part.*Age Ratio*				
Pred. Own Part.*Age Ratio		0.788***		0.841***
		(14.49)		(15.41)
Constant		0.110***		0.0932***
		(3.23)		(2.71)
*Own Part.*Friends' Op. (Women)*				
Pred. Own Part.*Friends' Op.		0.938***		0.996***
		(37.00)		(39.36)
Constant		0.013		0.011
		(0.93)		(0.81)
Own Part. Villagers' Op. (Men)*				
Pred. Own Part.* Villagers' Op.		0.880***		0.929***
		(32.04)		(33.41)
Constant		0.014		0.012
		(0.96)		(0.82)
Friends' Part Low Educ.*				
Pred. Friends' Part* Low Educ.		1.029***		1.039***
		(26.60)		(22.60)

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Table 4.18 – Continued

	NREGS		Leave W/o Permission	
	Base	Mechanism	Base	Mechanism
Constant		0.048		0.037
		(0.62)		(0.45)
*Friends' Part.*Friends' Op. (Women)*				
Pred. Friends' Part.*Friends' Op.		0.946***		0.941***
		(35.56)		(27.87)
Constant		0.131		0.140
		(1.24)		(1.24)
*Friends' Part*Villagers' Op. (Men)*				
Pred. Friends' Part*Villagers' Op.		0.939***		0.938***
		(33.93)		(28.70)
Constant		0.125		0.131
		(1.11)		(1.08)
Observations	419	403	390	375

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.19: Child Food Intake: First Stage of 3SLS Base Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation			
Participation IV	-0.019***	-0.018***	-0.018***
	(-4.62)	(-4.21)	(-4.22)
Friends' Participation	-0.014	-0.036***	-0.034***
	(-1.33)	(-2.92)	(-2.71)
Spousal Age Ratio	0.444*	0.415	0.419
	(1.66)	(1.54)	(1.55)
Own Age	0.008**	0.007**	0.007**
	(2.19)	(2.09)	(2.09)
Friends' Opinion (Women)	0.063	0.068	0.067
	(0.88)	(0.94)	(0.93)
Villagers' Opinion (Men)	-0.032	-0.040	-0.039
	(-0.45)	(-0.55)	(-0.54)
Low Education	0.029	0.032	0.032
	(0.52)	(0.56)	(0.56)
Age of Sons	-0.001	-0.001	-0.002
	(-0.23)	(-0.31)	(-0.35)
Number of Sons	-0.015	-0.012	-0.012
	(-0.50)	(-0.38)	(-0.40)
Brahmin	0.233***	0.246***	0.243***
	(3.88)	(3.95)	(3.91)

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Table 4.19 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
Lives with In-laws	-0.126***	-0.127**	-0.127**
	(-2.58)	(-2.56)	(-2.57)
Number of Rooms	0.009	0.011	0.011
	(0.84)	(0.97)	(0.96)
Electrification	-0.083	-0.088	-0.087
	(-1.24)	(-1.30)	(-1.28)
Constant	0.317	0.422*	0.410
	(1.26)	(1.66)	(1.61)
Friends' Participation			
W_{water}*Part. IV	-0.077***	-0.070***	-0.071***
	(-6.22)	(-5.92)	(-5.97)
W_{caste}*Part. IV	0.031***	0.029***	0.030***
	(11.03)	(10.49)	(10.57)
Constant	3.224***	3.210***	3.209***
	(10.92)	(11.00)	(10.98)
Observations	383	383	383

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

Table 4.20: Child Food Intake: First Stage of 3SLS Mechanisms Regressions Using a Women's Empowerment Study, Uttarakhand, India, 2009-2010

	LN(Rice)	LN(Lentil)	LN(Dairy)
Own Participation			
Participation IV	-0.014***	-0.014***	-0.014***
	(-10.94)	(-10.89)	(-10.99)
Friends' Part.	0.035***	0.035***	0.035***
	(13.75)	(13.68)	(13.67)
Spousal Age Ratio	0.468***	0.464***	0.466***
	(5.05)	(5.00)	(5.02)
Own Age	-0.000	-0.000	-0.000
	(-0.03)	(-0.01)	(-0.04)
Friends' Opinion (Women)	0.049***	0.049***	0.049***
	(3.05)	(3.04)	(3.05)
Villagers' Opinion (Men)	-0.006	-0.006	-0.006
	(-0.36)	(-0.36)	(-0.37)
Low Educ.	0.054***	0.054***	0.054***
	(4.27)	(4.25)	(4.26)
Age of Sons	-0.000	-0.000	-0.000
	(-0.02)	(-0.13)	(-0.02)
Number of Sons	-0.001	0.000	-0.001
	(-0.13)	(-0.06)	(-0.15)
Brahmin	0.178***	0.177***	0.178***
	(10.52)	(10.48)	(10.51)

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Table 4.20 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
Lives with In-laws	-0.085***	-0.085***	-0.085***
	(-7.16)	(-7.15)	(-7.16)
Number of Rooms	0.004*	0.004*	0.004*
	(1.79)	(1.80)	(1.79)
Electrification	-0.011	-0.011	-0.011
	(-0.77)	(-0.77)	(-0.77)
Constant	0.185**	0.190**	0.188**
	(2.16)	(2.21)	(2.20)
Friends' Participation			
W_{water}*Part. IV	-0.044***	-0.044***	-0.044***
	(-6.77)	(-6.77)	(-6.78)
W_{caste}*Part. IV	0.022***	0.022***	0.022***
	(15.18)	(15.18)	(15.19)
Constant	3.007***	3.007***	3.007***
	(14.21)	(14.22)	(14.21)
*Own*Friends' Part.*			
Pred. Own*Friends' Part.	0.226	0.225	0.225
	(0.87)	(0.87)	(0.87)
Constant	2.890***	2.890***	2.890***
	(15.14)	(15.14)	(15.14)
*Own Part. *Low Educ.*			
Pred. Own Part. *Low Educ.	0.967***	0.967***	0.967***

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Table 4.20 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(32.55)	(32.55)	(32.55)
Constant	0.007	0.007	0.007
	(0.67)	(0.67)	(0.67)
*Own Part.*Age Ratio*			
Pred. Own Part.*Age Ratio	0.819***	0.816***	0.818***
	(14.60)	(14.54)	(14.57)
Constant	0.095***	0.097***	0.096***
	(2.72)	(2.78)	(2.75)
*Own Part. *Friends' Opinion (Women)*			
Pred. Own Part. *Friends' Opinion (Women)	0.933***	0.933***	0.933***
	(35.91)	(35.90)	(35.90)
Constant	0.008	0.009	0.008
	(0.58)	(0.59)	(0.58)
*Own Part. *Villagers' Opinion (Men)*			
Pred. Own Part. *Villagers' Opinion (Men)	0.870***	0.870***	0.870***
	(30.65)	(30.66)	(30.65)
Constant	0.010	0.010	0.010
	(0.68)	(0.68)	(0.68)
*Friends' Part.*Low Educ.*			
Pred. Friends' Part.*Low Educ.	1.031***	1.031***	1.031***
	(26.45)	(26.44)	(26.45)
Constant	0.063	0.063	0.063

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Table 4.20 – Continued

	LN(Rice)	LN(Lentil)	LN(Dairy)
	(0.82)	(0.82)	(0.82)
*Friends' Part.*Friends' Opinion (Women)*			
Pred. Friends' Part.*Friends' Opinion (Women)	0.917***	0.917***	0.917***
	(33.68)	(33.68)	(33.68)
Constant	0.162	0.162	0.162
	(1.47)	(1.47)	(1.47)
*Friends' Part.*Villagers' Opinion (Men)*			
Pred. Friends' Part.*Villagers' Opinion (Men)	0.903***	0.903***	0.903***
	(31.92)	(31.93)	(31.93)
Constant	0.158	0.158	0.158
	(1.35)	(1.35)	(1.35)
Observations	383	383	383

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Friends' Opinion (Women): importance of friends' opinion to woman.

Villagers' Opinion (Men): importance of villagers' opinion to husband

CHAPTER 5

CONCLUSION

India's economic growth of the past two decades has been spectacular, and has included increases in food grain production. However, over forty percent of all Indian children under the age of five continue to be malnourished. To equitably distribute the benefits of growth, Indian policy-makers must address the high rates of child malnutrition. This dissertation examines two approaches to reducing child malnutrition: through nutritional supplementation programs, and by using peers to empower women to control a greater share of household resources.

Using nationally representative data from India, I evaluate the Indian Integrated Child Development Services (ICDS), which aims to improve child nutrition by providing nutritional supplements, and pre- and post-natal services to targeted villages. The ICDS has been in place since 1977 and cost approximately $1.5 billion in 2008 alone. Previous evaluations of the ICDS and similar programs elsewhere in the developing world have largely failed to show the effectiveness of such interventions in improving child nutrition outcomes. I use new data to re-evaluate ICDS on several dimensions. In contrast to previous studies, I find that ICDS reduces long-run child malnutrition by six percent. ICDS also significantly benefits the worst-off children, girls in particular. However, while ICDS effectively targets poor areas, it fails to target areas with low levels of average education or those with sex ratios that indicate female feticide and infanticide.

Next, I use primary data that map self-reported networks in rural north India to test whether peer networks can empower women and improve child welfare. I use a community-level women's empowerment program, *Mahila Samakhya*, to identify shocks to

female bargaining power and networks. Using a 3SLS approach and network-weighted instrumental variables, I find that participation in the community-level intervention empowers women, and that more empowered women have better-fed children. Decomposing the peer effect into its component mechanisms, I find that social learning and social influence through program participation increase access to outside employment, and the ability to travel without permission. I also find that social learning, identity utility, and social norms significantly improve children's consumption of rice and dairy.

This dissertation highlights the importance of distributional effects in issues of development economics. In particular, I estimate the effect of the ICDS program on the worst-off children. We might not expect a nutrition program to improve the nutrition of well-fed children; presumably the intended outcome is for the program to improve the lot of those who currently face various degrees of malnutrition. My result that a nutrition supplementation program like ICDS differentially affects children with varying levels of stunting highlight the distributional impacts of such interventions. Further, I allow the effect of the *Mahila Samakhya* program to vary by individual characteristics, such as initial bargaining power, educational attainment, and identity utility. I find that this program particularly helps women low level initial bargaining power. I also present evidence that while the directly measurable interventions of ICDS and *Mahila Samakhya* are important in improving child welfare and gender empowerment, so are the indirect peer effects: social effects are important for participants and their non-participant friends.

By tracing networks, I exploit their overlapping nature and identify causal peer effects on individual behavior. Identifying the causal effect in turn allows me to understand not only whether networks and *Mahila Samakhya* increase female empowerment, but more importantly how they do so. Decomposing the peer effect improves our understanding of why networks influence individual behavior. The fourth chapter of this dissertation also has implications for survey methodology, particularly in economics, because it traces networks using a unique approach that combines snowball sampling with top-coding.

The fourth chapter is important because it studies a unique program, *Mahila Samakhya* and its effect on social networks in a rural and remote part of India. *Mahila Samakhya* is a low-budget program that has strong potential to be duplicated elsewhere, hence evidence of its success may help inform policies aimed at empowering women. My results suggest that networks may help remove cultural barriers, like constricting social norms, to development goals. Further, programs that account for the peer effect may benefit from differentiating between the mechanisms through which peer networks work. For example, programs that rely on social learning, i.e. ones that target lower educated women through their weak ties could just target a small number of well-placed women in a village. Such programs might include interventions aimed at increasing female labor force participation or improving children's food consumption or health outcomes. On the other hand, programs that rely on social influence or identity utility, such as interventions aimed at improving female mobility or physical independence may target clusters of villages to build up critical mass.

Finally, this dissertation contrasts the effectiveness of two programs that take very different approaches to their implementation: the first, ICDS, relies on a top-down approach, while the second, *Mahila Samakhya*, is grassroots up. The ICDS cannot explicitly benefit from networks because the program is agnostic of existing networks. However, the success of such a program is predicated on pre-existing networks and word-of-mouth reviews of the program. Hence, even the ICDS likely implicitly benefits from peer networks, and its effectiveness might be enhanced if it were to incorporate networks in a more substantial way.

This dissertation studies how policy interventions and peer networks influence child welfare and women's empowerment. I use innovate econometric techniques on nationally representative data as well as primary data to estimate the causal effects of interventions and networks. My results highlight the importance of considering distributional and social effects when evaluating the effectiveness of development programs.

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