Abstract

Title: **ECONOMICS AND EMPOWERMENT: CATALYSTS OR COMPETITORS?**

Upamanyu Datta, PhD Candidate, 2013

Directed by: Professor Kenneth Leonard, Department of Agricultural and Resource Economics

We look at the socio-economic impacts of a rural livelihoods program in Bihar, one of India's poorest states. Adopting a model prevalent in several Indian states, the Bihar Rural Livelihoods Project, known locally as JEEViKA, relies on mobilizing women from impoverished, socially marginalized households into Self Help Groups. Simultaneously, activities such as micro-finance and technical assistance for agricultural livelihoods are taken up by the project and routed to the beneficiaries via these institutions; these institutions also serve as a platform for women to come together and discuss a multitude of the socio-economic problems that they face.

We use a retrospective survey instrument, coupled with PSM techniques to find that JEEViKA, has engendered some significant results in restructuring the debt portfolio of these households; additionally, JEEViKA has been instrumental in providing women with higher levels of empowerment, as measured by various dimensions. Since the evidence points to improvements in economic and gender inequality, we consider household bargaining models to unpack the causality between economics and empowerment.

We propose a new framework of household bargaining that allows us to map out the interplay between household outcomes and bargaining equilibrium. We then proceed to demonstrate that when bargaining powers are endogenously determined, a strategy to deliberately suppress household income is rational. We regard such behavior as 'Aggregate Inefficient' behavior, and

note that it is completely possible for such behavior to coexist with Pareto Efficiency in consumption.

We use the Indian Human Development Survey to test the demand systems implied by two competing frameworks: collective bargaining and the framework that rationalizes aggregate inefficient behavior. We find that although the implications of the Collective Hypothesis are rejected, those for the alternate framework are never rejected. Thus, we conclude that 'Aggregate Inefficient' behavior is a real possibility in some societies.

We note that strategies geared towards Aggregate Inefficiency are driven by concerns over one's bargaining position in the household; such strategies are encouraged by social norms which create pressure on the individual to maintain a position of dominance in the household, especially in patriarchal societies. Thus any policy to encourage gender empowerment by providing women with more resources (for example, policies to increase women's labor force participation) must crack the conundrum of Aggregate Inefficiency by working on the stumbling blocks of individual incentives and social norms to prevent participation.

ECONOMICS AND EMPOWERMENT: CATALYSTS OR COMPETITORS?

By

Upamanyu Datta

Dissertation submitted to the Faculty of the Graduate School of the

University of Maryland, College Park, in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

2013

Advisory Committee:

Professor Kenneth Leonard, Chair

Professor Kenneth McConnell

Professor Vivian Hoffmann

Professor Sonalde Desai

Professor Vijayendra Rao

Dedication

Dedicated to my parents, Aparna and Deb K Datta.

Acknowledgements

Thanks Ken for the guidance over the years, at Symons Hall in person, or in Skype across the world. Thanks Ted, for mentoring me through the formative time of the research, and listening to my confusions endlessly. This research would not have been possible without your support and your knowledge; nor would this have been completed if you guys did not egg me on to take this to its conclusion.

Thanks Vivian, for our endless debates over the empirics. You and Biju played a key role in introducing me to JEEViKA; thank you Sonal, for allowing me the opportunity to use the IHDS data. Without JEEViKA and the IHDS, the story would not have seen the light of the day

I owe a debt of gratitude to the JEEViKA family, for allowing me to work closely with them, teaching me about project management, understanding 'the field', and guiding research to dovetail into operations. I must mention Mr Arvind Chaudhary, who allowed me the freedom to work so closely with his project as one of his own team members. Thanks Ajitbhai, for showing me the importance of converging program implementation and research; for not allowing me to slow down in the pursuit of the Ph.D.

It is said that when you are far from your family, your friends play the role of your family. Liz & Tim, Liz & Adan, Clara & Taka, Denny, Jeff, Kabir, Seth, Will, Amparo, John, Eduardo, Geret, Kanishka, Simone; thanks for the times we had. It was a pleasure to distract you and be distracted by you. Adan, Denny and Taka, I just realized that the three of you together spent almost as much time as I did in the formative months of this research. So cool that you didn't request co-authorship!

It is easy to lose sight of your investments when you are engrossed in a new engagement halfway across the world. Nethra, Roshni and Mohor, thank you for keeping me focused on this.

Contents

Chapter 1: An Introduction to the Research Agenda

As the most basic socio-economic unit after *the Representative Individual*, households command a lot of interest among social scientists. For the sake of simplification, researchers have usually focused on the differences between households, assuming away the issue of differences between the constituent individuals. This is popularly known as the Unitary Household Hypothesis, where the household is captained by a dictator. This dictator might either be a person (probably the head of the household) or an economic construct whose preferences are a weighted average of the preferences of the individuals in the HH (household); as long as the weights on individual preferences remain unaffected by external factors that affect HH decision making, the HH is effectively unitary in nature. Thus the Unitary Household and the Representative Individual have absolutely indistinguishable economic behavior.

The implications of this model have been empirically tested in the last two decades, and have been generally rejected. One implication of the Unitary Household Hypothesis is the Income Pooling implication. The demand for a good is a function of the available total income; given total income, changes in individual incomes would not affect demands. Empirically, this prediction has been proved wrong time and again. Slutsky symmetry, which is an essential property of maximization by a single entity, has been frequently rejected in demand analyses, implying once again that households do not behave as a single agent.

These results proved that it was important to recognize that individuals have unique preferences, and a bargaining approach was necessary to map these preferences into HH outcomes. Several bargaining models were suggested, of the co-operative and non-cooperative flavor. The empirical evidence for each model has been mixed. If the empirical implications were rejected, it was not clear if the reason was a misspecification of the bargaining process or whether bargaining itself was non-existent.

A parallel strand of literature, regarded as the Collective Household Hypothesis was proposed and developed by a host of economists in the following years. In this model of bargaining, the only assumption made was that resources inside the HH are allocated Pareto optimally; given the total resources available, an agent cannot improve his own lot without lowering the welfare of

others inside the HH. This assumption is realistic; it is conceivable that in a long term institution like family, information symmetry leads to Pareto-Optimal outcomes. The elegance of the model lies in the fact that despite this minimal assumption, falsifiable empirical tests were derived. Usually, the implications of the empirical tests were not rejected pointing to the fact that the Collective model of household bargaining was responsible for the results. These empirical tests usually relied on the effect that distribution factors had on household demands; distribution factors are essentially parameters exogenous to the household and have no contribution in individual indirect utility functions as income effect, price effect or effect as taste shifters. However, the distribution factors affect household demands by realigning bargaining power inside the household; for example, changes in individual incomes affect household demands even after controlling for the total household income. Thus, the household demand function reflects the preferences of the individual who experienced the increase in income, by putting more emphasis on his or her bargaining weight.

Theses insights from the Collective Hypothesis have led to the framing of policies geared to increase public welfare in households by routing resources to the woman in the household. Conditional Cash Transfers and women's Self Help Groups are examples of interventions and institutions which assume that household welfare is better reflected in the woman's preferences; channeling economic resources through the woman has the dual effect of addressing the provision of public goods in the household and increasing the empowerment level of the woman.

However, the Collective approach does not explicitly state the mechanism through which these distribution factors influence bargaining weights. Rather, it assumes that bargaining weights are determined as an exogenous function of distribution factors and are not affected by actions taken by the constituent individuals. Indeed, this setup allows the Collective model to not rely on an explicit bargaining process but still recover some information on whether preferences are diverse inside the household. Clearly, if the determination of bargaining power is an outcome of the optimization system in the household, this framework may paint an incomplete picture.

Let us consider for a moment that bargaining power is not determined exogenously; if there are no further implications of such endogeneity other than satisfying scientific curiosity, this simplistic modeling would still lead us to similar policy conclusions. However, as we argue later,

there are far reaching implications of bargaining power being determined through individual strategies, which would feed into household decision making and outcomes.

This paper proposes a new framework, the RU (Reservation Utility) Augmented Hypothesis, which argues that rational strategies by an individual lead to sub-optimal or even non participation in productive activities by other individuals in the household. Driven solely by economic benefits and without any consideration about bargaining power, an individual in the household finds it rational to limit his or her spousal Income after it equals a certain 'bliss-point' level. This bliss-point is analogous to that faced by an individual when he maximizes his utility function, given income and prices. However, the bliss-point faced by an individual with respect to his spousal income is always achieved at a lower level than his own income. Thus, individuals find it rational to limit their partner's income, given own income; for the household, this is an inefficient outcome, as it foregoes additional resources.

We recall that although the Collective model recognizes the importance of bargaining as a definitive characteristic within a household and the role bargaining plays in affecting household demands, it proposes that bargaining powers are determined exogenously. In the RU Augmented Hypothesis, we do not allow bargaining power to be a choice variable in individual preferences but allow it to be determined as an outcome of the household decision making process. Under this framework, with constant individual income and increasing spousal income, tactics to subvert spousal income is rationalized by concerns about an even lower 'bliss-point', coupled with erosion in bargaining power. This loss of bargaining power undermines the position of the dominant spouse continuously, and over a limited time frame reverses the role of dominance in the household.

Rational income subversion tactics for the individual puts the household on an **'Aggregate Inefficient'** path, where it generates less resource than it could have. Such behavior is completely consistent with efficient allocation of given resources, thereby nesting most bargaining models, including the Collective Hypothesis within the RU Augmented Hypothesis.

Naturally, such behavior has the potential to destabilize well thought out policies and programs. In the developing world, numerous programs, especially microfinance and CCT interventions, deliberately target women to engender benefits which have a distinctly 'public' flavor in the

beneficiary's household. However, if Aggregate Inefficient behavior plays a role, then the uptake of program benefits would be lower in scale and scope.

This paper extends this thought in several related directions. We take a close look at the impacts of a rural poverty reduction program in Bihar, one of India's poorest states. This program JEEViKA, focusses on building Self Help Groups (SHGs) of marginalized women; these groups are then federated into higher order institutions of such women at the village and local level. Cheap credit for a variety of purposes, technical assistance for various livelihood activities and encouraging awareness about various public services are the key agendas of this program. However, due to the very nature of JEEViKA's target population, and given Bihar's vicious income and gender inequality, the potential for impacts on women's empowerment exists. A retrospective survey instrument, coupled with 'Propensity Score Matching' methods are used to estimate the impacts.

In Chapter 2, we look at the program in greater details, including its geographical coverage, focus areas for rural development and expansion strategies. In Chapter 3, we discuss the design of the research study including the most important process of identifying good counterfactual villages for the project villages, the survey instrument and the key algorithms used for propensity score matching. We consider the quality of the matched sample and discuss how different specifications of the outcome variables could give us precise estimates of the final outcome. In Chapter 4, we discuss the entire basket of changes that have been brought on by JEEViKA in the 6 project districts of rural Bihar.

In line with findings from a variety of studies in various disciplines, we find that poverty reduction (in terms of relaxation of the credit constraint) and gender empowerment (in terms of greater involvement in decision making, mobility and collective action) have gone hand in hand in the JEEViKA project area. However, the nature of this study does not allow us to map the resource allocation of the average household and neither can we get a look at the resource generation; although we observe that the household and the woman are better off, we cannot make any claims about the nature of the link between the two. We do note that although empowerment outcomes are higher in project areas, outcomes which indicate participation in the public domain are always at a lower level that participation in the individual domain. Given that these outcomes have matured over the course of 3 years, it needs to be examined if there are any

factors which mitigate higher levels of empowerment when the woman deals with her household or community.

To reasonably unpack the link between empowerment and economics, we first appeal to the existing literature on household bargaining. We focus on the Collective Hypothesis, which has had a wide range of applications in the last two decades. We note the role of 'Distribution Factors', parameters which influence household decision making by affecting the bargaining weights. After a thorough discussion of the literature and findings, we consider some findings which are potentially dissonant with the implications of the Collective model. We note that these findings have two common features; they are usually nested in a 'developing country' setting. Additionally, these findings do not stem from a study of just the consumption decisions of the household, but have an overlap with some production decisions.

In Chapter 5, we consider the literature and evidence about the Collective Hypothesis; we also discuss the key empirical implications of this hypothesis on cross-sectional data. In Chapter 6, we use a pan-Indian cross sectional dataset, the IHDS 2004-2005, to empirically test the demand systems as implied by the collective model and find that the implications are usually rejected.

In Chapter 7, we develop the RU Augmented Hypothesis including the theoretical implication of Aggregate Inefficiency and the empirical implications that this framework posits for a cross-sectional dataset. We maintain the assumption of Pareto Efficiency in consumption decisions, which is *also* the key assumption of Collective Bargaining. However, we make a subtle change in the optimization program. The decision maker in the Collective household is an '*agent'* whose preferences are a weighted aggregate of actual individual preferences in the household; the weight on an agent's preference is his/her bargaining power, which is determined exogenously by distribution factors. In our model, we look at the maximization problem from the view point of one individual (really, the extant household head, regarded later as the Dominant Decision Maker) who has to incorporate constraints on total budgets and partner's incentives while making decisions on optimal resource allocations.

Under such an optimization program, we find that Aggregate Inefficient behavior is rationalized. Determination of bargaining power is an outcome of the optimization program (the key difference with the Collective model), and concerns about preserving the bargaining power

drives Aggregate Inefficient behavior. Although not modeled, we recognize that preserving bargaining power is not driven solely by economic considerations; the social environment of the household plays a considerable role.

In Chapter 8, we use the same sample from IHDS 2004-2005 and find that the empirical tests on the RU Augmented model are never falsified by the data. It would not be out of place here to point out that the empirical tests are not used to estimate the extent, or even the existence of Aggregate Inefficiency, which is the main socio-economic implication of the RU Augmented Model. We look for evidence proving or disproving the existence of such a model. The non-rejection of the demand system implies that the RU Augmented Collective model may be underlying the bargaining structure inside the average household. Chapter 9 concludes this research by summarizing the findings and proposes policy adjustments to address the concerns of Aggregate Inefficiency and accelerate reduction in socio-economic inequality.

In the next chapter, we discuss the architecture and aims of the JEEViKA program, before looking at the changes brought on by JEEViKA in the life of the average beneficiary.

Chapter 2: An Introduction to JEEViKA

Historically, Bihar has been one of India's most impoverished states, languishing at the bottom of the heap along various socio-economic dimensions. Social segregation along caste lines, gender discrimination, poor infrastructure and a near breakdown in provision of public amenities had accentuated the abysmal income levels, especially in rural Bihar. However, in recent times, Bihar has witnessed a steady turnaround under a slew of administrative reforms. In late 2006, the Govt. of Bihar inaugurated the Bihar Rural Livelihoods Project or JEEViKA, executed by the autonomous Bihar Rural Livelihoods Promotion Society and funded by the World Bank. JEEViKA slowly became the flagship rural poverty reduction program of the government, operating in 9 out of 34 districts of Bihar. Recently, JEEViKA received the mandate of scaling up its model across Bihar under the National Rural Livelihoods Mission (NRLM). Over a period of the next 10 years, the mandate is to mobilize 12.5 million rural HHs into 1 million SHGs (Self Help Group), 65000 VOs (Village Organization) and 1600 CLFs (Cluster Level Federation).

The project has certain key features, which include

a) Focusing on the poor and vulnerable members of the community, particularly women.
b) Building and empowering pro-poor institutions and organizations.
c) Emphasis on stimulating productivity growth in key livelihood sectors and employment generation in the project area.
d) Positioning project investments to be catalytic in nature to spur public and private investment in the livelihood areas/sector of poor households.
e) Identification of existing innovations in various areas and help in developing processes, systems and institutions for scaling up of these innovations.

The basic building block of the project is to promote socio-economic inclusion of rural impoverished households by mobilizing women members from such families into SHGs (Self Help Groups). In Bihar, the sharp caste segregation implies a considerable correlation between belonging to a low caste and being impoverished; additionally, in an average village in rural Bihar, low caste populations live in a separate hamlet (which may be a fair distance from the actual village center) inside the village. JEEViKA does not conduct any baseline of any kind to

identify its target population; project personnel take advantage of the geographical and economic segregation to approach the relevant hamlets and target low caste households for initial mobilization.

In an average SHG, members meet regularly to participate in savings, borrowing and repayments; additionally, it provides a small platform for 10-15 women of similar backgrounds to come together and discuss their day-to-day lives. The microfinance activities have a humble beginning where each member makes a weekly saving to the tune of 10-20 cents; the members start inter-loaning among one another, by drawing on the aggregate savings parked at the SHG. Once such practices continue over time, the project provides the SHG with a one-time grant of 900 USD, which the SHG disburses as loans to the members. Going forward, these SHGs get linked to banks and leverage funds from formal credit institutions. All avenues of such micro credit have an annual cost of 24%, as opposed to the credit from village money lenders and shopkeepers which are usually to the tune of 60% or 120% annually.

Once a minimum number of SHGs form in a village, they are federated into a Village Organization (VO); a VO is perhaps the key institution of the project as it is large enough to affect changes in the village and small enough to account for the demands coming out of the community. Thus, the key interventions of the project, such as food security, health and nutrition, livelihood activities, identification and training of youth and convergence with other schemes are driven by the VO. The VO also has a mandate to identify issues at the village level and liaison with the project's staff to provide practical solutions.

JEEViKA piloted initially in 5 blocks (sub-districts) and had its first major expansion in 2008, when it rolled out in 13 more blocks; thus at various points of times in 2008, JEEViKA started operations in 18 blocks across 6 districts of Bihar, namely, Gaya, Khagaria, Madhubani, Muzaffarpur, Nalanda and Purnea. The objective of the following study was to understand the changes brought about by the project in the socio-economic conditions of beneficiaries over a time period of 3 years, from EARLY 2008 to end 2010.

A large literature, both theoretical and empirical, in development microeconomics, suggests that credit constraints limit income and consumption growth and increase vulnerability among poor households; when credit is routed through women, the household as a whole experiences better

outcomes in the form of increased consumption or investment on goods with a public flavor. Pitt and Khandker (1998) examine 3 group based credit programs by BRAC, BRDB and GRAMEEN and find that credit routed through women increases labor supply across gender, schooling across gender, consumption expenses by the household and non-land assets held by women. Bobonis (2009) finds a similar effect of increased income for women (due to the PROGRESSA program) on expenditure for children's goods. However, Banerjee et al (2010) do not find any effects on long term investments (health, education and empowerment) due to the SPANDANA program in the urban slums of Hyderabad in Andhra Pradesh, India. Feigenberg et al (2010) find evidence in West Bengal, India that increased interaction in a group setting (for the purpose of micro finance) enhance social networking and cooperative outcomes like regular repayments and repeated credit dosage.

However, it is unclear if such programs affect women's empowerment. The complexity of measuring women's empowerment is probably a major reason why there is no clear answer. Kabeer (1999) and Agarwal (1997) provide excellent discussions about how multiple dimensions like agency, ability to choose and participation in decision making indicate women's empowerment; the authors also discuss initiatives which could affect some or all of these dimensions.

Given JEEViKA's thrust on building institutions and providing cheap credit, we should expect that the program have impacts on debt reduction; if financial wisdom (encouraged by the program) is practiced by beneficiary households, we hope to see some movement towards credit for productive purposes. To encourage livelihood opportunities, JEEViKA's main thrust was to provide technical assistance for agriculture; thus, we could expect to see some increased adoption of agricultural activities. Indeed, if such adoptions are significant, we may expect to see increased land holding or land leasing. Finally, given that JEEViKA beneficiaries meet weekly to engage in financial transactions and discuss agendas about their personal and communal life, we could expect that some effects on women's empowerment should be visible.

The main complication that the research team and the project team faced was that no baseline instrument was fielded prior to the expansion. Additionally, the project did not expand into the new blocks in a haphazard way; rather, the project targeted villages for entry that had large

numbers of target populations. Thus, non-availability of information at baseline combined with non-random expansion complicated any interpretation of causality.

To address the problem of non-availability of data at baseline, a questionnaire with current and retrospective modules was administered in early 2011, which probed for situations at the end of 2010 and at the end of 2007. The non-random nature of JEEViKA's expansion was taken advantage of, by selecting villages from un-entered blocks (in the same districts as the entered 18 blocks) which would have been entered (according to JEEViKA's expansion logic) had the project selected those blocks for expansion.

The details on the questionnaire and selection of villages to survey are discussed at greater lengths in the following chapter; we pay attention to understand if the selected villages were indeed good counterfactuals on average, since the validity of the study rests on making a credible case that had JEEViKA expanded into another block, surveyed control villages had a good chance of being treated. We subsequently use the method of propensity score matching to match the treated primary sampling units (households from treated villages) to the appropriate counterparts from control areas.

Chapter 3: The Research Design

Multiple discussions with the JEEViKA team revealed that project personnel considered the Census 2001 data to identify villages with high populations of SC/ST, regarded as target population. Such villages would always get the highest priority for intervention. Grassroots personnel would then enter the village and identify the hamlets where the SC/ST populations live. The spearhead team from the project would then hold a meeting in the center of such hamlets and inform the villagers about the project, the benefits of regular saving and arrange an exposure visit to a project village. Mobilization would start when 10-15 women from such communities commit to a weekly savings amount and federate themselves into an SHG.

The discussions with the JEEViKA team pointed out that for each block, prioritizing villages for entry was contingent on the number of total households & target (or low-caste) households in the village, as per Census 2001. Once the block-level plan had been formalized and the sequence of village entry finalized, the field team would conduct some initial scoping to look at the priority villages more closely. Specifically, they would consider the number of women in the village who are functionally literate, as JEEViKA mobilizes community members to perform as book-keepers and act as resource personnel to handhold the community institutions of SHGs and VOs. Additionally, the scoping team would also look at the number of people who are working in the village or locally; this information would be helpful when the VO becomes mature enough to conduct the interventions for various livelihood options.

In light of these discussions, the research team considered village level data from Census 2001 in 18 administrative blocks across 6 districts of Bihar, namely, Gaya, Khagaria, Madhubani, Muzaffarpur, Nalanda & Purnea. Out of these 18 blocks, 12 blocks were marked for the JEEViKA program in October 2007. Field operations in 5 of the remaining 6 blocks had started in early 2007. The remaining block, Bochaha in Muzaffarpur, was the pilot block for this program and field work had started here in late 2006.

In these 18 blocks, the research team considered 200 villages that were entered by the JEEViKA project at various points during 2008. For the purposes of this study, these villages were considered as the treatment units and all surveyed households in a treated village were considered beneficiaries of the JEEViKA program.

To look for counterfactuals, we consider villages in a separate set of 21 blocks in 5 of these 6 districts (excluding Khagaria). When the retrospective survey instrument was administered in early 2011, the JEEViKA project had just brought these blocks under its ambit; the block management offices had been set up and some initial scoping had been done to understand the logistics behind future interventions. After the retrospective survey was completed, the project scaled into 26 blocks, including *all the 21 blocks containing the control villages*.

To identify the proper counterfactuals for the 200 treatment units, we consider village level data from Census 2001. The details on the variables that were used to match villages are provided in Table 3.1.

Table 3.1: Variables used to match villages (Data Source: Census of India, 2001)

Number of Households in Village	Information considered to compare a non-project village to a project village came from the Census 2001 dataset for Bihar. Attention was restricted to only those non-project villages of 21 blocks in districts Gaya, Purnia, Madhubani, Muzaffarpur and Nalanda. The variables provided to the left are Census 2001 village level data that were used to construct the matched sample.
Total Population in Village	
SC Population in Village	
ST Population in Village	
Percent Females Literate in Village	
Percent Population Working in Village	
Percent Workers Main Workers in Village	
Percent Females Working in Village	
Percent Working Females Main Workers in Village	

The hope behind this matching was to construct a set of non-project villages from the 21 non-project blocks, which were reasonably similar to the set of project villages from the 18 project blocks. However, there is a potential problem that may invalidate this 'reasonable similarity'. Recall that JEEViKA targeted villages (in the 18 blocks) for entry based on data from Census 2001; once the village was scoped in 2008, it is possible that the field personnel found out that due to migration, the caste profile of the village had changed. This creates the possibility that the project would change the intensity of mobilizations drastically, especially given scarcity of resources at its disposal. We have the potential of a bad match if a village that is selected as a counterfactual unit, on the basis of 2001 data, does not retain the required demographics for JEEViKA to intervene in 2008.

To address such issues, the survey was administered to 10 randomly selected households from the target hamlets in all 200 project and 200 non-project villages; we can assume that had caste compositions changed significantly since 2001 in either the selected project or non-project villages, this should be reflected in the sample statistics. It is to be noted that the survey team did not have a beneficiary list for the treatment villages; thus the selection of interviewed HHs were truly random, and not a sample of beneficiary HHs only.

An identical survey instrument covering several broad areas on socio-economic indicators was administered to each of the 4000 households. The instrument had two broad modules; the general module was administered to a responsible adult (preferably HH head), and the women's module was administered to an ever married adult woman. The general module collected economic information focused on asset ownership, debt portfolio, land holdings, savings habit and food security condition; social indicators attempting to capture changes in women's empowerment focused on women's mobility, decision making and networks were part of the women's module. The demographic profile of each household was captured by an appropriate household roster and caste-religion profile; in addition, a livelihood roster was also administered. Given the retrospective nature of the study, questions on certain indicators were designed to capture the levels at end 2007, along with the current level. However for other indicators, like debt portfolio, questions for end 2007 levels were not asked since the chances for incorrect responses are considerable.

The first agenda is to check for balance in treatment and comparison groups on dimensions which are invariant to interventions, but which may interact with interventions to cause impacts. To start the procedure of checking for balance in key variables, a distinction needs to be made to identify which variables are relevant for analysis at the individual level, and which are relevant for analysis at the village level.

Balance in key variables at village level enables an answer to the question: **If the project had gone to control Village B instead of Treatment Village A, could we expect to see similar impacts?** Now a similarity (difference) in impacts could be due to a combination of several characteristics in the village, and how the characteristics interact with the project, once it enters. Thus it is important to understand whether the village characteristics are similar, and whether the project interventions would have been similar in the villages. Note that the answer to this

question is of paramount importance when we construct the counterfactuals; after all, if we cannot reasonably infer that Village B would have been intervened if JEEViKA went to that relevant block, then it is not very useful to consider households from village B to construct counterfactuals. In the following section, we examine sample characteristics at the village level to understand if the 200 non-project villages are a reasonable image for the 200 project villages.

Section 3.1: Balance at Village Level

a) Balance in indicator variables determining project expansion

We look at the determinants of project expansion first. Conversations with project officials revealed that expansion of the project uses two broad indicators. At every level of the project hierarchy (State→ District→ Block), project officials are given macro targets like achieving an N number of SHGs and X number of SC/ST beneficiaries. Under such targets it is optimal for the project to roll out into

a) Villages which have high levels of target population to raise chances of meeting the joint target levels, N SHGs and X SC/ST members.

b) Villages which have high proportions of target population in smaller villages to raise the chances of enrolling X SC/ST members.

c) Larger villages, but maybe smaller numbers in target population, to raise chances of forming N SHGs.

The choice is clear: Rolling out in (a) type villages is better than the other types. However the choice between (b) and (c) is fuzzy. Obviously, the project manager is limited in his/her choice by the distribution of demographics in the block; for example, if there are no villages with high levels of target population, the decision collapses to a choice between (b) and (c). The question to consider here is as follows: Assume in late 2007, that instead of Phase-1 (actually entered) Block A, the project had decided to roll out in Phase-2 Block B (entered in late 2010), where both blocks are in the same district. Consider that identical targets were provided whether the block in question was A or B. **Would the project manager follow the same strategy for expansion in the control villages that he had followed for the treated villages?** With

reasonable confidence, the answer is Yes, if the project manager faced similar distributions in levels of target populations and total households in both blocks. We can also consider a related question: **could a similar target be feasible in both blocks?** Once again, the answer is Yes, if the blocks in question had similar number of villages with similar distributions of target populations.

Thus the first checkpoint for balance is to identify if the control villages match up to the treatment villages in terms of the distribution of the above variables. When the project was operational in the first 18 blocks, targets and strategies were based on data from Census India 2001. The strategy for balance checks thus relies on the Census 2001 dataset; the total target population (SC+ST) is calculated in each village. The overall distribution of the Target populations in the 400 villages is considered, which provides us with mean and standard deviation of the distribution. Each Standard Deviation interval is considered as a Stratum (since the S.D. came out as about 660, the 1st Stratum is 0-660, 2nd Stratum is 661-1320, and so on). Villages are then grouped into strata based on their target population level. We then ask if,

a) Within each Stratum as defined above, are there a similar number of villages across T-C Status?

b) Within each Stratum, are the averages of target population and total households statistically similar across T-C status?

Table 3.2: Distribution of project and non-project villages across strata of target population

	STATUS		
	Non-Project	**Project**	**Total**
Stratum			
1	122	116	238
2	57	55	112
3	13	14	27
4	7	7	14
5	1	8	9
Total	**200**	**200**	**400**

H_0: Distribution of villages is similar across status of intervention: p-value (Chi-square) = 0.225

Table 3.3: Distribution target population (low caste) and total number of HHs, by status of intervention, across strata of target population

		Distribution of target population			Distribution of total no. of HHs		
		STATUS			STATUS		
		Non-Project	Project	p-value	Non-Project	Project	p-value
Stratum							
1	Mean	326.6	297.3	**0.2101**	229.5	250	**0.5088**
	S.D	177.3	182.9		22.6	21.1	
2	Mean	949.7	920.8	**0.3901**	715	620.5	**0.2948**
	S.D	22.7	24.6		76.7	45.1	
3	Mean	1586.7	1619.2	**0.6788**	1455.5	1233.9	**0.5154**
	S.D	49.4	59		310.5	147.6	
4	Mean	2264.3	2345.4	**0.5511**	1713.6	1357.4	**0.1462**
	S.D	87.3	99.4		219	67.6	
5	Mean	2668	3287.1	**NA**	3279	1801	**NA**
	S.D	NA	160.5		NA	276	

Table 3.2 reveals that the number of villages by each strata of target population (apart from Strata 5) is statistically similar across project and non-project areas. Table 3.3 implies that in these villages the number of households affiliated to low castes and the total number of households was statistically similar across status of intervention, for each stratum. Together, they imply that similar targets were possible had the project rolled into the non-intervened 21 blocks, instead of the actually intervened 18 blocks. Not only that, the similarity of the numbers of target population and total households imply that block project managers would follow a similar expansion strategy in either case; distribution of villages of type (a), (b) and (c) is similar in the intervened 18 blocks vis-à-vis the non-intervened 21 blocks.

b) Balance in indicator variables for village quality

It can be argued that even with similar intensity of expansion in villages across status of intervention, village quality may have an important say in the manifestation of impacts; after all, a village with better infrastructure might be paid more attention by project staff, as mobilization

in such areas makes their job easier. On the other hand, due to geographical and economic segregation, villages with better infrastructure might have little or no populations of low castes. Thus, they may not be on the radar of JEEViKA at all. Although there may be ad infinitum indicators of village quality, we consider the presence of three key public amenities at the village level to identify if treated and control villages are similar, at least in the existence of these three amenities. The three indicators considered are the presence of a school, a PDS (Ration Shop) and a Primary Health Center in each village.

The table appended below considers the percentage of villages which DO NOT have the above amenities in the village, across intervention status; the p-value on the null that percentages of absent amenities are similar across intervention is provided.

Table 3.4: Distribution of percentage of villages without given amenity, across status of intervention

		Non-Project	Project	p-value
Situation of Amenity				
School Absent in village	Mean	0.07	0.085	**0.5748**
	S.D	0.018		
PDS Absent in village	Mean	0.32	0.33	**0.8309**
	S.D	0.033	0.033	
Health Center Absent in village	Mean	0.61	0.585	**0.6102**
	S.D	0.034	0.035	

Tables 3.2, 3.3 and 3.4 prove that on the basis of available data, coupled with an understanding of the expansion strategies of JEEViKA, we can claim with substantial confidence that the grassroots managers would have faced,

a) Similar targets
b) Similar distribution of target population and total population in villages
c) Similar basic quality of villages

in the 21 blocks had they been intervened in the first place, instead of the actual 18 intervened blocks. This is a key result; we can now use matching techniques to look for counterfactual households from the non-intervened villages for the beneficiary households in the project villages. Constructing a counterfactual is not a useful exercise if the average non-project village

in question is radically different from the average project village, since chances are that the former village would not have been intervened by JEEViKA in any case. The above results nullify such a scenario.

We are now in a position to consider techniques for appropriate construction of comparison units; we use matching methods through propensity scores for this. As with all PSM based studies, the choice of variables that are used to generate the propensity score assume considerable importance. In the next section, we combine the thoughts from existing work in this area with knowledge of the project to identify the candidate variables that should be used to generate the propensity scores.

Section 3.2: Towards a Propensity Score

Let a population of N units be divided into two sets of $n_1$and n_2. Let a representative unit from each set be denoted by $i_1$and i_2 respectively. Let an intervention T be administered to the units in set n_1. Heckman (1997) pointed out that the relevant statistic is the ATT (Average Treatment Effect on Treated) to measure the success (or failure) of the program and is given by

$$E(\Delta Y|T) = E[Y_{i1}|T=1] - E[Y_{i1}|T=0]$$

The problem of the missing counterfactual is that the 2nd term is not observed. Experimental studies approximate the 2nd term by randomization; hence if the population units were assigned to sets of $n_1$and n_2 randomly, the effect of treatment could be consistently estimated by

$$E(\Delta Y|T) = E[Y_{i1}|T=1] - E[Y_{i2}|T=0]$$

However if separation into the sets was by some rule, then the above expression is an inconsistent estimate of the ATT, since the units $i_1$and i_2 are fundamentally different from each other.

Rosenbaum and Rubin (1983), Heckman and Robb (1985) and Lechner (1999) proposed a quasi-experimental approach to exploit knowledge about assignment of treatment to properly identify the control units from the set n_2 for the beneficiary units in set n_1. The essence of this approach is to note that if we can observe the levels of variables which affected the assignment of treatment,

then if we can find a pair of units (one from each set) with the same levels on the same variables, either unit is the counterfactual of the other. This known as the Conditional Independence Assumption, which essentially proposes that if assignment of Treatment was a function of a vector of covariates, that is, $T = f(X)$ then

$Y_{i1}, Y_{i2} \amalg T \mid X$ *where the symbol* $\amalg$ *denotes independence*

In such a case, the ATT can be consistently estimated by $E(\Delta Y \mid T) = E[Y_{i1} \mid T = 1] - E[Y_{i2} \mid T = 0]$

Note that the vector of covariates ***X*** affects treatment, but not the other way round; for example consider a poverty reduction program which targets beneficiaries after conducting a baseline survey to identify the households below a certain poverty line. The vector of covariates would then contain the consumption levels, asset positions and other poverty indicators; however they must be measured at pre-treatment levels (for both treated and control units) to construct counterfactuals. Of course, time invariant variables (like caste) which contain information about poverty and hence influence treatment assignment should also be included in the vector ***X***.

Constructing matched pairs for a given value of ***X*** becomes improbable when the vector has multiple dimensions, and is complicated even more by continuous elements in the vector. Rosenbaum and Rubin (1983) showed that a balancing score, b(***X***) which is essentially a scalar projection of the vector can be of substantial use to redress this 'curse of dimensionality'; indeed, if potential outcomes are conditionally independent of treatment assignment given the vector ***X***, they are also independent of treatment assignment given the index b(***X***).

The propensity score p(***X***), which is essentially the probability of treatment as predicted by the vector of regressors ***X***, is an excellent candidate for the balancing score; matching on the propensity score allows the proper construction of the counterfactual Y_{i2}, which allows us to estimate the ATT.

We now consider the broad types of information that we use to construct the propensity scores. The 1st category consists of household level variables which cannot be affected by the project, but may interact with interventions to cause differential impacts. For clarity, such variables are regarded as **time invariant variables.** For example, if education of the HH Head is systematically higher in treated areas, then one can argue that practicing financial wisdom

through SHG participation would have a greater impact in treated areas. The problem is that in that case it would be tricky to ascribe what part of the impact is due to higher education, and what part is due to the intervention. Note that in various econometric settings this is still feasible, especially since the AFC data collects the information of the HH head. However we are in trouble when we consider the fact that higher education probably indicates higher motivation and abilities, which are not collected in the data (or in any data set for that matter). In such a scenario, it is impossible to ascertain what part of the impact was due to a) higher education in treated areas b) highly motivated individuals in treated areas and c) just due to the intervention itself.

The above discussion motivates why one needs to first check for balance on time invariant characteristics. This brings us to the 2nd category of household level variables on which balance checks are necessary. Consider an indicator for project impact, for example, the number of cows in a household in 2010. If treated households systematically had a higher number of cows in 2007 than control households, then comparing the 2010 levels would overestimate the effect of the project in increasing the holdings of cow. On the other hand, if control households had systematically higher holdings in 2007 than treated households, then a comparison of 2010 levels would underestimate the impact of the project. Thus, a balance check is necessary on the **pre-intervention levels of outcome variables** before one gets into discussing impacts.

Note that in case balance does not exist (for one or both categories of variables), a comparison is not impossible; attention has to be restricted to those treated and control households which have similar levels of indicators. Various matching strategies can be employed to identify units to which attention should be restricted to; but more on that later. Of course, the village level indicator variables on amenities and target population levels are included in the balancing analysis. The detailed list is provided in Table A3.5, A3.6 and A3.7 in the appendix.

These variables are used in a probit specification, where the dummy indicating whether the observation in question is a treatment or control unit is the dependent variable. The predicted probability of participation is the propensity score, and is used in conjunction with various matching methods to generate the counterfactuals.

Some words about the specifications that are used to study the impacts are in order here; although the score generating mechanism is always a probit specification, we consider two broad cuts of the data, each of which have two specifications. The details are as follows;

Spec 1a) All households with complete information are considered in the analysis; however only economic outcomes are under study.

Spec 1b) Around 90 households did not provide information on the women's module, and 90% of such observations came from control areas. To look at all outcomes (economic + empowerment), we repeat the p-score estimation and matching algorithms to construct the ATT for all households with complete information from general and woman's module.

Spec 2a) Some of the surveyed households did not have any outstanding loans; since the most basic intervention of JEEViKA is to provide micro-credit, it would be instructive to consider the debt portfolio of the households. To do this, we consider only indebted households in this specification, rerun the complete analysis and consider only economic outcomes.

Spec 2b) In this last specification, we consider indebted households which provided information in both general and women's modules; thus, we are in a position to look at all economic and empowerment changes across indebted households in this specification.

With these thoughts on matching variables and specifications, we are now in a position to discuss the matching algorithms that we use to study the impact of JEEViKA. However, the retrospective nature of the instrument raises the potential of recall error, which if not accounted for, can lead us to false conclusions. Next, we discuss this issue in detail.

Section 3.3: The Problem with Recall Errors

Before we consider matching algorithms, we need to consider the probability and implication of recall errors, given the retrospective nature of the survey and the need to balance on pre intervention values of outcome variables. Usually, there is no clear reason for a recall error to have a different character in general across treated and control groups. But consider an outcome which might change substantially, and change at a quicker pace, due to interventions. For example, field experience reveals that a member experiences increased freedom to move within

3-4 months of joining an SHG. Now, in January 2011, when a question was asked to a beneficiary about whether she went to a particular place at the end of 2007, there is a considerable risk that she might reply yes, although that increased mobility may have materialized 6 months down the line. Recall errors on such outcomes, which can materialize in the short run, are always going to bias the outcome upward at 2007 levels due to extrapolation by the respondent.

Indeed we can consider a question to identify if this extrapolation is actually taking place. In the mobility section, the respondent is asked whether she went to SHGs during end 2007. Around 15% of the respondents in the treatment areas said that they did; however, it is a fact that there were no SHGs (run by JEEViKA) during that time, and almost none of these respondents were part of any SHG prior to their current affiliation with JEEViKA.

What might happen if outcomes, which are subject to a systematic recall error of the above type get included in the matching process? Note that by their very nature, such outcomes are going to be higher in treatment areas at 2007 levels, which means that they will have a strong and significant contribution to the estimation of the propensity score. Now consider two potential matches, identical on all dimensions apart from the outcome on recall-error prone variable vector, say, mobility. Recall errors on that vector would then imply that the estimate for the propensity score of the treated household diverges from that of the control household; the distance in p-scores contributed by the vector may invalidate an otherwise excellent match.

Thus, among variables which have 2007 levels, we have only considered those for which impacts should materialize over a longer time horizon. In fact, the only outcomes from the women's module that has been considered for balance at pre-impact levels are whether the respondent would be able to engage in collective action when faced with some issues. The reason is that collective actions can materialize when sufficient numbers of women have joined the SHG movement in a given village, and that should take a longer time to happen than say, increased mobility to a given place.

However, this opens up the analysis to a reasonable challenge that since 2007 levels are not considered on matching, ATT estimates of 2010 levels on such variables would not account for the fact that 2007 levels were *actually* different and this difference was not due to recall errors.

To address this concern, all variables (for which 2007 figures are available or can be generated) have been considered at two different specifications while constructing the ATT. The 1st specification is the level at 2010; hence the ATT is a first difference. The other level is the *Delta-Outcome*, the difference in 2010 from 2007. Hence, for variables which were not used for balancing at 2007 levels, the ATT on the delta-outcome consistently estimates the change across the groups; a caveat being that the groups did not share divergent trends during 2007 and before.

How does recall error on a variable affect its ATT on the delta-outcome? Consider a situation where there are significant recall errors on a vector, say the mobility vector, where some respondents in the treated area systematically respond that they went to different places at end 2007, when actually they did not. If the same respondents still go to these places, the delta on these observations is essentially 0. This implies that for variables prone to recall errors, the estimated ATT on the deltas will be biased downward, the bias depending on the extent of recall error. Thus to summarize, **in case a recall error causes an upward bias in 2007 outcomes in treated areas, the ATT on the Delta-outcome will be biased downward and vice-versa.** An ATT estimate would hence provide a lower bound on the actual impact.

The delta-outcome variables play another significant role. Note that the matching technique matches on propensity score, and not exact covariate matching. Thus it is completely possible that although matches have close propensity scores, they diverge on the 2007-level of some of the balancing variables. A balance check is always performed to check for significant differences in average level across the treated and control groups; however, this does not imply that the individual matched pairs are actually similar on all dimensions of pre-outcomes. To consider a crude example, imagine that a treated and a control HH have been earmarked as a match for each other, but had dissimilar holdings of, say, cows in 2007. If the 2010 level is comparable, the contribution towards the ATT would be negligible. However, the delta for the HH which increased its holdings would contribute much more towards the ATT on the delta for the overall sample. Thus, considering the delta-outcomes, along with the first difference increases the confidence in changes, as the delta controls for level differences at 2007 and just considers the net change in 3 years.

Hence, the delta-outcomes play a dual role: they mimic the advantages of a Difference-in-Difference estimation, but are able to allow information in time invariant characteristics to

construct the counterfactual, when such variables are used to estimate the propensity score. Do note that the assumption of similar trends apply to either process of estimation for consistent results.

If the 2007 level is balanced across T-C on average, then a significant ATT on the first difference will imply a significant ATT on the delta. In fact it would be a very odd result, if for outcome X, 2007 levels are balanced, 2010 levels are significantly different but the delta is statistically similar across groups.

However, if the 2007 level is not balanced across T-C on average, we may have a significant ATT on the first difference, and an insignificant ATT on the delta, which implies that the groups are moving similarly. In fact, if the ATT on the delta is positive, it can probably be said that the gap is closing.

A significant delta will not imply a significant ATT on the first difference, due to inexact covariate matching at 2007 levels. In this case a significant delta contributes towards the confidence in impacts.

To summarize the discussion on recall errors:

1) A systematic component of the recall error may bias the 2007 level of some outcomes upward in the treatment areas. Using such variables in matching would raise chances of inexact matches. Thus such variables are not used for matching. However the deltas are used, along with first differences, to address the issue that had the 2007 levels been used, ATT estimates on the first difference might be very different; the key point is that the estimated ATT on the delta, if recall error of the above kind has taken place, will be a lower bound on the actual ATT.

2) Since exact matching on all covariates at 2007 levels is impossible, the estimate on the ATT of the Delta-outcomes raises confidence in the presence or absence of impacts, as the delta removes the concern of mismatch at 2007 levels.

Hence, the broad types of variables considered:

Type A: 2007 level is available or computed. 2007 level is used for matching and balance. ATT on 2010 level and ATT on Delta are computed.

Type B: 2007 level is available or can be computed. However, 2007 level is not used for matching and balance. ATT on 2010 level and ATT on Delta are computed.

Type C: 2007 level is not available. Hence only ATT of current responses are computed. The implicit assumption is that Type C variables are highly correlated with both Type A and B variables.

Before we move on to the algorithms for matching, we briefly digress to discuss systematic recall errors that may be introduced on the account of any retrospective values. Given the previous discussion, it is clear that if beneficiaries ascribe changes in outcomes at the retrospective level, the ATT would underestimate the true effect. It might be argued that beneficiaries may underestimate pre-treatment outcomes and paint a 'worse' picture than it actually was, before the program came in. This might be due to a psychological effect of imagining a worse situation than it actually was; it may also be due to a strategic ploy on part of beneficiaries to paint a better picture about the program. This would be a sensible ploy only if the beneficiaries know that the program is being evaluated and they have found the program actually beneficial. A counter-argument may be that under such a scenario, beneficiaries may under-report current outcomes, if they assume that reduction in poverty may remove them from the program's ambit.

In any case, if a systematic recall error causes beneficiaries to underreport retrospective levels, the difference in outcomes at current periods would overestimate the actual effect. If under this situation, beneficiaries underreport current levels, then there is a downward bias. In any case, the absence of a true baseline complicates our understanding about the direction of bias if systematic recall errors exist. Indeed, the data points out clearly that on some dimensions, beneficiaries are ascribing program outcomes to retrospective scenarios; for example, claiming that they did go to SHGs when it is a fact that SHGs did not exist. We know that under this scenario, ATTs on the current outcomes are a lower bound on the actual effect. However, a-priori we do not know which outcomes are subject to systematic recall errors, and in what direction. For this reason, we re-run Specifications 1b and 2b without any outcome variables measured at retrospective levels. The results on balance and subsequent matching from these re-runs are presented in the appendix, as an additional robustness check on the main specifications, which still include the retrospective levels of outcomes.

In the next section we look at the various matching methods along with the respective pros and cons, before concluding the chapter and moving onto the results.

Section 3.4: Matching Procedures to find the best counterfactual

Essentially, all matching algorithms come with a tradeoff between bias (approximated by distance in p-score) and variance, and thus there is no algorithm which is a silver bullet for all matching questions. We discuss the various matching methods first, before moving onto the methods adopted for the present study.

a) **NN Matching, w/o replacement:** Under this algorithm, each treated observation is matched to one control. Once a match is found the T and C pair is removed from the sample, and the algorithm looks for the next best match. Now there is some confusion on how this matching should work; optimally (minimize distance in p-score estimate in full sample) or greedily (minimize distance in p-score estimate between each matched pair). A few studies focus on the distinction between the two algorithms, and usually claim that optimal is better than greedy matching.

b) **NN Matching, with replacement:** W/o replacement procedures tend to get better matches when the propensity scores are very close together. However, in its attempt to find matches for every treatment, match quality decreases when a) propensity scores are not close and/or b) after removing matched pairs, propensity scores get progressively further for remaining observations. With replacement addresses this problem. Once a control matches to a treatment, it is returned to the sample and considered once again. Thus, with replacement, both greedy and optimal algorithms would perform much better and similarly. Not only that, with replacement will do at least as good as w/o replacement matching, given optimal/greedy algorithm, on the quality of matching. However, the problem is that with replacement implies that fewer control cases are used to form the match, which means that although bias may decrease, variance will increase. Note that in w/o replacement strategies bias may become a serious issue if progressive matches are made on propensity scores that are further and further apart.

To counter the increase in variance, a strategy of matching with k-nearest neighbors can be considered.

c) **k-NN (Nearest Neighbor) Matching, with replacement:**In this algorithm, it is specified a-priori how many controls are to be used to frame the counterfactual for each treated observation. Although this would reduce variance due to more observations being used, note that it would increase the bias, as at least k-1 controls will have a greater distance in p-score from the one treated observation, had we used 1 NN matching.

d) **Caliper Matching:**NN matching faces the risk of bad matches, if the closest neighbor is far away. This can be avoided by imposing a tolerancelevel on the maximum propensity score distance (caliper).For a given treated (control) observation A, the control (treatment) observation lying within the tolerance level and closest to A in terms of p-score is matched up to A. This implies that the choice of the caliper is very important: too small a caliper would throw out a bunch of observations, and too large a caliper would include outliers which are potentially bad matches. Unfortunately, there is no consensus at all about the caliper distance, just like there is no consensus about the number of neighbors to match in k-NN matching. Note that since the caliper method uses ONLY the nearest neighbor inside the caliper, it uses less information and hence increases variance. Indeed, specifying a tolerance level implies that the researcher is comfortable with the distance specified in terms of p-scores, and considers that all observations within the tolerance level are 'good matches'. Considering the nearest neighbor among such observations means that extra observations which are good matches are not being used, which may increase variance.

e) **Radius Matching:** Radius matching works very similar to caliper matching; however ALL observations within the tolerance bounds are considered as matches, thus reducing variance.

f) **Kernel Matching:** Kernel matching weights all control units to construct the counterfactual for each treated observation; the weights are a factor of the kernel bandwidth specified by the user and the distance in propensity scores between the treatment unit and the control unit under consideration. Since kernel matching uses all the control units to construct counterfactuals, the variance should decrease. However, even a small but positive weight on the most distant control units could seriously contribute to bias; thus, the choice of the bandwidth becomes very important. To sum up:

With Replacement VS W/O Replacement:

On Bias: 'W/o Replacement' should usually perform worse than 'with replacement' when it comes to reducing bias. Indeed, progressive matches reduce the quality of matching, if the estimated propensity scores on the remaining observations are further and further apart.

On Variance: Since with replacement would tend to consider the same observations to construct a match (especially if propensity scores keep diverging), it would generally use less information than w/o replacement strategies, thereby increasing variance.

With Replacement, 1-NN VS K-NN:

On Bias: 1-NN matching cannot do worse than K-NN when it comes to decreasing bias.

On Variance:K-NN can never do worse than 1-NN when it comes to reducing variance. However, both NN methods are subject to bad matches due to propensity score divergence.

With Replacement, Caliper VS Radius:

Imposing a tolerance level avoids the chances of a bad match, in the sense that observations with scores far away are not considered. The choice of the tolerance level becomes very important, since a small interval will increase the match quality, but reduce the number of observations (both treated and control) that are used for analysis. A large tolerance level raises the chances of a bad match, but includes more observations into the analysis. However, given a tolerance level, caliper matching provides better matches than radius matching as it considers only the nearest neighbor. However, being inside the tolerance level implies that all observations are considered 'good enough' for matching; considering only one of them increases the variance. Radius matching solves this problem because it constructs the counterfactual by considering all 'good enough' matches.

In the present study we consider 5 matching methods to construct the counterfactuals. The 1st two methods are NN (with replacement) matching and kernel matching, where the bandwidth is given by the auto-generated rule of thumb optimum.

The 3rd method is also a kernel algorithm; it uses a bandwidth which comes out of minimizing the root mean square error (RMSE) by using a process of leave one out cross validation (LOOCV). A few words about this process are in order before progressing further.

The Leave-One-Out-Cross-Validation (LOOCV) process uses a minimization criterion of the RMSE to identify a reasonable bandwidth by the following process:

a) A variable, say X, which was used to estimate the probit model is used as an outcome.

b) A bandwidth is assumed; any one observation is left out, and the remaining observations are used to predict out X for the one left out observation, where the explanatory variable is the Propensity scores from the original probit fitting. The difference between the actual X and predicted X for the left out outcome is an error. This process is repeated for all the observations in the sample, which generates an Average RMSE from predicting X for given bandwidth.

c) Multiple bandwidths are used to find out which bandwidth minimizes Average RMSE on X.

The X chosen here is the pre impact level of Mobile phones (2007 levels). There are two reasons for this choice. This variable is significant in the probit specification across all cuts. The idea is that if a variation in a variable precisely predicts the variation in propensities, propensities would precisely predict the variable out. Additionally, the purpose of using multiple matching algorithms is to check the robustness of the estimates of ATT; the ATT on mobile ownership is significant across all methods. Thus if the LOOCV bandwidth generates an ATT that is biased, we can compare it with the ATT from the other methods. However comparing the ATT on an outcome which is not significant is meaningless for robustness checks.

The last 2 methods considered are a caliper and radius specification with the same tolerance level. We recall that the choice of this tolerance level is important for caliper/radius specifications; hence, we spend some time to discuss the reason behind choosing the tolerance level.

Recall that a probit estimation is used to predict the probability of participation, given the variables that were considered in section 3.1. A t-test of the estimated probabilities is then done across status of intervention to get a crude understanding of the distribution of p-scores. The tolerance level for radius/caliper matching is then computed as:

Tolerance Level= (SE of Average Treatment Probability of Treated Observations) –

(SE of Average Treatment Probability of Control Observations)

Assume that the estimated probabilities have reasonably identical distributions, both in the treated and control sample, with the average probability of treatment higher in the treatment sample. In such a case, the difference in the standard errors would be small, irrespective of whether the standard errors themselves are large (distribution is spread out) or small (distribution is tight). This implies that as the distribution of p-scores gets tighter in both treated and control groups, the tolerance level gets smaller to prevent a potentially bad match-up. If the distribution of p-scores are more spread out (which is the scenario when NN matching does badly), the tolerance level will still stay small to prevent bad matches; obviously, this would mean that less observations are used, which means that variance should increase.

What happens when one distribution is much more spread out than the other? In this case, the tolerance level increases thus raising the chances of bad matches; however, it would allow more observations to be used in the analysis, thus reducing variance. Note that NN matching would still find out matches for all treated observations under very different distributions of p-scores, thereby increasing the probability of bad matches. Indeed, the tolerance level, even though it is larger under such a scenario, would ensure that bad matches are kept to a minimum. Under such a specification, a tolerance level would be disastrous only if the estimated distributions are very different, leading to an absurdly high radius. Even in such a case, matching without specifying tolerance levels will lead to worse matches, since NN matching would attempt to find matches for every treatment, some of which may be invalidated by large tolerance bounds.

To summarize, the matching algorithms considered are

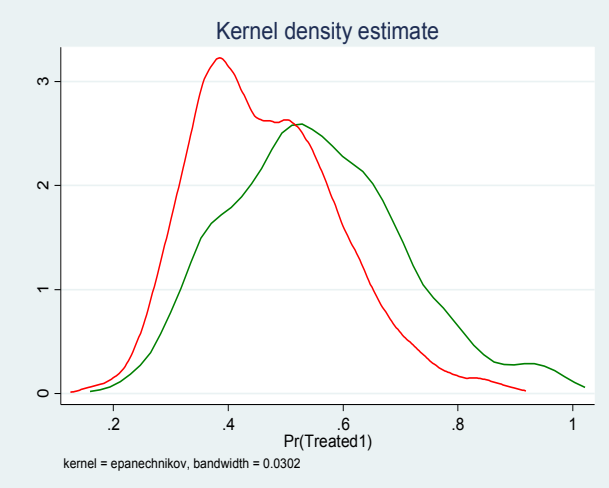
a) Nearest Neighbor, with replacement
b) Kernel Matching, where bandwidth is rule of thumb optimum
c) Kernel Matching, where bandwidth is LOOCV optimum
d) Caliper Matching, where tolerance bound is the difference in the Standard Errors of the estimated scores from the treatment and control groups.
e) Radius matching, with exactly the same tolerance bounds as above

Section 3.5: Understanding Balance in key dimensions

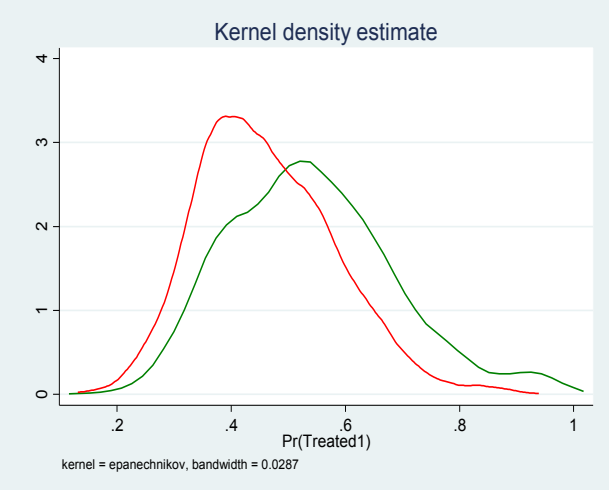
We start by looking at the estimation of the propensity scores and their distribution among the treatment and control units; these are distributions are from the unmatched sample.

Figure 3.1: Distribution of Propensity Scores, by Intervention Status, across Specifications

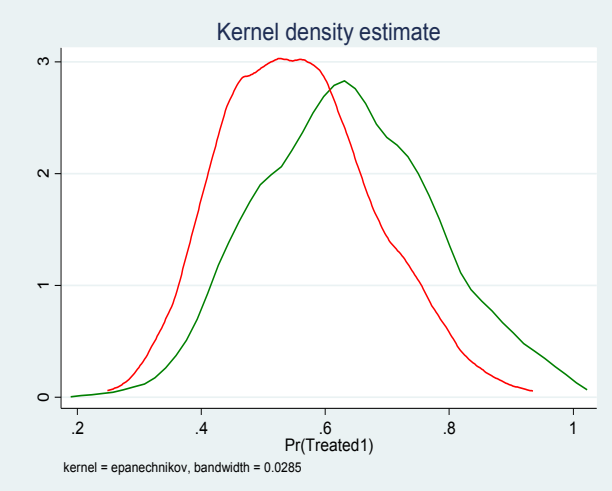
(Distribution of propensity scores of Treatment & Control units in green and red respectively)



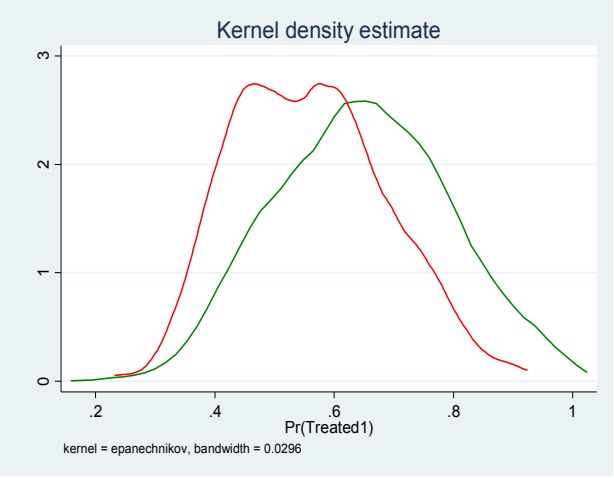
Spec 1a: All HHs, only variables from gen module used



Spec 1b: All HHs, variables from both modules used



Spec 2a: Indebted HHs, only variables from gen module used

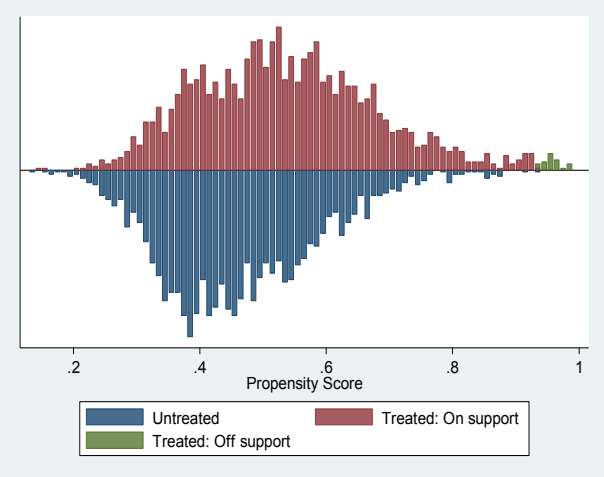


Spec 2b: Indebted HHs, variables from both modules used

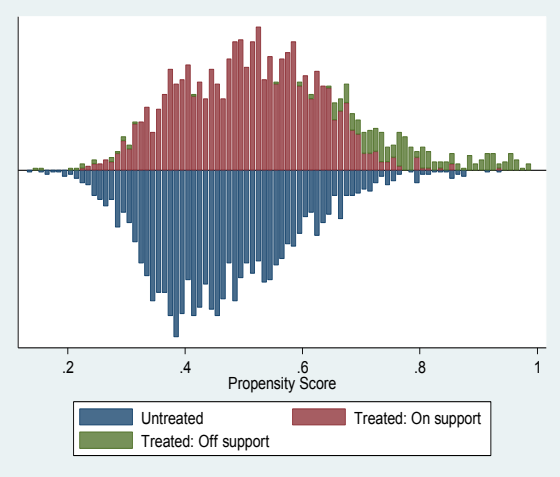
The distributional graphs contain a major implication; a substantial number of observations from either treatment or control sets are in the common support region. In plain terms, in 2008, a large number of households in either set enjoyed the same probability of getting treated. Had that not been the case, we would have been unable to say anything about the control units with very low probability of participation and the treatment units at the other end of the spectrum.

We recall that for each of our 4 specifications, we use 5 matching algorithms. Although the distribution of the propensity scores are identical for each algorithm by specification (see above graphs), the matches are not. Below, we provide the graphs of distribution of matching and the statistics on post-match balance for Spec 1a to understand the intuition.

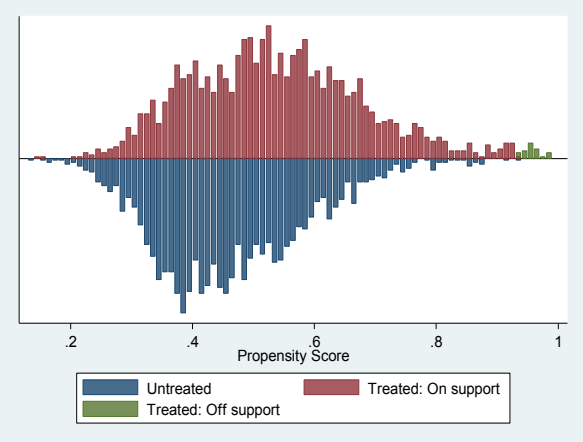
Figure 3.2: Distribution of Matched Units, across Match Algorithms



Nearest Neighbor Post Match Graph



Radius/Caliper Post Match Graph



Kernel Post Match Graph

Red: Matched Treated Units

Green: Unmatched Treated Units

Blue: Control Units

In the balancing exercise, common support had been imposed; this essentially means that the treated units with a propensity score higher than the propensity score of the control unit, with the maximum propensity score, are not considered for matching. For nearest neighbor and kernel algorithms, this is the implication of common support. Note that in nearest neighbor and kernel, all treatment units are matched; additionally, in kernel matching, all control units are used to construct the match.

In radius/caliper algorithms, the imposition of a tolerance bound, say ε, implies that all treated units which do not have a control unit within a distance of |ε| in propensity scores are left unmatched. Thus under radius/caliper algorithms, the quality of matching (in terms of proximity of propensity scores) is decreasing in ε.

In table A3.8 we look at the balance statistics on the pre-treatment levels of the outcome variables for Spec 1a. The main columns pertain to the algorithms of NN (with replacement), Caliper, Radius and Kernel (Rule of Thumb bandwidth) matching respectively. For each balancing variable, the 1st row indicates the statistics from the unmatched sample, while the 2nd row captures that from the matched sample. For each algorithm, the 1st column captures the average level of the variable for the treated units, while the 2nd row relates to the sample average from the control units. The 3rd column is the t-statistic on the difference in means, while the final column indicates if the difference in means is significantly different from 0. Thus, for a given variable, if the p-value indicates no statistical difference in the means from the treated and control units for the unmatched sample, then we really do not need a balancing exercise on that variable. If that is not the case, a balancing exercise is necessary; the p-value on the difference of means in the matched sample tells us if the matched sample generated balance on the variable being considered.

A variable can be balanced, in the same specification, under some of the matching algorithms but may be unbalanced under the others. The direction of difference at 2007 levels contains a caveat towards interpreting the ATT in 2010. If there is a statistically significant positive difference between the averages from the treated and control units at 2007, then a significant positive ATT at 2010 may be an overestimate of the actual impact. Indeed, let us consider such a scenario; how do we know what the true effect of the program was on an outcome, given that the levels were unbalanced in 2007 and has a significant ATT at 2010? To fix ideas, assume that for this

outcome A, the 2007 results indicate a significantly higher average among treated units in the matched sample. The ATT on A is also significant and positive. The ATT for the Delta-outcome on A assumes a lot of significance in such a scenario. Assuming that pre-intervention trends on the variable in question were similar in treatment and control areas, if 'Del'A is insignificant, then the project has had no impact on this dimension in the last 3 years; the difference in 2010 was driven by the difference in 2007. However, if the 'Del'A is significant and positive, then the program has accelerated the realization of outcome A among treated units. The detailed results for the balancing exercise are in Table A3.8 of the appendix.

To put more clarity into the previous discussion, we consider the variable, 'Tot_PermEarner_past'; this indicates the number of members who earned some income, throughout the year, in 2007. The unmatched sample indicates that the average control unit had a significantly higher number of such members. If the program does not affect this outcome, then a simple comparison of the average (without matching) on this variable at 2010 levels would falsely imply that due to the JEEViKA project, the average beneficiary household has fewer regular income earners than the non-beneficiary household.

Consider the variable 'Land_2007' now; in the unmatched sample, the averages from treated and control units were statistically similar. However, the matched samples (under NN and caliper) have significantly lower land ownership under treated units. We need to keep this in mind when we consider the ownership levels at 2010; if the ATT is negative and statistically different, it does not imply immediately that the program is having a negative impact on land ownership. This is where the Delta-outcome on land ownership becomes important (assuming that historical trends in ownership were similar before interventions). For example, if the ATT on the Delta is significant, and (say) positive then beneficiaries have accelerated land ownership and thus the gap has reduced; if it is the other way round, then the program beneficiaries are indeed reducing their land holding. We note the importance of the similar trends assumption here.

Chapter 4: Socio-Economic Changes due to JEEViKA

We are now in a position to interpret the results. Due to the number of specifications, algorithms and probable outcomes, we have a large set of ATTs to consider. The preceding discussions on the aim of the JEEViKA program point out that although we consider a multitude of outcomes, the key focus areas of JEEViKA are micro-finance, livelihoods and empowerment. Impacts on these dimensions would hopefully lead to higher level outcomes such as improved quality of living, consolidation of assets, higher incomes and consumptions, better planning for children, etc.

We first look at outcomes on livelihoods, keeping in mind that the survey instrument was not geared towards pinpointing changes in incomes from various sources due to the retrospective nature. Instead, we try to understand if such changes happened by considering a variety of proxy indicators, such as number of income earners, substitution among livelihood activities, land holding and leasing patterns and finally, buildup of assets.

We then consider a variety of outcomes on quality of living, education and aspirations before moving onto outcomes related to the debt portfolio and empowerment indices for the woman. These are two of the three main thrust areas of JEEViKA and we hope that the survey instrument could accurately measure the impacts of the program along these dimensions.

Section 4.1 Results on Livelihoods and Assets

JEEViKA was unable to change the **number of income earners in beneficiary households**, irrespective of the income being seasonal or year round. We note that across each balancing exercise for a given algorithm and specification, the number of seasonal and year round income earners in 2007 was always balanced across treated and control units. Now, this may not signify absence of impacts once we recognize that JEEViKA does not provide employment opportunities, but attempts to expand livelihood options (an avenue of generating income). Thus, income earners in the beneficiary household may either allocate more time to their existing livelihood(s) or substitute towards a better livelihood option generating higher net income. Due to the retrospective nature of the instrument and the difficulty in collecting accurate income

figures from rural India, we do not ask for income earned for each past and present livelihood. Rather, we look at the livelihood activities (by season) and attempt to infer something from that.

There is a small and significant **shift towards casual labor in urban areas**, during monsoon months; but this result is sporadic across matching algorithms. There seems to be a small and significant **shift away** from doing **agriculture on own land** during the summer months. We find a similar trend, that is, a **shift away from agriculture on lease land** during the same period, especially for indebted households. There are some small sporadic shifts towards casual agriculture in rural and urban areas, but these results are not robustly significant under algorithms.

However, two options stand out for the stability in significance and impacts. There is a significant and negative, albeit small, **shift away from salaried employment in the treated areas**. There is an even more robust (still small) result for animal husbandry; **treated households are shifting towards animal husbandry as a primary livelihood option**, across most algorithms and all specifications.

Thus, for livelihoods, the take away result is that animal husbandry is an option being taken up by project beneficiaries. Note that salaried employment is not a project outcome; however, reduced rural migration is an agenda for the program. Whether the shifts away from salaried employment are bringing beneficiaries back to their native places, and whether that is making them better off with alternative livelihood options is a question beyond the scope of this study.

The shifts away from agricultural activities (given that the evidence is sporadic, but strong under some algorithms) provide us with reason to look at the land patterns for cultivation. We have the luxury of having pre-intervention levels of land owned to balance on, when we consider these outcomes.

First we note that land ownership levels were unbalanced, under Spec 1a and caliper and NN matches at 2007 levels. The ATT on **land ownership at 2010 is insignificant across all specifications and algorithms**, except for Spec 2b under radius and caliper. Interestingly, under Spec 1a, the ATT on change in land ownership is significant for NN and caliper. This is an excellent example of the use of the Delta-outcome; it shows **that land ownership patterns were**

accelerated (although the evidence is not universal at all) under the Spec 1a among treated HHs. Thus, the gap closed at 2010, although control units had higher holdings in 2007.

For indebted HHs, there is some evidence under NN and caliper matches that the level of land rented was higher in treated areas. However, when we consider all households**, there is some evidence that treated units are leasing in less land over the last 3 years**, under NN and caliper algorithms.

The preceding results on land patterns point to a small shift away from agricultural activities in JEEViKA areas, especially when we recall the small sporadic away-shifts from agriculture related activities. Whether this is good or bad comes down to the question of alternate options. Before concluding this dimension, it is apt to mention that 2009 and 2010 were drought years in Bihar; a shift away from agriculture related activities might imply that an expanded option of livelihoods is proving beneficial for beneficiaries, while the control units are choice constrained; hence we see the shift away.

When we consider indebted households only, the **current holdings of buffaloes** by treated units are **lower** than control units, under Spec 2b. A quick look at the balance reveals that in 2007, for NN, caliper and radius matches under Spec 2b, buffalo holdings were lower in treated areas. The Delta-outcome becomes important; **Indebted treated households exhibit a robust significant reduction in buffaloes**.

Another very interesting result manifests itself in holding of cows; treated households seem to be **increasing their holdings of cows over the last 3 years,** especially under kernel algorithms. Indeed, the trend exists when we consider Spec 2a and radius/caliper algorithms. We recall a result from the discussion on the livelihoods dimension; a small, but sure shift towards animal husbandry. The confusing part is that ownership levels over the last 3 years are moving in opposite directions for cows and buffaloes, which are essentially substitutes. The buffalo is monetarily dearer than the cow, and provides better milk, but the cow brings an immense value of prestige and sentiment with it. The instrument does not collect any details on the leasing in of animals, which is a substantial activity under animal husbandry. Future work may provide a better understanding of this result.

However, an even stronger, across the board result materialized in the ownership of mobile phones; **ownership of mobiles in 2010 is significantly higher under almost all algorithms and specifications.** Finally there is some evidence on reduced holding of cots (especially among indebted HHs) and increased holding of watches (especially under all HHs).

Section 4.2 Results on House Quality and Food Security

Across all specifications, but usually under radius algorithm, there is evidence that the **percentage of households with flooring made of permanent or 'pucca' (cement, concrete, etc.) materials in the house has increased at a faster pace in control areas** than in treatment areas.

A promising effect materializes across the board when we consider the defecation practices. **Across the board (specifications and algorithms), treated HHs are using open fields less than control HHs, for defecation over the last 3 years.** Use of closed public or private toilets has increased in project areas. Indeed, **around 1% extra households from treated areas have started using private toilet facilities over the last 3 years**.

However, we need to put this change in perspective; a high percentage of the population (around 86-90%) still use open fields for defecation in the present day, both from project and non-project areas. A lot of work remains to be done in this area, given the fact that defecation in the open leads to a plethora of health problems.

Across specifications and under kernel algorithms, there is evidence that the duration of acute **food shortage has reduced over the last 3 years in treated units**. However*, this reduction is extremely small, although significant and robust at about .09 months.* Once again, the absolute number of months of acute shortage is very high (around 1 month for the control areas, 27 days for the treated areas) which is why the difference works out to around 3 days.

Across specifications, especially for kernel and radius algorithms, **there is evidence that the percentage of insecure HHs has reduced faster over the last 3 years in project areas**. This effect is to the tune of 2.1-2.9 more households from treated areas, per 100 HHs from either area.

Section 4.3 Education of Children, Women's Aspirations and Profile

The **enrollment figures for the girl child are significantly higher in treated areas, under Spec 1a and the NN, caliper and radius algorithms.** Around 8%-10% more girls attend schools in treatment areas. However, these results are not repeated under other specifications.

The **enrollment figures for the boy child are more significant, for the indebted households, apart from the caliper algorithm.** Around 8%-13% more boys are currently enrolled in schools from the treated units.

Respondents from both treated and control areas wanted to marry off their daughter when she is 16 years old; and due to this, there were no differences along this outcome across specifications or algorithms. The NN and caliper algorithms under Spec 1b imply that **women from treated households want to educate their daughter for 0.4 years more on average**. However, the significance is lost for the other specification as well as the other algorithms.

Women from treated areas seem to be much more interested in their son's education; **women from beneficiary HHs want their boys to be educated for 0.47-0.54 extra years**; when we focus on indebted HHs, women want to educate their sons for 0.42-0.54 more years.

33%-34% more women are signature literate from treated areas. Now this is, to a large extent, a trivial impact. Women are encouraged to sign their names in JEEViKA SHGs. We can consider the ATTs on sign literacy to understand if women are getting keener in recognizing numbers or letters. **Around 3.3-4.4% more women are sign literate from treated areas** under Spec 1b. Once again, scope exists in this area as percentages of sign literacy are in the range of 16-20% in the entire sample. Lastly, we consider the percentage of women who mentioned their husband's name by themselves. Although this is no direct indicator of empowerment or well-being, orthodox societies consider this as taboo. It is interesting to see that 15-17% more women from project areas do not view it as such.

Section 4.4 Savings Habits and Debt Portfolio

We note that JEEViKA members are highly encouraged (in fact, required) to deposit a weekly saving in their Self Help Group. Thus an impact on savings is expected. Unfortunately, due to the retrospective nature of the instrument, we cannot look at past and present savings amounts and compare. We consider the regularity of savings at current levels and changes in such behavior over the last 3 years; additionally, we consider where these savings are usually parked.

Quite naturally, savings practices have been boosted significantly in treated areas; indeed **69-75% more indebted households from the treated areas practice savings.** The magnitudes of the ATT on savings and the significance levels are preserved when we look at all HHs (Spec 1a and 1b). **Around 57-60% more HHs, across specifications and algorithms, started regular saving over the last 3 years.** Quite obviously, SHGs have become the dominant place to park these savings, at the cost of non-formal and other formal mechanisms.

Although these impacts are structural, and simply massive, we should note that this is somewhat trivial. A more fundamental change would have been had beneficiary households saved larger and larger amounts voluntarily. Unfortunately, the instrument did not probe for voluntary saving amounts (rather, any savings amounts) due to the retrospective nature and the fact that a concept of voluntary savings is confusing in non-SHG areas. However, we need to take cognizance of the fact that even a token savings practice is absent in impoverished households of rural Bihar. At the end of the day, weekly savings to the tune of 5-10 Rupees is still an achievement, given the resource constraints on JEEViKA's target population.

We now consider the (and perhaps the most important) dimension of debt portfolio. The pernicious poverty levels in rural Bihar are engendered to a large extent by high cost informal credit markets, and complete unavailability of formal credit. Emergency situations make expensive credit unavoidable, leaving fewer resources to take credit for productive purposes. Assets get mortgaged, leading to the debt trap; the extent of the debt trap leads to occurrences of bonded labor in some areas. We take a careful look at the debt portfolios to understand whether JEEViKA has been able to crack this problem at all.

The retrospective nature of the instrument meant that we could not look at the initial credit position of any household. Indeed, the best indicator for historical indebtedness is the year of borrowing; one could look at the amounts and purposes of old loans (that are still outstanding) and make some inferences. This is exactly what we exploit, by looking at loans taken on or before 2007 and since 2008. Note that loans taken on or before 2007 are not variables that we should balance on; if the intervention takes root, old loans should get retired much faster in treated areas. Hence, we cannot balance on any debt related variables.

We take a close look at the distribution of high cost (monthly interest rate greater than 2%) loans, separated by the year of 2008, across treated and control areas. We then look at loan uptake by purpose. Immediately we run into a problem; interpretation of amounts borrowed by purpose doesn't make a lot of sense if we cannot control for the entire portfolio. For example, cheap credit may encourage loans for consumption and/or productive purposes in treatment areas. However, if beneficiary households keep using credit for consumption purposes, then the beneficiary households may be getting to higher credit equilibrium for the time being, but that's about it; such practices would not translate into higher incomes. Just a casual comparison of the absolute borrowing by purpose might be very misleading, as the total portfolio (and the part allotted to consumption) may be higher in project areas just due to easier and cheaper credit. Thus we need to consider percentages. This means that we necessarily consider only the currently indebted households; and this is the main motivation for Spec 2a and 2b.

1.5-2% less households from project areas has high cost loans which were taken before 2008. Note that in any case, **5% households from control areas still have outstanding amounts on such loans**. The amounts borrowed on such loans are similar across treated and control units.

Note: The similarity of amount borrowed on old high cost loans, across treatment and control units under both specifications is a major result; it points to the similarity of these households on this dimension before the project expanded. In light of non-availability of debt data at baseline, this result is a powerful indication that debt portfolios were perhaps similar before interventions.

Strong results show up when we consider high cost loans taken after 2007; program areas show a clear substitution away from such loans. **17.6-19.6% less households from JEEViKA areas**

hold such loans; 42-44% households from control areas have outstanding amounts on high cost loans taken after 2007. The amounts borrowed on such loans are **Rs 3500-4100 less in project areas; the average control HH borrowed Rs 7750-8300 on high cost loans.** Additionally, the average number of loans (any loan) is 0.5 units higher in treated areas.

The results are expected and encouraging; JEEViKA beneficiaries have retired old loans at a faster pace; significantly lower numbers of project households have taken high cost loans after the project expanded into the blocks. Additionally, the amounts taken out on such loans are significantly lower in project areas. Due to the lower cost of the loans, beneficiaries are taking more loans on average; however, the total amounts borrowed are not different.

We glance quickly at the borrowings by purpose; project beneficiaries are taking loans more frequently for a variety of purposes, including repair of house, purchase of food, marriage expenses, durables purchase, debt reduction, livestock purchase and petty business. However, the differences in amounts borrowed by purpose are not significant across the board. This implies that beneficiaries are taking out loans more frequently; however, this does not translate into higher total borrowing, implying that smaller amounts are borrowed more frequently by beneficiaries.

We now turn towards the indebted households; results on the debt portfolio become more pronounced and more clarified now, as we have the luxury of considering percentages.

Among currently indebted households, **4.9-6% less households from project areas still have positive outstanding amounts on old high cost loans. About 10% households in the control areas still retain such debts.** Once again, the amounts borrowed on such loans are still statistically similar.

47-50% less households from project areas have taken high cost loans after 2007; indeed, the percentages of control HHs with 'new' high cost debt burden is 77-80%. The results on amounts borrowed are even starker. **Program HHs have taken around 9300-10000 Rs less on high cost loans after 2007; the control HHs borrowed around 14200-15000 Rs on high cost loans after 2007.**

Two results follow immediately, which are extremely encouraging when taken together; **indebted HHs in project areas has taken 0.18 more loans (any loans) than indebted control HHs**. However, although the number of loans is thus higher in program areas, **control units have a higher total borrowing to the tune of 5400-6500 Rs. Indeed, their total borrowing is around Rs 19500-20500.**

These two results imply that project HHs take more frequent loans, but borrow smaller amounts on each loan. This may lead to a potentially healthy practice of repeat doses of credit, if it's done for income generation activities. We also note that due to the practice of mortgaging assets while accessing loans from informal spheres, rural families usually borrow a high amount of money for multiple purposes, in lieu of mortgaging a single item. Obviously, this is a prime recipe for debt trap. Cheap credit with no requirement of mortgages has been able to crack this conundrum, and thus program families can now go for repeat doses of smaller credit. We now look at the purposes of borrowing to understand if these repeat doses are being used for short run benefits like consumption purposes.

The radius algorithms point out that there is a reduction in the number and amount of loans taken out for health purposes. **For every 100 Rs borrowed, program households take 4.4-5 Rs less for health reasons. This is the by far the most important purpose of credit in rural Bihar; out of 100 Rs borrowed by the control unit, almost 41 Rs is for a health reason.**

There is a strong result when we consider loans taken for **marital expenses; program HHs have taken out 1700-2900 Rs less than control HHs** for this reason. This translates into 10-13 Rs difference, when we consider a project and control HH with a total debt of 100 Rs. **The average control HH borrows 23-24 Rs for marriage expenses, out of every 100 Rs it borrows**.

Distribution of borrowing patterns is very similar when it comes to the purposes of food requirement and schooling across treatment and control areas across all algorithms.

However, treated HHs borrow lower amounts for house repair. **Indebted control HHs borrow around 1900-2500 Rs for house repairs; treated HHs borrow around 700-1100 Rs less for this reason.** However, there are no significant differences in the percentage borrowed for house repair. There is some sporadic evidence of program HHs borrowing lower amounts for purchase

of durables, under the NN, caliper and radius algorithms to the tune of 470-550 Rs; once again, there is no significant difference when we consider the percentage of total money borrowed for purchase of durables across treatment and control.

An extremely strong result shows up when we consider the purpose of debt reduction; **indebted program HHs borrow, on average, 700-800 Rs more than the indebted control HHs to reduce other debts.** If we **consider a program and control HH with a total debt of 100 Rs, the average control HH borrowed Rs 27-70 for debt reduction; the program HH allocates Rs 7 more to this purpose**; in percentage terms, this is 0.48-0.80% of the total amount borrowed. Simply put, cheaper loans are being used to retire other loans by beneficiary households; it is a significant step towards coming out of the debt trap. Now, we recognize that this would be a sustainable strategy if program HHs move towards credit for income generation.

Program HHs borrow around 250-380 Rs more to purchase livestock; this translates to 4.3-4.9 Rs more being borrowed, by the beneficiary, for every 100 Rs borrowed by either beneficiary or non-beneficiary. Indeed, the average control HH allocates 1.7-2.5% of her entire portfolio to this purpose.

2.2-3 Rs more are allocated by beneficiaries towards setting up a shop, when either treated or control borrow 100 Rs total; however, we do not see a significant difference in the amounts borrowed.

Unfortunately, due to oversight, the author did not create a separate category for agriculture purpose; such information was lost as it got clubbed under others.

However, the debt portfolio sends out some very clear results; a structural change has taken place in the debt portfolio of program households. They take more frequent loans but they borrow smaller amounts on each tranche. The loan burden under high cost debt is lower by a large margin; additionally, a much lower percentage of project HHs have such debt. Old high cost loans have been retired at a faster pace by project HHs.

The results on the purposes of debt reduction, consumption and income generation point out that the borrowing pattern implies financial wisdom on the part of beneficiaries; they borrow more to reduce other debt, they borrow less to arrange for marriages, house repairs and purchase of

durables. Although there is some evidence that percentages of amount borrowed are lower for health purposes, the evidence is not across the board. It makes sense, since credit for health emergencies and food requirements would fall in project areas only if JEEViKA provided health services, or the agricultural interventions were adopted by large sections. From the livelihoods section, we already saw that this was not the case, especially in the view of droughts in 2009 and 2010. However, the program households have definitely moved towards credit for productive purposes, evidenced by higher uptake of loans for livestock rearing and setting up small shops.

Section 4.5 Dimensions of Empowerment

Stable results on mobility materialize across algorithms along the entire dimension of mobility, especially when we consider all households. **We start with the results from indebted households, where the ATTs are a bit dampened**. Presently, **around 3.9-4.5% more women from project areas can go to health centers for concerns regarding themselves and their children**. Note that the ATT on the change in mobility to health center question was not significant; there is no significant difference among treated and control areas, in the percentage of women that have started going to health centers over the last 3 years.

Before moving on, we recall the earlier discussion on recall errors; note that we had said that the Delta-outcome is of much use when exact covariate matching is not used. However, when we do not balance on 2007 levels due to the chances of recall error, the ATT on the current level may well be significant due to not balancing. However, the ATT on the Delta-outcome always provides a lower bound, and hence provides additional information towards validating impacts. An example follows.

We look at another across algorithm result from indebted households; attending panchayats meetings is really not usual among women from impoverished, low caste households. Reservation for women has not been of much use either, because the elected representative is usually remote controlled by her husband anyways. Women, especially from the program's focus households, have enjoyed abysmally low levels of voice, participation and representation in the political process at the grassroots.

However, **5.8-6.5% more women from program areas attend such meetings currently. To understand the importance of this impact, note that only 3-3.5% women from control areas go to panchayat meetings presently.** Due to the possibility of recall errors, balancing was not done on pre-impact levels of mobility. Thus we consider the Delta-outcome, the number of women who have started going to panchayat meetings over the last 3 years. The ATTs are significant (although small) on this outcome; around **1.4-1.7% more respondents from project areas have started this practice over the last 3 years**. This is where the Delta is of additional importance; clearly, it tells us that the program has made women more participatory in the political process, and that the estimated effect is still a lower bound.

We now consider the results from all households, keeping in mind the importance of the Delta-outcomes.

2.7-3.5% more women from the project areas go to neighborhood grocery stores in 2010; however the ATT is not significant when we consider the change over the last 3 years.

4.5-6.3% more women from project areas go to health centers in 2010; over the last 3 years, 2-2.6% more women have been going to this facility from the project areas. The significance of the Delta tells us that the program has been able to change mobility patterns when it concerns the health of the woman or her child.

When it comes to **visiting a friend or neighbor** in the village presently, **around 2% more women from treated areas have been able to do so; note that the percentage from control areas at present dates are at 95%.** Over the last 3 years, similar percentages of women from the program villages are visiting their neighbors. Thus the program has been able to relax restrictions on mobility, even to the woman's immediate neighborhood for the most 'strict' households.

Around **3.3-5% more women from treatment areas are able to go outside their village to visit a relative presently. Around 2-3% more women have done that over the last 3 years, from program villages.** Thus, the program has been able to engender better contacts between a woman and her networks, whether such contacts are within or outside the woman's domicile village.

The results on attending panchayat meetings presently and attending such meetings over the last 3 years are consistent and comparable with the results from the indebted households. Once again, we recognize that JEEViKA has been able to crack a very low level equilibrium and encouraged participants in the program to participate in the political and deliberative process of their community.

No significant differences can be seen on the decision making patterns with respect to daily cooking and purchase of personal items, where percentages of women who participate in such decisions are high across areas.

However, around **8-10% more women from JEEViKA villages provide an opinion in the purchase of a durable item in 2010**; around **2% more women have started doing that over the last 3 years**. To put this in perspective, 41-43% women from control areas provide their opinion on this aspect currently.

We should expect that due to the close correspondence between the outcomes "Participating in decision related to health of self or child" and "Mobility to health center for health purpose", the results should follow similar lines. This is confirmed, as the ATTs are dampened for indebted households but get pronounced when we look at all households. **2.8-4.4% more women participate in such decisions currently, while 2-2.6% more women have started participating in the last 3 years.**

Among indebted households, **10-13% more women from treated villages have an opinion when it comes to their children's education in 2010**; however, the Delta is not significant'. When we look at all households, 8.5-9.5% more households exhibit such opinions; additionally the ATT on the "Del" is significant and implies that 1.5-2% more women started providing such opinions over the last 3 years. Putting this in perspective, **68-70% women from control areas have any say in their children's education currently**.

Among indebted households, around 5% more women have a say about what and where the primary livelihood should be while 2% more women have started providing this opinion over the last 3 years. However, this result is significant only for the radius algorithm for indebted households. When it comes to her employment, 5.4-7% more women have a say presently; around 1.7-2.5% more women have participated in this decision over the last 3 years.

These results are more pronounced and stable when we look at all households together. **5-6.3% more women provide a decision about the primary livelihood activity currently;** in 2010, **6.4-7.5% more women participate in decisions regarding their own work**. **Over the last 3 years, 1.9-2% and 1.5-2% more women have started to provide an opinion about primary livelihoods and self- employment respectively**. Once again, we note that around **50% of women from control areas participate in either aspect of decision making currently.**

We'd expect that since cheap credit is coming from SHGs via the female member, the woman should have a higher say in **borrowing decisions. Among indebted households, 18-20% more women provide an opinion currently, while 6-7% have started providing an opinion over the last 3 years.** Results are stable (and more pronounced) when we look at all households. We note that currently, **only 58% women from control areas provide an opinion in the credit needs of the household.**

Lastly, we look at the patterns of decision making when it comes to politics. We recognize that having a separate political identity in such families is extremely unusual for women; a cursorily look at the profiles of some of the elected candidates from the 'Hindi Heartland' is proof enough, where irrespective of performance, caste alignments dictate political allegiance. Indeed, **from control areas, around 19-20% women have any say in the political preference of the household**. However, in 2010, **8.7-10% more women from JEEViKA areas provide an opinion in this aspect of household decision making. Around 2.6-4% more respondents have started to participate in this decision over the last 3 years.**

Once again, we see that the program has encouraged the participants to engage with her family on increased issues at increased frequencies regarding the dimension of household decision making. Such changes have materialized at either high (for example, education/health) or low (for example, politics) level equilibriums.

We now look at the propensity of program participants to engage in problem solving at the community level. We look at 4 issues, which relate to some woman being beaten up, some problem with the PDS, some problem with the school and some problem with the mukhiya (the elected panchayat chief). We ask if the woman would act if she faces such a problem, and if she does, who would she approach to take a suitable action. We focus on the percentage that would

act by themselves and/or act with other women. Note that we assume that if she does not act, then she does not take anybody's help either. Thus if the woman responds that when confronted by given problem, she is unable to act, then the response for who she acts with are coded to 0. Essentially, the percentages who act by themselves or with other women are defined over the entire sample and not for the subset which says that they are capable of doing something. We should note here that 0s on 'who you would approach/act with' includes responses like 'ask my husband', 'approach mukhiya' and the responses 'can't do anything'.

Note that the percentages of women who would take some action when faced with such issues at end 2007 are used as balancing variables. Thus, although we look at the Delta-outcomes, the use of them as a triangulation mechanism for the corresponding variables at current levels is less now.

Among indebted HHs, **6.4-7.8% more women from project villages claimed that they would act if a woman is beaten up in her village in 2010; over the last 3 years, 4.2-6.8% more respondents have become capable of acting in the last 3 years. Around 5% would act by themselves and 13% (which may include some or the entire previous figure) said that they would act in sync with other women. Around 73% women from control areas would act when some other woman is beaten up in her community; however, only 36-40% of the (entire) respondents would act by themselves or in sync with other women**. The impacts are more pronounced when we consider all households, irrespective of indebtedness status.

Significant results materialize for indebted HHs only under the kernel algorithms, when we consider issues with PDS. Around **5% more women would act presently (and 5% have become capable of acting over the last 3 years) when there are issues with the PDS. 6-7% more women would work with other women in harnessing this issue.** Around **38-40% of respondents from control areas would act on this issue, and around 15% would act with other women.** When we consider all households we get comparable results and statistics on all of the above figures. There is no difference in propensities of acting by self in case of PDS related issues between treated and control areas, across specification.

Similar statistics hold true for indebted households when we consider issues with the school in the community. **5% more women would act presently and similar percentages have become**

capable over the last 3 years. Additionally, 5-6% more women from project areas would act with other women to resolve such issues. The results are comparable (somewhat more pronounced) when we look at all households. **Around 36-40% of women from control areas would be capable of acting to resolve this issue.**

Women from indebted treated households are not more likely to act than their counterparts in control areas when they have some complaints against the mukhiya; however, the pattern of action is different. Around **3.4-4.7% more respondents from indebted households in program areas would work with other women to act on mukhiya related issues.**

The result becomes more interesting when we consider all households. Currently, **there is no significant difference between the percentages of women (between project and non-project areas) who would act when some issue with the mukhiya crops up.** However, **2.6-3.6% more women, under JEEViKA's ambit, have become capable of dealing with mukhiya related issues over the last 3 years. 4.4-4.7% more women from program areas would work with other women to resolve mukhiya related issues.**

Once again, we note that this is an impact at a **low-level equilibrium; about 26-28% women from control areas said that they would be able to do anything when faced with mukhiya related issues; only 11% would be able to work with other women to try and address those issues.**

To quickly summarize the findings from the previous 3 dimensions; clearly, JEEViKA has unambiguously affected empowerment levels of women. We see clear evidence in the mobility of the average beneficiary woman, her participation in household decision making and her confidence and propensity to engage in Collective action when faced with issues related to the community. One avenue of these changes is clearly strengths in numbers; once the SHG movement spreads in the village, the woman's network inside her village keeps expanding exponentially. But these numbers progressively relax the social norms of 'right and wrong'. We'll return to this discussion later, when we summarize the entire paper. The detailed results on ATTs, for all households reporting information in women's modules across the key matching modules are presented in table 5.1 in the appendix

Section 4.6: Changes due to JEEViKA- A Summary and Some Questions

The JEEViKA program has brought about some definite changes on a variety of dimensions in the lives of the socially and economically marginalized castes in Bihar. It has freed up most of the households from high cost debt; beneficiaries have started to take steps towards using credit for productive purposes, after retiring expensive loans. The results from different matching algorithms and across specifications imply that these trends are robust and stable, as they are manifested in different cuts of the data. Additionally, beneficiaries are now practicing regular savings.

However, these trends have perhaps not translated into higher level outcomes to the extent that the project may have envisaged. For example, there is strong evidence for higher ownership of mobile phones and watches; however, there is mixed and weaker evidence when we consider clearly productive assets like cows and buffaloes. Beneficiary households seem to be increasing the holding of cows, but reducing the holding of buffaloes. The survey instrument does not collect information on leased animals, a quite popular practice in rural Bihar.

The project seems to have reduced incidences of acute food shortage. Similarly, there are clear trends in decreased defecation in open fields. In both cases, the impacts are small in scale, and there exists scope of further reduction in food insecurity and unsanitary practices.

When we consider livelihood practices, we observe some stable trends in two broad activities; income generation through salaried employment has declined and beneficiaries have moved towards animal husbandry as a primary livelihood option. There is some evidence for shifts towards casual labor; given the low land holdings among the target group in rural Bihar, coupled with the droughts in 2009 and 2010, these changes indicate that the constraint on changing livelihoods has relaxed in program areas to an extent. The instrument cannot say anything further, that is, whether such relaxation has led to higher incomes.

If we look at indicators of social achievements, JEEViKA's impacts are substantially deeper. Women aspire to educate their children more, especially the male child; we can see some evidence of those aspirations taking root, as evidenced by higher enrollments of the boy child in project areas. The ability to sign one's own name is definitely higher among beneficiaries; but if

the project assumed that this would trigger an automatic interest into higher orders of literacy, then the trends show that this is not the case. There is evidence that a higher percentage of women from project areas can read numbers, letters and signs, but once again, there exists considerable scope in improving these numbers.

Mobility, decision making and propensities towards collective action can be assumed to be definite indicators of women's empowerment, especially among low caste households of rural Bihar. The program has made significant strides towards empowering women along a variety of dimensions; the results on increased political participation, an erstwhile no-go area for women, are highly encouraging.

However, it is worthwhile to note the following point; relative to counterfactuals, women from JEEViKA SHGs demonstrate significantly higher empowerment, as evidenced by a variety of indices. In absolute terms though, there is scope for higher achievements. Outcomes related to political awareness or participation are a clear example of this phenomenon; although women from project areas display considerably higher engagement in political decision-making, the scope for further changes are immense. On the dimension of participation in decision making, we find such phenomenon for every decision which relate to outcomes that are more public in nature. Thus, JEEViKA women have significantly higher say in self-employment, primary livelihoods, purchase of durables, etc., than control HHs; however, in absolute terms, the percentage of women that do participate in such decision making can still improve by a large margin.

Given that this evaluation takes place over a 2-3 year time horizon, a question can be asked of the impacts in empowerment; have they run their course? Note that apart from bringing women together and then encouraging participants to 'develop a greater say', JEEViKA did not have tailor made interventions designed to bring about women's empowerment. But the question still remains. Given that these women are bringing in cheap credit to the household and thus relaxing the budget constraint, their absolute levels of empowerment (as evidenced by engaging with their respective household and community) can be higher. Well-designed interventions to ratchet up these 'empowerment' outcomes to a high level equilibrium can definitely play a role. But could there be anything intrinsic in their environment which is holding them back? After all,

engendering empowerment by ameliorating a mitigating factor in the woman's environment may be more cost effective and sustainable than a specific intervention to increase empowerment.

We note that high absolute levels of empowerment may be in the best interest of the individual, but may not be of particular attraction to a household consisted of such highly empowered individuals. Indeed, if the preferences of such individuals are not aligned with each other, the household itself may cease to exist. To attain a high level equilibrium, the household needs to continuously align the individual preferences, while relaxing constraints on budgets and empowerment. If relaxing one constraint acts as catalysis for relaxing the other constraint, then we should have a self-sustaining path to higher equilibriums; however, if an unrecognized 'intrinsic' factor(s) mitigates, or even reverses this catalysis, projects are back to designing costly interventions which would not attain their potential outcomes.

In the next chapter, we turn to models of household bargaining in an attempt to understand the presence of such factors and the rationale behind them. We look closely at contributions from other scientists in the literature of household bargaining; however, we lay a special focus on the literature of the Collective Household, since the alternate theory that we propose later borrows heavily from the Collective school of thought.

Chapter 5: A Review of Household Bargaining and the Collective Hypothesis

Samuelson's seminal work on Consumer Theory to understand the behavior of the 'Representative Individual' was extended to modeling household behavior. The implicit assumption was that agents in such households could be seamlessly modeled as

a) Having identical preferences, and hence represented by the 'Representative Individual'. OR
b) Were captained by a benevolent dictator, whose preferences were a weighted aggregate of the preferences of all agents in the household.

Such an approach was known as the 'Unitary Hypothesis'. Assuming away heterogeneity in individual preferences inside the Unitary Household provided computational and theoretical simplicity in predicting household behavior and designing policies. A key implication of the Unitary Household was that incomes of all agents were pooled prior to consumption decisions. This means that only total income mattered for demands; the identity of the income earner had absolutely nothing to do with consumption.

In the last years of the 20th century, this implication came under increased scrutiny. A multitude of programs with diverse themes as micro-finance, livelihood assistance and conditional cash transfers were designed to exploit the heterogeneous preferences in the household; the policy aim was to identify the bottleneck to a particular development agenda(s), and place resources in the hands of the individual(s) who care most about such agenda(s). Obviously, such programs are meaningless if the Unitary Hypothesis of household behavior is correct.

Lundberg et al (1997) found evidence that household resources were diverted towards women's and children's clothing in response to a policy of reallocating child allowances towards mothers in the UK in the late 1970s. Thomas and Chen (1994) found evidence from Taiwan that demand for some goods were affected by the identity of the income earner, and the quantity of income earned by that earner. Browning et al (1994) and Bourguignon et al (1993) found similar behavior among couples in French and Canadian datasets respectively. Fortin and Lacroix (1997) studied the labor supply behavior of Canadian couples and found evidence against income

pooling. Apart from such (and more) examples of scientific findings, the success of programs like PROGRESA, BRAC, SEWA, etc. indicate that assuming away individual heterogeneity in household decision making may be too simplistic an assumption.

Scientists proposed various bargaining structures which would account for individual heterogeneity and predict a household equilibrium. Manser and Brown (1980) developed Pareto Efficient Cooperative Equilibriums (in a 2-person household) based on Nash and Kalai-Smorodinsky bargaining solutions. McElroy and Horney (1981) focused solely on the Nash bargaining solution to derive off-equilibrium (comparative statics) behavior of bargaining households and derive conditions for such a household to follow the Unitary Hypothesis. Such research usually proposed that the benchmark for bargaining be the welfare levels at divorce. However, Lundberg and Pollack (1993) argued that it would be unrealistic to suppose that agents threat each other with divorce while deciding on the allocation of usual HH goods. They proposed that the appropriate fall back positions should be the welfare that each would receive when they stay as a family but do not cooperate; maximization is done as if they are separate entities inside the HH. Naturally, such solutions were not Pareto Optimal since welfare improving trades in consumption allocations were not possible.

A common theme among all these studies was the effect of extra-environmental parameters or distribution factors. Several studies pointed out that these parameters contributed to the welfare level of the individual if he or she pulled out of the household. These parameters did not affect demands through individual preferences, either as choice variables or taste shifters; nor could their effects be justified as the usual income or price effects on individual demands (while they were part of the household) via the indirect utility functions. The literature justified the effects of such parameters by arguing that variation in these factors recalibrated the bargaining weights on each individual; this recalibration affected individual demands, thus finally affecting household demand.

The empirical evidence for each model has been mixed. In case the empirical implications were rejected, it was not clear if the reason was a misspecification of the bargaining process or whether bargaining itself was non-existent. Additionally, the assumption of Pareto suboptimal consumption decisions seems untenable, especially in the backdrop of a long-term institution like marriage. A parallel strand of literature, regarded as the Collective Household Hypothesis was

proposed and developed by a host of economists in the following years. In this model of bargaining, the only assumption made was that resources inside the HH are allocated Pareto optimally; given the total resources available, an agent cannot improve his own lot without lowering the welfare of others inside the HH. This assumption is realistic; it is conceivable that in a long term institution like family, Pareto optimal outcomes can be reached due to information symmetry. The elegance of the model lies in the fact that despite this minimal assumption, falsifiable empirical tests were derived.

The literature on collective bargaining has 3 principal strands. Perhaps the most rigorous strand uses price variation on commodities to untie the properties of household demand functions. Browning and Chiappori (1998) showed that demand functions of collective households should satisfy a special case of the Slutsky Matrix; responses to prices form a symmetric negative semi-definite matrix plus a matrix of at most rank 1. They examine panel data from Canadian households and find that the implications of unitary model were rejected for multi-agent households. As might be obvious, exploiting price variation on commodities requires multiple rounds; exploiting wage differentials, where the commodity in demand and under study is leisure (or labor supply), provided an opportunity to use cross-sectional data to test the competing implications of unitary and collective hypotheses.

Chiappori (1992) proposed preference structures under which the household behaves as if it first allocates non-labor income among members, after which labor supply and consumption decisions are made individually. Blundell et al (2005) use a rich, multi-round dataset from the UK and exploit the fact that hours of labor supply do not vary too much among males, although there is significant variation among women. They go on to show that although the implications of unitary model are rejected, those of the collective are not. Chiappori et al (2002) identify the 'sharing rule', which is essentially the allocation of non-labor income and show that sex ratios and divorce laws affect this sharing rule. Such parameters have no apparent role in a unitary setting (since they do not affect budget constraints and preferences); however, they play a role in collective households as shifters of bargaining weights. Donni and Moreau (2003) use PSID data to condition female labor supply on the food consumption of the household to unpack estimates of the sharing rule without using distribution factors. Donni and Moreau (2007) carry out a

similar analysis on French data with similar non-rejection of the collective model and estimates of the sharing rule.

However, this strand relies on a key assumption; all hours over and above labor hours are for leisure and are not used for any domestic production. Even if such an argument could be made, the estimation of the sharing rule requires that individual leisure has no public component; that is spousal leisure does not affect the welfare of the individual. In an attempt to bypass these objections, and to satisfy the key requirements to unpack the sharing rule, scientists have attempted to explain the demand for assignable goods in a collective setting. Assignable goods are consumed individually, and the individual consumption levels could be observed. To estimate the sharing rule the benefit of consuming such assignable goods can accrue only to the relevant individual. Expenses on male and female clothing in 1 and 2 person households have been used as prime candidates. Browning et al (1993) and Bourguignon et al (1994) use these insights on Canadian and French data and decisively reject the unitary model for 2 person households, but could not reject the same implications for 1 person households. Indeed, the effects of individual non-labor income on clothing demands (where total expenditure was controlled for) led to the rejection of the unitary hypothesis.

The 3rd strand of the literature on Collective Bargaining focuses on precisely such effects; in the above examples, only salaried agents were considered (to bypass the endogeneity of labor supply). The effect of individual incomes (once the effect of total income is accounted for) is the effect of individual resources on realigning the bargaining weights. Such distribution factors clearly identify collective behavior and have the additional benefit of identifying factors favorable towards the male (female) by realigning the bargaining weights towards him (her). Thomas and Chen (1994) use these thoughts to reject the unitary hypothesis for Taiwanese households. Thomas et al (2002) use marital practices of bringing in and retaining control over assets brought into the household during marriages in Indonesia to show that health outcomes improve as the asset levels brought in (and controlled by) women increase. The 3 strands of the literature are nicely summarized in Vermeulen (2002) and Bourguignon et al (2009).

A common broad feature of all these strands is that the empirical implications of collective bargaining usually concern consumption decisions, including leisure. Indeed, labor supply (and thus leisure) is always considered an outcome of the bargaining process and not a determinant.

The implicit assumption (indeed, a restriction) is that the bargaining weights are not influenced by outcomes at all; the effect of distribution factors on the bargaining weights are entirely exogenous to the household's choices. It would probably not be a naïve supposition that choices made by individuals in the household could influence bargaining power; after all, that should be the crux of bargaining. Before we move onto a discussion along such lines, we consider some of the literature which did not confirm to the predictions of the collective model.

Udry (1996) finds that women controlled agricultural plots in Burkina Faso suffer from a sub-optimal allocation of resources compared to plots controlled by men in the same household. Strictly speaking, the Collective Hypothesis posits that consumption allocations are Pareto Efficient, while Udry's findings point to inefficiencies in production. However, it is clear that such sub-optimal production practices constrain the Utility Possibility Frontier during consumption; even though Pareto Efficient allocations could be made on a lower Utility Possibility Frontier, such allocations are clearly sub-optimal to those that could have resulted due to a more efficient allocation of production inputs. Dercon and Krishnan (2000) find that impoverished Southern Ethiopian households do not pool health risks (where health is the commodity in demand). Indeed, as the levels of landholding in such households go up, the nutritional allocation towards the wife increases; the confounding fact is that in such households, the land is usually held by the husband. The authors argue that as poverty levels increase, sub optimal allocations are made towards the woman as a result of gender and productivity bias, thus violating Pareto Efficiency.

Consider the following anecdotal evidence from Agarwal (1997). She talks about the experiences of women in Bangladesh who have been engaged in co-operative activities by BRAC bank. Women who participated in the BRAC's initiatives faced severe restrictions on their mobility under the ambit of 'Purdah' (Curtain), which was institutionalized by the religious head of the village under pressure from the village elders. However, Purdah restrictions were relaxed for the women in the same village who had not joined the BRAC co-operative. This suggests a carrot-and-stick policy towards women who were engaging in income generating activities; engaging in cooperatives and forming networks inside their village would tighten their mobility, while non-participation would be rewarded by a relaxation of the moral norms for women. Evidently, joining a cooperative allows unemployed women to participate in income generating activities,

which should raise her say over household decisions. However, it would increase the income flow to the family. The fact that men get together to prevent this from happening seems to be irrational behavior on their part, but it would seem that they are motivated by a loss in bargaining power to take such a step.

Lancaster et al (2006) extend the Collective Hypothesis in an interesting direction; they allow the bargaining weights to be a function of outcomes, and find a high correlation between bargaining weights and aggregate household expenditure. The authors propose that the movement of these weights is decidedly non-linear and hence an even distribution of bargaining weights is more beneficial to the welfare of the household, compared to a skewed distribution (even towards the woman). Basu (2006) introduces a game-theoretic framework to argue that in a dynamic setting of collective bargaining, bargaining weights in any period are a function of resource allocations in the previous period. He goes on to show that a sub-game perfect equilibrium, characterized by inefficiencies in consumptions are possible under this setting. Basu shows, via an example, that if the husband knows that allowing his wife to work now will shift all the decision making power to her in the next period, he finds it optimal to forego the additional income from her labor wage, and just keep her at home. Although this argument was made through an example, it showed that strategies by one agent to subvert income of the other are rational under some circumstances.

Given these thoughts and findings, several questions emerge; does Pareto Efficiency in consumption preclude inefficiencies in other domains, especially production? If not, how probable are such situations? Should they be exceptions, or can we expect them? And what role does bargaining play in such scenarios?

In the next section, we revisit the Collective Hypothesis, starting from its very fundamentals. We then look at the implications of the Collective Hypothesis in a situation of little price variation, fixed labor supply, and multiple distribution factors.

Section 5.1: Empirical Implications of the Collective Hypothesis

As mentioned before, the only maintained assumption in this setting is that resource allocations are done in a Pareto efficient manner. Individuals have well defined preferences, which are not necessarily the same. The vector of distribution factors (Z) plays a key role in this model as the

determinants of bargaining power. It is important to note that usual determinants of demands like income, prices, and taste shifters (X) can and will act as distribution factors too; however, empirically the issue would be to isolate their distributional impacts from the usual effects. For example, age and education of each partner can affect their demands as taste shifters. But the differences in their demands, given aggregate HH demand, can still be a function of age and education which is precisely the distributional impacts of the above mentioned variables. Whether we can untie these separate impacts is an empirical question.

With these insights, the optimization program for the Collective household (Chiappori, 1992; Browning and Chiappori, 1998; Vermeulen, 2002) can be written as

$$L = \theta(p,Y,Z)U_A(q_1,q_2,q_3;X) + [1-\theta(p,Y,Z)]U_B(q_1,q_2,q_3;X) + \lambda[Y - p'q] \quad (1)$$

Where A and B are the individuals in the HH, goods $q_1$and q_2 reflect private consumption of A and B, and q_3 denotes public good consumption. Allowance is made for the fact that the agent can derive utility from partner's consumption; thus$q_j$is a determinant of U_i.The price vector of the goods is given by **p**′.

Y is the aggregate income for the HH, and it can be made of a combination of individual labor and non-labor incomes. WLOG, let

$$Y = Y_A + Y_B + Y_{NL} \quad (2)$$

Y_I is the income earned by member I, and Y_{NL} is non-labor income. Thus, λ is the standard multiplier on the budget constraint.

A fair point here is the identity of the agent performing the above optimization; in the Collective setting, this agent is a constructed individual whose preferences are a weighted transformation of the preferences of the actual individuals, A and B. The weights depend on θ, which is the variable of paramount importance here; it reflects the bargaining power of each agent and is bound between 0 and 1. To make ideas clear, if θ = 1, the HH welfare function can be replaced exactly by agent A's preferences. If θ = 0, then B's preferences are reflected by the HH. For intermediate values of θ, the HH welfare function recognizes the unique preferences of each individual. The key point is that if θ is a constant, then we are back to the world of unitary

households; this is the case where the dictator is a weighted aggregation of individual preferences.

The Collective model recognizes bargaining by proposing that θ be a function of prices, income plus a vector of distribution factors, Z, which play a prime role in the working of this framework. This dependence allows bargaining powers of constituent individuals to realign as external factors change.

Empirically, this variation in bargaining power allows us to test for the Collective model against the competing unitary model. Note that θ is never observed in any dataset; however, if external factors have a distributional effect on HH demands (via bargaining power) and that effect could be observed, then that is an empirical proof for the Collective hypothesis. In the unitary model, distribution factors have no role to play.

Thus in the Collective model, the demand for good i can be written as,

$$q_i = f_i(p', Y, \theta(p', Y, Z); X) \tag{3}$$

X is a vector of control variables which affect demands (education, age, occupation, etc), and Z is the vector of distribution factors. Note that there might be an overlap between Z and X.

Since distribution factors affect demands only through the scalar θ, a test can be framed by taking the ratios of the responses of demands with respect to a unit change in any distribution factor(Vermeulen, 2002, Bourguignon et al, 2009). Thus for any pair of goods 1 and 2 and distribution factors Z_K and Z_L,

$$\frac{\frac{\partial q_1}{\partial z_k}}{\frac{\partial q_2}{\partial z_k}} = \frac{\frac{\partial f_1}{\partial \theta}\frac{\partial \theta}{\partial z_k}}{\frac{\partial q_2}{\partial \theta}\frac{\partial \theta}{\partial z_k}} = \rho_{12} = \frac{\frac{\partial q_1}{\partial z_l}}{\frac{\partial q_2}{\partial z_l}} \tag{4}$$

That is, for any pair of goods, the ratio of the change in the demands due to a change in any distribution factor is invariant with respect to any distribution factors.

Another test can be framed by using conditional demands. Distribution factors play no role in the decision making process other than realigning the bargaining power, which itself is a scalar otput as a function of exogenous parameters. Thus, when the demand for, say, good 1 is conditioned on the demand for good 2, all the information contained in the distribution factors is already present in good 2 (Bourguignon et al, 2009). Hence, the conditioned demand for good 1 is independent of distribution factors. The following steps show the logic.

The demand for good 2 is expressed along usual lines as,

$$q_2 = f_2(p', Y, \theta(p', Y, Z); X)$$

We can then locally invert the demand function to get

$$\theta = f_2^{-1}(p, Y, q_2; X)$$

Replacing in the demand for good 1, we have

$$q_1^2 = f_1^2(p, Y, q_2; X) \qquad (5)$$

This implies that the response of conditioned demand of good 1 to a change in any distribution factor, that is

$$\frac{\partial q_1^2}{\partial z_k} = \frac{\partial f_1^2}{\partial z_k} = 0 \qquad (6)$$

Thus the relationships given by the Proportionality (4) and Conditional Demand (6) tests provide testable implications for the Collective Hypothesis. Before concluding this section and moving onto the empirical evidence, we note here (once again) that the optimizing agent in the Collective model is a weighted representative of the partners, and not any individual. More importantly, bargaining weights are determined as an exogenous function of external parameters, and is independent of actions taken by individuals in the HH.

In the next chapter, we examine cross-sectional data from the IHDS survey of 2004-05 to examine if the implications of the Collective Hypothesis are validated by the data. We note that

the empirical literature exploits equations (4) and (6) on cross sectional datasets to (dis) prove the (non-) existence of the Collective Hypothesis of bargaining in the average household.

Chapter 6: Evidence for or against the Collective Hypothesis

The Indian Human Development Survey: The data for the present analysis is a sub-sample of the Indian Household Development Survey (IHDS) undertaken from late 2004-2005. The IHDS is a nationally representative, multi-topic survey of 41,554 households in 1503 villages and 971 urban neighborhoods across India (www.ihds.umd.edu). Two one-hour interviews in each household covered health, education, employment, economic status, marriage, fertility, gender relations, and social capital. Children aged 8-11 completed short reading, writing and arithmetic tests. There are 3 broad modules in the dataset. In Module 1, a responsible adult, usually the head, answers questions about demographics, income, consumption, community level institutions, etc. In Module 2, another responsible adult, usually the spouse of the head provides information on current students, marital practices, health, etc. In Module 3, an eligible woman (where eligibility is defined by an ever married woman between the ages of 15-49) answers questions on gender relations, fertility outcomes, and beliefs about health.

The sub sample used in this analysis consists of nuclear families; irrespective of the number of minors, a nuclear family can have at most 2 adults older than 21 years of age. This is done to minimize any effect of a 3rd adult income earner might have on HH bargaining. It is necessary to control for the simultaneity of leisure choice when considering demands. Thus the dataset consists of adults who are either unemployed or employed in salaried jobs, where work hours are pre-determined by the contract. Moreover, although the agents in the framework may not be husband-wife, the agenda of this paper is to discuss this framework in the backdrop of spousal bargaining. Thus we only consider nuclear HHs where the two adults are married to each other. Additionally, we drop those households where the income source is purely non-labor; usually such households are dependent on remittances and pension and are hence not of interest to the topic at hand. According to work status, the sample of 3371 HHs can be divided into:

1) Head is employed while spouse is unemployed- 3020 HH
2) Head is unemployed while spouse is employed- 41 HH
3) Both Head and Spouse are employed- 310 HH

Section 6.1 Estimation Strategy

Given the cross-sectional dataset and the sample at hand, we closely follow the empirical strategies adopted by Bourguignon et al (1993), Thomas and Chen (1994) and Browning et al (1994). These papers consider the effect of distribution factors on household demands by looking at French, Taiwanese and Canadian family expenditure data respectively. To avoid the problems of endogeneity of labor supply with the choice of consumption goods, these studies consider households where the income flow is either through salaried jobs or non-labor income, or a mix of both. We examine if and how distribution factors affect household demands and observe if the effects confirm to equations (4) and (6), as proposed by the Collective Hypothesis. The consumption shares which are studied under the present analysis are as follows:

1) Share of Staple consumption, where staple items consist of rice, wheat, other cereals and pulses. The motivation behind this categorization is that the above 4 items are the most basic and cheapest items to meet the nutritional needs of an individual.

2) Share of Other Food Consumption, where every other food item is included (apart from meals taken outside the HH).

3) Share of HH Public Goods, where the items consist of goods which have a distinct public nature of consumption, including rental payments, consumer taxes, telephone bills, house repair bills, furniture, crockery, etc.

4) Share of Private goods, where the items consist of goods which are essentially private in nature. However, we observe expenditures only at the HH level, and thus it is impossible to isolate individual expenses. This share of made up of expenses on toiletries, personal care goods, other personal items, and personal transport equipment. I also include conveyance expenses into this share.

5) Share of Fuel expenses, which consist of expenses on kerosene, electricity, lighting, etc.

6) Share of Clothing, which includes expenses on Clothing, bedding and footwear.

All shares are expressed as ratio of spending on that group to the total expenditure. Note that this dataset contains price information only on food items, including staples. Of course, price information is implicitly included as we use expenditures on each item to construct shares. However information on Price indices from a separate report on CPI levels in India in 2005 is used in this study. These are Indices on the 5 broad categories of food, fuel, clothing, tobacco, alcohol and Miscellaneous items, which vary by states and whether the HH is urban or rural. The reason for including prices in a cross section analysis where we estimate, at most, Engel curves will become clear later. There are other goods which we do not include in the present analysis, since a substantial proportion of the households do not exhibit demands for such goods. Note that since expenditures are collected for these goods for the past one year (like jewellery, health, education, etc.), such zero demands are not due to infrequency of purchases; rather, they are corner solutions.

As pure distribution factors, we include 3 variables which come out of Module 2 from the section of marital practices. The first variable is a dummy, which takes the value of 1 if the HH belongs to a community which allows the daughter to be married into her natal village. Note that although the sample consists of predominantly urban households, this variable is evenly distributed since this question is about a community practice. The other two distribution factors that we use are the logged average expenditures incurred by the bride and the groom's families during marriage. Note that this again is a community level variable as the question is how much do families of 'your community' usually spend during the wedding. Now it can be easily argued that the more the bride's family spent during the wedding, the better was the bargaining of the groom's family in determining the total outlay for the wedding. It should be noted that although we recognize that these expenditure levels may reflect bargaining outcomes, we implicitly assume that they are pre-determined to the current demand system, and hence can be safely included as regressors.

To model the unconditional demand system, we include as regressors the number of children in various age groups, variables controlling for Urban/Rural region of residence, religion, castes, and states. We also include the logged age and education levels of the head and the spouse, and of course, the distribution factors. We also include the 5 price indices from the CPI data. We also include the log of the total expenditure incurred by the HH in the last year.

Immediately we have a problem regarding the correlation of the variable total expenditure with the error term. Since total expenses are made up of individual shares, any unobserved effect on any expenditure share will affect total expenses by precisely the same amount. To account for this link, we instrument total expenses by the level of HH assets, which is simply the sum of 30 dummy variables which each take the value of 1 if the asset in question is possessed by the HH. The intuition behind this is borrowed from the Permanent Income Hypothesis, where long run wealth, as captured by level of HH assets is correlated with current wealth, which is captured by the income levels. However, current consumption should be financed out of current income, if we assume away income shocks. Since we consider either salaried or retired Households, the chances of an income shock are minimized, since even retired Households should have built up assets such that their non-labor income is sufficient to cover their current expenditures. Of course, a big ticket purchase like a car can have a direct impact through HH assets, but we are modeling expenditures on goods which by themselves are not a huge proportion of total expenditures. However, there are a couple of natural instruments that we can use; the log of total income. The hypothesis is that total income can have an impact on each share only through the budget constraint as an income effect. This effect should be captured by the instrumented value of logged annual total expenditure. Any secondary effect of income on each share has to be due to a distribution factor effect; but to capture this we will use the individual incomes as regressors in demand equations. Thus total income is a natural instrument for total expenditure. The last instrument that we use is the general CPI, varying across states and region of residence. It should have an impact in the 2^{nd} stage due to substitution effects between goods, but that will be addressed by the presence of the 5 group wise price indices in each 2^{nd} stage.

There is another reason to exclude total incomes from each share. Since, individual incomes add up to total income (along with non-labor income), putting the latter into the 2^{nd} stage will underestimate the distributional effects of individual incomes. To get an idea about this underestimation, we run two alternate specifications on the demand system. In the 1^{st} specification, we use total income in both stages and instrument total expenditure on assets and the general CPI only. In the 2^{nd} specification, total income is excluded from the 2^{nd} stage. If total income does soak up distributional impacts in the 2^{nd} stage (probable, since a large proportion of observations have one income earner in the HH), coefficients on individual incomes should attenuate towards 0.

However, this raises a statistical issue. Excluding the log of total income from the 2nd stage makes the over identification tests fail (for Fuel share), since if the components of income are significant, the aggregate will be significant by default. This creates a problem during the over-id tests for each share; if they reject, one would not know when they were rejected just due to the effect of total incomes or if the excluded instruments, say HH assets enter the 2nd stage. For this reason, we run all the individual shares by including HH assets in the 2nd stage, excluding total incomes and general CPI.

To sum up the discussion on the estimation strategy for unconditional demands, we run 3 broad specifications:

Spec 6a) Excluded instruments from demand equation: Total Income and General CPI; HH assets included in the demand equation. This is to check whether HH assets can be properly excluded.

Spec 6b) Excluded instruments from demand equation: HH Assets and General CPI; Total Income is included in the demand equation. This is to check the extent to which Total Income soaks up the distributional impacts.

Spec 6c) Excluded instruments from demand equation: HH Assets, General CPI and Total Income. If Total Income does soak up distributional effects in spec **6b** (due to low variation of multiple income earners in the sample), excluding it from demand equation should allow individual incomes to regain significance. If coefficients on other variables stay stable (especially that on total expenditure), then including or excluding total income does not cause a difference in information, apart from soaking up distributional impacts; in such a case, specification **6c** could be used to test the implication from the proportionality test.

In case of the proportionality test note that if individual coefficients are imprecisely estimated, equality may well be trivial. An insignificant coefficient will have a large interval around it; taking a ratio with another insignificant coefficient will just inflate the bounds on the ratio even more. And when the coefficients are small in magnitude, equality of ratios may just be a statistical guarantee. Thus specification 6c provides a more strict setting for the proportionality test.

The unconditional demand system in specifications **6a-6c** is estimated by robust 2-stage least squares. However, to perform the proportionality tests, we run absolutely the same specification in 6c, but the estimation is done via a 3 stage least squares system, so that across equation tests can be performed.

To carry out the conditional demand approach, we use the share of expenses on Staples as the conditioning good. There are several reasons to use Staples on the right hand side.

Theoretically it makes sense to use a good on the right hand side, if its consumption is pre-determined or rationed somehow. Staples are the most necessary good that a HH can consume, but once the necessary level is met, staple demand does not rise with income. In fact, a cursory glance at the results from the unconditional demand regressions shows that Engel's law holds for staple items; the coefficient on Log Total Expenditure is negative. This makes Staple goods an ideal candidate for use as a conditioning good. Note that the bargaining model does not put any restriction on the good that should be used for conditioning. The above discussion just motivates the use of staples as a natural candidate. However, we do need to account for the fact that if there is absolutely no bargaining over staple goods, then a rejection of the exclusion test of distribution factors may well be due to the fact that staple demand does not have any information on bargaining. In other words, if distribution factors do not affect staple consumption, then including staples as a regressor will contain no information on distribution effects. Examining the unconditional demand for staples should tell us if distribution factors play a role in the determination of the demand. Recall we have 3 pure distribution factors and the two individual incomes to capture the distributional effect of money.

If such regressors are significant, we should instrument for Staple before we put it on the right hand side. Thus each individual demand would have two endogenous variables; total expenditure and demand for staples. We have a natural instrument for the Share of Staples; the price vector on staple goods. Prices can have only two effects (according to standard theory); the Income effect, which will be controlled for by the inclusion of prices in the equation estimating total expenditure. The Substitution effect will be captured by the instrumented value of Staples on the right hand side of each conditional demand equation. The Collective Model does predict a 3^{rd}effect of prices; that as a distribution factor which acts through θ. But since we are using conditional demands, that effect should again be captured by the coefficient on Staples.

However, the risk with two endogenous variables in one equation is that if the excluded regressors do not have a significant projection on the instrumented variables, coefficients in the 2nd stage are meaningless. We use Shea's partial R squared measures to understand if excluding the price of staple goods is a sufficient strategy for instrumentation. Note that the exclusion restriction proposed by the Collective model implies that distribution factors can be safely excluded from the 2nd stage, which is the equation for conditioned demands. We exclude female income and examine if a) Statistics on over-identification tests suggest that excluded instruments should have been included *and* b) Coefficients on included distribution factors are significant. The set of excluded instruments for the conditional demand system are then

Spec 6d) Logged General CPI, HH Assets, logged total income and price vector of staple goods. If the Shea's R-Squared statistics indicate insufficient explanatory power, we use the specification b; the excluded instruments are

Spec 6e) Logged General CPI, HH Assets, logged total income, female income and price vector of staple goods.

Section 6.2: Results

Prior to looking at the first series of results on the proportionality tests, we need to first check for the diagnostics which indicate the validity of the IV regression. Recall that we used 3 specifications to test for the exclusion restrictions on total income and household assets. In the following paragraphs, we try to understand the validity of the excluded instruments and the effect of each specification on the coefficients of the distribution factors. After all, the present exercise is not to provide an unbiased estimate of the instrumented variable, total expenditure; we are examining for the robustness in the estimates of distribution factors before various tests are performed.

Specification 6a shows that when total income and the general CPI are excluded, HH assets is significant at the 95% level only for the demand for private goods (OthHHGoods). Moreover, the over-identification tests do not rule out the exclusion restrictions at 95% level for any goods (and rules out exclusion at 90% level only for Fuel demand).

In Specification 6b, Total Income is included while excluded instrument are the General CPI and HH assets. The exclusion restriction fails at the 95% significance level only for Fuel demand. Total Income is significant only for the demand of private goods; note that this is the same good which had a significant coefficient on HH assets in Spec 6a, pointing to the possibility that the demand of private goods is contingent on longer run wealth levels.

Turning our attention to the coefficients on the distribution factors (Head and Spouse Income, Average expenses during marriage by bride and groom's families and lastly, whether intra-village marriage is allowed) we notice a negligible change in the estimates across specifications 6a and 6b, even for significant estimates.

We look at the results from Spec 6c, where Total Income, HH assets and general CPI are all excluded instruments from all demands. The exclusion restrictions fail at 95% significance for private goods; head income becomes weakly significant (at 90%) for private goods, suggesting that is soaks up some of the long run wealth effect (in the absence of total income and HH assets) in the demand for private goods. However, all other distribution factors do not exhibit much variation in their coefficients, given the demand equation across all 3 specifications.

A key question is which specification to use for the tests; we use spec 6c, since theoretically, we are looking at demands which should not be contingent too heavily on long run wealth levels. Moreover, spec 6c offers us the best statistics for the first stage, that is, the excluded instruments contribute significantly towards explaining the total consumption equation. Indeed, the F-stat and partial R-squared for 6b and 6c are given by:

Spec 6b) 98.54 and 0.0885

Spec 6c) 92.26 and 0.1291 respectively

Thus, we use spec 6c to conduct the proportionality tests. Note that to perform cross equation tests we rerun spec 6c on a 3sls system before STATA is able to perform the required tests. We have noted that the proportionality tests are strong only if the distribution factors are significant in their contributions towards explaining the pair of demands under examination. Otherwise, products of insignificant coefficients would be equal by default. In the following page, we first look at the unconditional demand system (Specs 6a, 6b and 6c) to look at significance of the 3

'proposed' distribution factors in each demand; the expenditures undertaken by the bride and groom's family and the dummy (MP1) to indicate if intra village marriage is allowed.

Table 6.1 Dependence of Unconditional Demands on Distribution Factors

SPEC 6a

VARIABLES	(1) ShareStaple	(2) ShareOthFood	(3) ShareFuel	(4) ShareHHPub	(5) ShareOthHHGoods	(6) ShareClothing
MP1	-0.00307	0.00210	-0.00333	0.0107***	-0.000622	-0.00191
	(0.00225)	(0.00400)	(0.00221)	(0.00402)	(0.00160)	(0.00144)
Log_Avg_Groom_Exp	0.000809	-0.00331	-0.00726***	-0.00654**	0.00426***	-0.000465
	(0.00167)	(0.00344)	(0.00187)	(0.00324)	(0.00150)	(0.00105)
Log_Avg_Bride_Exp	0.00169	-0.00550	0.00249	0.00625*	-0.00313**	-0.00172
	(0.00195)	(0.00368)	(0.00207)	(0.00347)	(0.00147)	(0.00120)

SPEC 6b

VARIABLES	(1) ShareStaple	(2) ShareOthFood	(3) ShareFuel	(4) ShareHHPub	(5) ShareOthHHGoods	(6) ShareClothing
MP1	-0.00328	0.00136	-0.00344	0.0107***	-6.00e-05	-0.00199
	(0.00228)	(0.00377)	(0.00219)	(0.00401)	(0.00165)	(0.00144)
Log_Avg_Groom_Exp	0.00115	-0.00195	-0.00706***	-0.00651**	0.00317**	-0.000302
	(0.00167)	(0.00321)	(0.00183)	(0.00325)	(0.00151)	(0.00101)
Log_Avg_Bride_Exp	0.00218	-0.00347	0.00278	0.00631*	-0.00476***	-0.00148
	(0.00195)	(0.00330)	(0.00201)	(0.00334)	(0.00147)	(0.00117)

SPEC 6c

VARIABLES	(1) ShareStaple	(2) ShareOthFood	(3) ShareFuel	(4) ShareHHPub	(5) ShareOthHHGoods	(6) ShareClothing
MP1	-0.00329	0.00145	-0.00344	0.0107***	-0.000189	-0.00197
	(0.00229)	(0.00379)	(0.00218)	(0.00401)	(0.00161)	(0.00144)
Log_Avg_Groom_Exp	0.00118	-0.00221	-0.00707***	-0.00664**	0.00351**	-0.000363
	(0.00167)	(0.00322)	(0.00182)	(0.00322)	(0.00148)	(0.00101)
Log_Avg_Bride_Exp	0.00222	-0.00388	0.00277	0.00610*	-0.00423***	-0.00158
	(0.00193)	(0.00331)	(0.00198)	(0.00333)	(0.00142)	(0.00116)

It can be observed that across specifications, there is no gain/loss in significance of any distribution factor for a given demand. Thus, we consider Spec 6c to perform the tests. We consider only those pairs of distribution factors and pairs of demands such that at least one distribution factor is significant in at least one demand equation. The null hypothesis is that given

a pair of demands A and B, and a pair of distribution factors C and D, under the Collective model ***C(demand A)*D(demand B) = C(demand B)*D(demand A).*** The p-values are tabulated below.

- MP1 (Fuel)*Groom Expense (Public Goods) = MP1 (Public Goods)*Groom Expense (Fuel): ***0.0128***
- MP1 (Fuel)*Bride Expense (Public Goods) = MP1 (Public Goods)*Bride Expense (Fuel): *0.0829*
- Groom Expense (Fuel)*Bride Expense (Public Goods) = Groom Expense (Public Goods)*Bride Expense (Fuel): 0.3285
- MP1 (Public Goods)*Groom Expense (Private Goods) = MP1 (Private Goods)*Groom Expense (Public Goods): 0.1240
- MP1 (Public Goods)*Bride Expense (Private Goods) = MP1 (Private Goods)*Bride Expense (Public Goods): *0.0840*
- Groom Expense (Private Goods)*Bride Expense (Public Goods) = Groom Expense (Public Goods)*Bride Expense (Private Goods): 0.6014
- MP1 (Fuel)*Groom Expense (Private Goods) = MP1 (Private Goods)*Groom Expense (Fuel): 0.3842
- MP1 (Fuel)*Bride Expense (Public Goods) = MP1 (Public Goods)*Bride Expense (Fuel): 0.1761
- Groom Expense (Fuel)*Bride Expense (Public Goods) = Groom Expense (Public Goods)*Bride Expense (Fuel): *0.0729*

The equality of proportions is rejected at the 90% level of significance 4 combinations of demands and distribution factors, with one rejection at the 95% level. The full set of coefficients on the estimated demands given above is provided in the appendix. We note that the evidence for or against the Collective model is mixed from the proportionality tests.

Exclusion of the effects of Distribution Factors from Conditional Demands

In Spec 6d, we condition every demand on the demand for staple; thus, there are two endogenous variables in each demand equation, staples and total expenses. The excluded instruments in this specification are the same as in spec 6c; additionally the prices of staple goods (rice, wheat, other cereals and pulses) are excluded in spec 6d. If prices enter through a unique exogenously determined index (bargaining power), they should not have any explanatory power in the conditioned demand. Moreover, included distribution factors should have no contribution in explaining conditioned demands.

We notice that the over identification tests suggest failure of excluded instruments in the demand for fuel and private goods at the 95% level of significance. More importantly, distribution factors (individual incomes, marital expenses, custom of intra village marriage) still possess significant explanatory power in the conditioned demands. The first stage statistics for ***Shea's Partial R-Squared*** are ***0.0385 and 0.0667*** for the instrumented variables ***Staples and Total Expenditure respectively***.

In Spec 6e, we additionally exclude a distribution factor from the conditioned demand system; income of spouse. The Collective Hypothesis proposes that such exclusion is valid, since distribution factors have no role whatsoever in conditioned demands. We notice that the exclusion restrictions fail at the 95% level of significance for Fuel, Private Goods and Other Food Items. Moreover, included distribution factors like Head's Income, Marital expenses and custom of marriage in the village still retain their explanatory power in the conditioned demand system. The first stage statistics for ***Shea's Partial R-Squared*** are ***0.0404 and 0.0743*** for the instrumented variables ***Staples and Total Expenditure respectively***.

The Collective model implies that information in all distribution factors are contained in a singular index, which is the bargaining power; this index is determined as an exogenous function of external parameters, including distribution factors. In conditioned demands, the information in this index is already contained in the conditioning good, and hence, no distribution factor will play a role in the conditioned demand system. Thus, the results from the conditioned demand system are unambiguous in rejecting the implications of the Collective framework. In contrast, the proportionality tests threw up a mixed bag of results.

It needs to be noted here that the proportionality tests on unconditional demands did not involve any test with individual incomes, which play a key role as distribution factors. Given total income, the proportionality test posits that the ratio of responses of individual incomes on a particular demand equation is constant across all demand equations under the Collective framework. We hold off on testing the evidence from individual incomes till later; as we would see at the end of the next part, individual incomes posit a stronger restriction than simple proportionality in response on demand systems. Indeed, an additional restriction of the Collective model is that for a given demand and controlling for total income, coefficients on individual incomes are

a) Opposite in signs (weak restriction)

b) Equal in magnitude, and opposite in signs (strong restriction)

Section 6.3: Summary

Clearly, the empirical evidence implies that the Collective model is insufficient to explain the demand functions for 2-adult households in the IHDS data-set, where the income sources are either salaried on non-labor. This rejection may happen due to the assumption of Pareto-efficiency being violated, or the bargaining framework being insufficient, or a misspecification of the empirical equations. Clearly, the unitary model is also rejected; the pure distribution factors have a definite effect on the demands, and individual incomes have a statistically significant effect, after controlling for total income.

We note that violation of Pareto Efficiency in consumption may be an exceptional situation, especially given the sample under consideration. In a long term institution like marriage, information asymmetry that causes distorted consumption allocations are unlikely. Even if such distortions occur, they may not show up in household surveys; the respondent would either be unaware of them (due to information asymmetry) or hide them (to preserve the asymmetry). The empirical specifications are also in line with the previous literature which has confirmed the Collective Hypothesis. This implies that the underlying bargaining framework may be of a different flavor; in the next chapter, we propose an alternative framework, along with its empirical implications.

Chapter 7: Reservation Utility Augmented Hypothesis

Section 7.1: Dealing with Constraints

As a first step in describing the bargaining process, it makes sense to assume that when a couple bargain inside the HH, they do so with an individual benchmark in mind, which signals how much better off they are inside the HH, as opposed to outside it. The most straightforward indicator of these benchmarks is their respective Reservation Utility (RU), the welfare level that each would enjoy, had they left the family. A point can be made that Reservation Utilities, essentially the welfare at divorce, may be too extreme a benchmark especially for developing countries. Indeed, divorces are extremely rare in rural India; however, separations are not. We attach the concept of RU to the welfare level in case the household dissolves, that is, end of cohabitation and sharing of public goods. Such a scenario is possible, and usual, without formal divorces.

Do note that we said that Reservation Utilities are an indicator of the benchmark; in some cases, the RU may be the benchmark itself and in other cases, the benchmark might well be a monotonic transformation of the RU. This would nest non cooperative threat points as suggested by Lundberg and Pollack (1993). Obviously, if some change in external agencies causes the RU of any agent to increase above the non-cooperative welfare level (assuming that no changes occur to the RU of the partner) the agent could then use his RU as a credible threat in case his demands are not met, and thus raise his non cooperative welfare level.

Note that in a dynamic setting, modeling the benchmark as a function of current RU is different from Basu's approach (2006). He has proposed that current period benchmark of any agent is a function of the in-house welfare that she had received in the previous period. Assume, for any agent, that the current period RU is at a higher level than last period in-house welfare. Then the agent is worse off if she opts for a bargaining power determined by the previous period welfare, than that determined by the RU in the current period (assuming that bargaining power increases with either argument). On the other hand, if the current period RU is at a lower level than previous period welfare, and the agent demands a bargaining weight determined by the latter,

then this is a non-credible threat. The other agent can allot her lower resources and keep her inside the HH, since she would be worse-off if she opts out.

The key point to understand here is that the RU is the primitive which determines the benchmark for bargaining. Thus any factors affecting the RU will have implications for bargaining, and thus, implications on the in house welfare of either individual. We thus recognize the primacy of the RUs in household decision making.

To model the process, consider a HH made of individuals A and B, having well defined, convex preferences represented by U_A and U_B respectively. Further, let each earn incomes of Y_A and Y_B, while non-labor income is Y_{NL}. We allow for all possible interactions of preferences of the partners; hence, the consumption by each agent affects the welfare of the other. Furthermore, let the respective benchmarks be Φ_A and Φ_B, which of course are functions of the respective RUs $\bar{V}_A$ *and* $\bar{V}_B$. Note that RUs are indirect utility functions, independent of in-house consumption levels but dependent on individual incomes and other external factors. Thus the relevant arguments should include respective incomes and prices of goods which would form preferences outside the HH. Hence, from the point of A, the optimization program can be written as

$$\underset{\{q_A, q_B, Q\}}{MAX} \quad U^A\{q_1, q_2, q_3\} - \Phi_A(\bar{V}_A)$$

subject to

1) $U^B\{q_1, q_2, q_3\} \geq \Phi_B(\bar{V}_B)$ [Participation Constraint]

2) $p'q \leq Y_A + Y_B + Y_{NL}$ [Budget Constraint]

We recognize that the benchmark for participation may be a monotonic transformation of the RU. However, since we are interested to see how perturbations in any RU affect decision making, we suppress the symbol for benchmarks for clarity. Additionally, we generally look at the effect of changing B's RU on A and B; without loss of generality, the RU of A is set to 0. Thus the utility function of A can be regarded as A's in house welfare net of his RU.

With these notational tweaks, we can write the Lagrangean as,

$$L = U^A\{q_1, q_2, q_3\} + \mu[U^B\{q_1, q_2, q_3\} - \bar{V}_B] + \lambda[Y_A + Y_B + Y_{NL} - p'q] \quad (7)$$

We have our usual Income multiplier, plus an additional Lagrangean multiplier, μ (>0) which denotes the marginal effect of a change in B's RU on the welfare of A. This is a variable which really captures the essence of this section, and deserves a few more words before we progress. The derivative of the Lagrangean for A w.r.t. the RU of B is

$$\frac{\partial L}{\partial \bar{V}_B} = -\mu \tag{8}$$

Equation (8) implies that as the RU of B rises, A's benefit from staying in the HH falls as resources need to be reallocated to satisfy the higher RU of B; given the levels of other variables, μ captures the marginal cost to A when B's outside options improve. It is important to note that this multiplier does not denote the bargaining power of B. Bargaining power inside the HH should be a reflection of the importance attached by each HH member towards maintaining the HH. In the above program, A considers the cost implications of compensating B while optimizing; however, even if there are any changes in the status quo regarding bargaining strengths inside the household, A does not build that into his optimization. All that he cares about is the cost of compensation, without any consideration towards bargaining power. This situation would be re-visited later, and we would tweak the above program and see how bargaining powers (and concerns regarding them) are engendered.

We briefly digress here to compare this program with the program of the Collective Household. Note that Chiappori (1992) and a host of other authors take a similar approach to model the individual's choices and start with a Lagrangean similar to (7). However, instead of continuing to focus on the individual, they look at the weighted preferences of each individual, and construct the welfare function of the household out of the weighted preferences, subject to the budget constraint. This immediately assumes an initial equilibrium (for both individuals and the household) regarding the weights; these individual weights are precise indicators of respective bargaining power. Given the initial equilibrium, the Collective Hypothesis looks at perturbation caused by distribution factors, which affect the optimization program only through the bargaining weights. However, our approach tries to understand how this initial equilibrium is approached, from the point of any one individual.

As of now, we look at the 1st order conditions from (7), which are given by

$$\frac{\partial L}{\partial \lambda} = 0 \Leftrightarrow Y_A + Y_B + Y_{NL} - p'q^* = 0 \tag{9}$$

$$\frac{\partial L}{\partial \mu} = 0 \Leftrightarrow U^B(q_1^*, q_2^*, q_3^*) - \overline{V}_B = 0 \tag{10}$$

$$\frac{\partial L}{\partial q_i} = 0 \Leftrightarrow \frac{\partial U^A}{\partial q_i^*} + \mu \frac{\partial U^B}{\partial q_i^*} = \lambda^* p_i \ \forall i = 1,2,3 \tag{11}$$

Thus, Corollary 1: *Necessary and sufficient F.O.C.s imply that for interior solutions, the weighted sum of individual marginal utilities for each good should equal its price, deflated by the income multiplier. Additionally, each constraint should bind.*

It would be instructive to check if the 2nd order conditions on the constrained optimization problem, given convex preferences and hence, concave utility functions for both A and B, lead to a maxima. The 4thand 5th leading principal minors alternate in sign, with the 5th being negative. This implies that the FOCs implied by the above optimization program of A imply a maximum. The detailed proof is given in the Appendix, A2.

As with all problems of optimization, it is an instructive exercise to see how exogenous parameters affect A's choice-set. We note that in the above setting, an exogenous parameter like spousal income would have a dual effect through the budget and participation constraints. For the sake of simplicity, we ignore the simultaneous choice between labor supply and leisure (for both A and B), by assuming that hours of work are given. This implies that income is necessarily exogenous to the choice-set of either individual. To keep the theory and the empirics consistent, we would consider only salaried households in the empirical section. Note that this simplification is usually adopted by the literature on bargaining, especially when labor supply is not modeled. Later, we would consider questions of labor supply in a dynamic setting; however, the discussion would be centered on the individual's strategies in the context of potential wages that his spouse could earn, not between the trade-off between spousal labor and leisure.

Let us consider a change in A's in-house welfare, due to a one-time, ceteris paribus, positive change in B's wage, given fixed hours of work; this is given by,

$$\frac{\partial L}{\partial Y_B} = \lambda - \mu \frac{\partial \overline{V}_B}{\partial Y_B} \tag{12}$$

The first term is the multiplier on the income constraint, and points to the fact that as B's income rises by a dollar, it provides an identical benefit had A's income increased by a dollar; to see this equality, we can differentiate the Lagrangean w.r.t the income of A, Y_A. However, the 2nd term is the marginal cost of a unit increase in B's RU, multiplied by the marginal change in B's RU brought about by a dollar change in B's income. Thus the Left Hand Side is the net marginal benefit of A's in house welfare when B's income changes. We recollect a statement made some time ago: the program in (7) implies that all perturbations in B's RU affect A as pure monetary costs/benefits.

A should always operate at the range of Y_B where the above expression is non-negative; otherwise, increments in B's income hurt A as the compensation required to satisfy the participation of B (2nd term above) is higher than the benefit brought on by higher income (1st term above). The key question here is how the left hand side changes due to a ceteris paribus increase in B's income.

Consider the 2 FOCs relating to the budget and participation constraint. Totally differentiating both FOCs with respect to Y_B, we have

$$\sum_{i=1}^{3} p_i \frac{\partial q_i}{\partial Y_B} = 1 \quad \& \quad \sum_{i=1}^{3} \frac{\partial U_B}{\partial q_i} \frac{\partial q_i}{\partial Y_B} = \frac{\partial \overline{V}_B}{\partial Y_B} \tag{13}$$

Next, we multiply both sides of the FOC w.r.t goods (equation 12) by the term $\partial q_i / \partial Y_B$ and sum the FOCs w.r.t all goods. Thus we have

$$\sum_{i=1}^{3} \frac{\partial U_A}{\partial q_i} \frac{\partial q_i}{\partial Y_B} + \mu \sum_{i=1}^{3} \frac{\partial U_B}{\partial q_i} \frac{\partial q_i}{\partial Y_B} = \lambda \sum_{i=1}^{3} p_i \frac{\partial q_i}{\partial Y_B}$$

OR $$\frac{\partial L}{\partial Y_B} = \lambda - \mu \frac{\partial \overline{V}_B}{\partial Y_B} = \sum_{i=1}^{3} \frac{\partial U_A}{\partial q_i} \frac{\partial q_i}{\partial Y_B} \tag{14}$$

The last term is always non negative. In case some goods are inferior, the negative contributions from the marginal of such goods w.r.t income should be swamped by those of the normal goods; otherwise the budget constraint would not bind. The above result reinforces the point made earlier that A would maintain the HH for those levels of Y_B where a marginal change in Y_B would yield a non-negative benefit to A.

This brings us to the next point. How does A's benefit change due to successive increments in Y_B; that is, is A's welfare diminishing or increasing as B's income rises? We evaluate the expression

$$\frac{\partial}{\partial Y_B}\left(\frac{\partial L}{\partial Y_B}\right) = \frac{\partial}{\partial Y_B}\left(\lambda - \mu\frac{\partial \overline{V}_B}{\partial Y_B}\right) = \frac{\partial}{\partial Y_B}\left(\sum_{i=1}^{3}\frac{\partial U_A}{\partial q_i}\frac{\partial q_i}{\partial Y_B}\right)$$

Differentiating the 3rd term above would yield 2nd derivatives of the utility function w.r.t any good *i* as well as cross partials between goods *i and j*. Comparative statics could be used to evaluate and sign the 2nd term above. Both techniques would require some computations and assumptions.

Let us assume that the demand for any good is linear in B's income; this is not unusual, especially given the fact that in the empirical section, linear specifications (of demand w.r.t income) would be used to test the implications of this section. If this assumption holds, then the term $\frac{\partial q_i}{\partial Y_B}$ is constant for successive marginal increments of Y_B. However, with rising income, the quantity consumed of each good rises (if the good is not inferior); due to diminishing marginal utility of consumption, the term $\frac{\partial U_A}{\partial q_i}$ is continuously decreasing as consumption if good q_i increases. This implies that the marginal welfare of A inside the HH diminishes as B's income increases, ceteris paribus.

Thus continuous positive changes in B's income have two income effects; the regular income effect is due to the relaxation of the budget constraint, and diminishes in increasing income whether that income is generated by A or B. The other effect is actually a cost and reflects the compensation to B; as B's RU rises, this cost gets amplified.

Let Y_B be the income level of B where these two income effects wash each other out such that

$$\frac{\partial L}{\partial Y_B}' = \lambda' - \mu' \frac{\partial \bar{V}_B}{\partial Y_B}' = 0 \qquad (15)$$

This level of B's income generates a 'bliss point' for A, given the level of other parameters; any additional income introduced into the HH would imply a welfare level lower than L′. We consider this welfare as the target level that is optimal for A to pursue, given the optimization problem he faces in a 2 person household. Note that we have not discussed bargaining power under the RU Augmented framework yet; μ measured the compensation that A has to provide for a unit change in B's RU. λ, as usual, measured the value of an additional dollar to A. The net in-house benefit to A was based on these multipliers only.

We observe an obvious, but interesting implication. Starting from the some initial welfare level (say, the formation of the HH) ceteris paribus increases in B's income takes A to his 'bliss point'; however this 'bliss-point' is a 2nd best compared to the bliss point that A would have reached if the HH started from the same initial level, and A experienced identical ceteris paribus changes in his own income.

Immediately, we have the first rationale for subverting B's income. Even driven by considerations of monetary costs and benefits, an individual may find it rational to limit income gains to his/her partner as the cost of compensation may wash out the benefits of higher resources at high levels of income.

Proposition 1: *Driven solely by considerations of economic costs and benefits, the dominant decision maker will face a 'bliss point' due to ceteris paribus changes in his partner's income. Any increase in partner's income beyond the 'bliss point' income level is against the decision maker's interest as costs of compensation nullify and swamp any income benefits.*

With these initial findings, we now change the optimization program in (7) with the agenda of introducing bargaining power into the framework.

Section 7.2: Introducing Bargaining Power

In the previous discussion, the multipliers did not point anything towards the relative importance that each agent attached to partner and self. The literature on the Collective bargaining usually derives the indices of bargaining power from this 'relative importance'.

Let us revisit the same agents facing the same optimization program from the previous section, and look at it from A's perspective. Thus the Lagrangean is, once again,

$$L = U^A\{q_1, q_2, q_3\} + \mu[U^B\{q_1, q_2, q_3\} - \overline{V}_B] + \lambda[Y_A + Y_B + Y_{NL} - p'q] \quad (7)$$

We look at μ from a related, but different angle; it denotes a cost that A is willing to bear as long as he wants to maintain the household. Thus μ can be viewed as the absolute importance A attaches to B's participation in the HH (the same way as λ illustrates the importance of a dollar to A). Thus an individual who assigns a greater importance to his partner's presence inside the HH has to bear a higher cost of compensation as the partner's outside options improve. The initial value of μ, given identical levels of parameters affecting the maximization program, depends on a variety of factors (and almost all such factors are beyond the scope of this study!) along social, economic, communal and psychological dimensions.

Given an absolute importance of μ attached to B, A attaches an absolute importance of '1' to his own participation in the HH. Recall that we had assumed the RU of A to equal 0. Thus '1' is not the importance that A attaches to his utility; rather it is the importance index attached to self-participation, that is, the value of the term, $[U^A\{q_1, q_2, q_3\} - \overline{V}_A]$, where the last term is pegged at 0.

Along the lines of the Collective literature, we construct relative weights out of the two absolute weights (or importance indices) and deflate the utility functions of the two agents by their respective weights; the key difference is that we recognize that the RUs of the agents still play a role in determining the movements of these weights. Once again, we assume that external parameters that affect A's RU do not change, and hence peg A's RU at 0. Thus we can focus on the effect of perturbations in B's RU on the in-house benefits.

The rescaled Lagrangean, which is faced by A, can be written as

$$\widetilde{L} = \frac{L}{1+\mu} = \frac{1}{1+\mu} U^A(q_1, q_2, q_3) + \frac{\mu}{1+\mu}[U^B(q_1, q_2, q_3) - \overline{V}_B] + \frac{\lambda}{1+\mu}[Y_A + Y_B + Y_{NL} - p'q]$$

Let $\frac{\mu}{1+\mu} = \theta \Leftrightarrow \frac{1}{1+\mu} = (1-\theta); \frac{\lambda}{1+\mu} = \lambda(1-\theta)$

Hence the Lagrangean for the RU Augmented optimization program, using relative weights, is

$$\widetilde{L} = (1-\theta)U^A(q_1, q_2, q_3) + \theta[U^B(q_1, q_2, q_3) - \overline{V}_B] + \lambda(1-\theta)[Y_A + Y_B + Y_{NL} - p'q] \qquad (8')$$

Corollary 2: Since both original and rescaled Lagrangeans address the same problem, the F.O.C.s are identical. **See Appendix 2 for detailed proof.**

The coefficients on the welfare levels of each agent can now be viewed as their respective bargaining powers. The transformation of the objective function is automatic, as A attaches a relative weight to himself instead of an absolute weight of 1. The above treatment implies that when RUs are used in the bargaining process, bargaining weights are endogenous and should be treated as such. The very nature of the program allows us to map out the effect of bargaining power on the welfare of A explicitly. To see this, we once again consider a one-time, ceteris paribus, marginal change in B's income, Y_B. The effect on A's welfare is given by,

$$\frac{\partial \widetilde{L}}{\partial Y_B} = U_A \frac{\partial(1-\theta)}{\partial \mu}\left[\frac{\partial \mu}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \lambda(1-\theta) - \theta\frac{\partial \overline{V}_B}{\partial Y_B} \quad where \quad \theta = \frac{\mu}{1+\mu} \qquad (9')$$

[See Appendix 2 for detailed proof]

The last two terms in the above expression denote similar income effects that appeared in relationship 13; each income effect is now discounted by the relative bargaining weights, since A views benefits in relative terms, instead of absolute terms. The 1st term is a product of A's in house net welfare and the response of a unit change in B's income on the relative weight, that is, the bargaining power of A. Thus this is a substitution effect which maps out the effect on A's welfare as the relative weights realign with an increase in B's income. As the RU of B rises due to higher income, ceteris paribus, the cost of compensating B rises as A has to forego available

resources to meet the participation constraint. However, as the cost of compensation (the multiplier on the participation constraint) increases, this implies a reduction in the relative weight that A places on himself. Thus,

$$\frac{\partial \mu}{\partial \overline{V}_B} > 0 \quad \& \quad \frac{\partial (1-\theta)}{\partial \mu} < 0$$

Hence, the substitution effect is always negative in B's income.

Finally let us re-examine how the left hand side of 9′ change due to continuous increases in B's income. Considering the FOC w.r.t any good i we have,

$$\frac{1}{1+\mu}\frac{\partial U_A}{\partial q_i} + \frac{\mu}{1+\mu}\frac{\partial U_B}{\partial q_i} = \frac{\lambda}{1+\mu} p_i \Leftrightarrow (1-\theta)\frac{\partial U_A}{\partial q_i} + \theta \frac{\partial U_B}{\partial q_i} = \lambda (1-\theta) p_i$$

Once again, we multiply both sides of the above relationship by the term $\partial q_i / \partial Y_B$ and sum the FOCs w.r.t all the goods. This gives us

$$(1-\theta)\sum_{i=1}^{3}\frac{\partial U_A}{\partial q_i}\frac{\partial q_i}{\partial Y_B} + \theta\sum_{i=1}^{3}\frac{\partial U_B}{\partial q_i}\frac{\partial q_i}{\partial Y_B} = \lambda(1-\theta)\sum_{i=1}^{3} p_i \frac{\partial q_i}{\partial Y_B}$$

$$Also, \sum_{i=1}^{3} p_i \frac{\partial q_i}{\partial Y_B} = 1; \sum_{i=1}^{3}\frac{\partial U_B}{\partial q_i}\frac{\partial q_i}{\partial Y_B} = \frac{\partial \overline{V}_B}{\partial Y_B}$$

$$Hence, (1-\theta)\sum_{i=1}^{3}\frac{\partial U_A}{\partial q_i}\frac{\partial q_i}{\partial Y_B} = \lambda(1-\theta) - \theta\frac{\partial \overline{V}_B}{\partial Y_B}$$

9′ can then be written as $\frac{\partial \widetilde{L}}{\partial Y_B} = U_A \frac{\partial (1-\theta)}{\partial \mu}[\frac{\partial \mu}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}] + (1-\theta)\sum_{i=1}^{3}\frac{\partial U_A}{\partial q_i}\frac{\partial q_i}{\partial Y_B}$ (10′)

We are now at a place to discuss strategies that A could adopt, given the responses to his in house welfare brought on by changes in B's income.

Section 7.3: Aggregate Inefficiency

Section 7.1 showed that at some $Y_B=Y_B'$, A reaches his 'bliss point' in B's income and the expression 14 equals 0. Once we introduce relative weighting into the RU Augmented framework in Section 7.2, the expression within the Σ sign in the last term of 10′ (above) is identical to the right hand side of 14. However, A's bargaining weight is the coefficient on this income effect now. An entirely new term denoting a substitution effect appears; together, these two terms determine the marginal impact of B's income on A's in house welfare.

Instead of a one-time change in B's income, we consider an alternative where B's income could increase continuously, ceteris paribus. Let us allow the dependency of B's income over time by allowing returns to experience in B's job; thus at $t=t^0$, let $Y_B=Y_B{}^0$and at $t=t'$, $Y_B=Y_B'$. Now consider that A has three options at time period $t=t^0$.

A) Not allow B to work, which is the status quo

B) Allow B to work, but in a job that does not reward experience (Y_B is constant)

C) Allow B to work, in a job that rewards experience (Y_B is increasing over time)

It is important to note that the above options are about A examining time-paths with respect to the wage-rates faced by B, and not her supply of labor. For clarity, we may assume that all options of work are restricted to salaried jobs, with given hours of work. *Option A* can be viewed as the initial bench-mark, which applies when the household comes into existence. If a one-time increase in income expands the feasible set of consumption to A such that there is a positive marginal benefit to A after compensating B for her higher RU, it is sensible for A to go for *option **B***. Note that *option B* excludes un-paid household work, as long as such work does not have any implication for the RU of B; indeed, un-paid household work would relax the budget constraint of the household, without affecting either reservation utilities. However, option B could subsume work performed on household agricultural plots; including temporary transfer of ownership of plots from A to B. Essentially we consider only those options which affect the reservation utility of B, given the reservation utility of A. *Option B* is a subset of these options where B's RU experiences a discreet, one-time change.

However, if successive relaxations in the budget constraint yield positive (but progressively smaller) marginal benefits to A after compensating B, then it makes sense for A to go for *option **C***, since this leads A towards the bliss point outcome. Indeed, *option C* should be the apparent choice as it leads to continuous welfare enhancements for both individuals and the household.

Under *option C*, ceteris paribus, the income of B is time dependant; hence $Y_B = Y_B(t)$ with $\partial Y_B / \partial t = 0$. Thus, *option C* would be opted for by A if at $t=t^0$,

$$\frac{\partial L}{\partial Y_B(t)}\Big| t = t^0 \Big| > 0$$

Due to returns to experience, B's income increases over time, implying

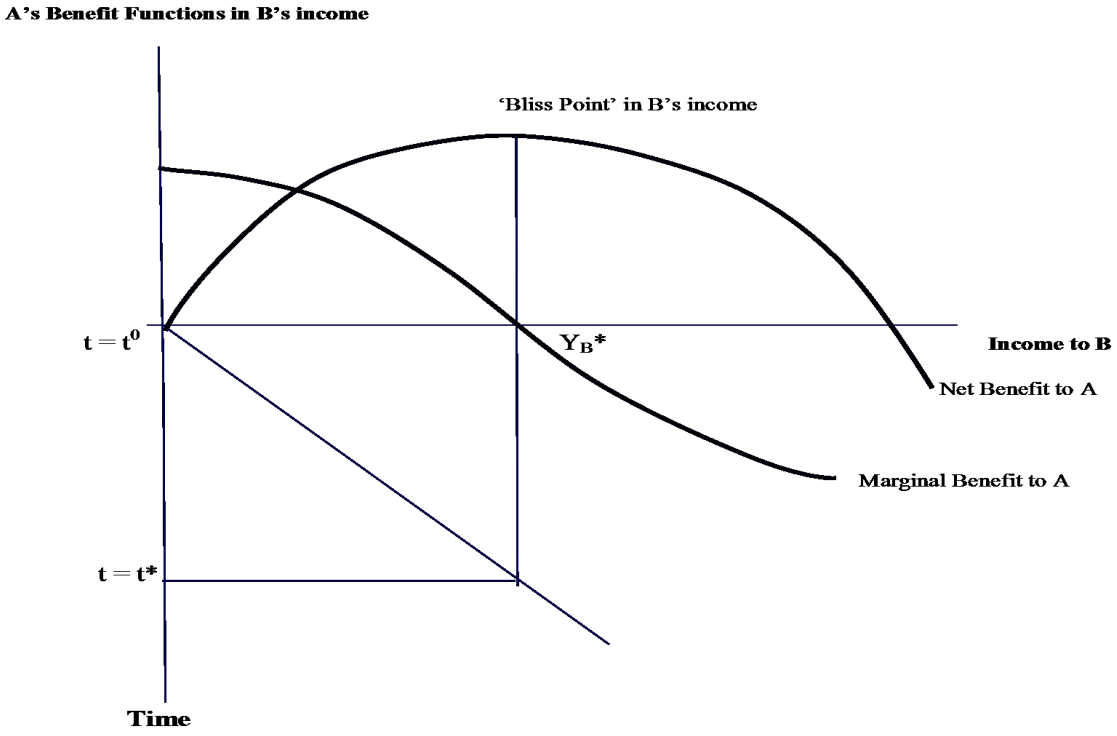
$$\frac{\partial}{\partial Y_B(t)}\left(\frac{\partial L}{\partial Y_B(t)}\right) < 0.$$

However, given 10′, pursuing the previous bliss point level is irrational now. Say at $t=t^*$ ($t^* < t'$), the substitution effect equals the net income effect in absolute terms. Thus at $t=t^*$

$$\frac{\partial \tilde{L}}{\partial Y_B(t^*)} = U_A \frac{\partial(1-\theta)}{\partial \mu}\left[\frac{\partial \mu}{\partial \bar{V}_B}\frac{\partial \bar{V}_B}{\partial Y_B(t^*)}\right] + (1-\theta)\sum_{i=1}^{3}\frac{\partial U_A}{\partial q_i}\frac{\partial q_i}{\partial Y_B(t^*)} = 0$$

Under the RU framework with relative weighting, and thus endogenous bargaining power, a strategy to allow B to work in a job which generates higher income over time leads to continuous erosion in A's bargaining power. Eventually, this negative substitution effect is strong enough to wipe out the benefits of the income effect; any subsequent increase in B's income may well lead to a positive net income effect for A, but the consequent reduction in A's bargaining power would swamp that positive effect.

Figure 7.1 Marginal and Net Benefit of Dominant Decision Maker in Spouse's Income



At t=t*, A's best strategy would be to swap B from a job with returns to experience into a job with similar income levels, but without any rewards to experience; essentially, make B's income independent of time. This situation is decidedly unreal, as it assumes that A could effectively affect B's RU; A could opt for a 2nd best strategy, which is to pull B from the labor market altogether. However, even in the first scenario, HH income suffers due to income subversion tactics played by A.

Proposition 2: *When the dominant decision-maker derives welfare from his position (even though his position may not affect his preferences), the 'bliss point' in spouse's income is at a lower welfare level compared to a ceteris paribus situation when the dominant decision maker is driven solely by monetary benefits and concerns. Hence, the spousal income level at which income subversion is optimal is always lower when the dominant decision maker is driven by concerns of preserving bargaining power.*

However, let's now look at B's situation. If she does not pull out of the labor market, she enjoys a higher income level and a higher bargaining power in the next period t=t*+1; a higher bargaining power leads to a greater say in the allocation of her own income. Thus, it is a rational strategy for B to continue participation in her job.

Moreover, note that we considered only ceteris paribus changes in B's income; that is, no factors which could have affected A's RU changed from $t=t^0$ to t=t*. Let us assume that at $t=t^0$, A's net in-house welfare level was 0, that is

$$U^A\{q_1, q_2, q_3\} - \overline{V}_A = 0 \quad at \quad t = t^0$$

Allowing B to participate in the labor market relaxes the budget constraint; A derives utility from consumption of public goods and the private consumption of B. Pushing B onto her RU level under such a situation would immediately generate a positive in-house welfare for A, net of his RU. As long as the change in A's in-house welfare due to increase in B's income is positive, A's in-house net welfare level would keep increasing. Thus at t>t*, although the marginal response turns negative, A still enjoys a positive in-house welfare, net of his RU. Thus, it may seem that it is in A's interest to allow B to retain her job till his Net Benefit itself turns negative.

Given these facts, B knows that any threat by A to divorce if she does not pull out at t=t* is non-credible. However, at $t=t^0$, A knows that opting for strategy ***C*** would lead to B continuing labor market participation beyond period t*. Such an action by B would mean that A loses bargaining power continuously (recall that 1-θ is bound between 0 and 1, and decreases in Y_B); his net in-house welfare, weighted by his bargaining power would start decreasing. Finally, at some t>t*, his net benefit from participation would be driven down to 0; essentially his role as the dominant decision maker would be completely reversed and he would be pushed onto his RU.

To summarize, at $t=t^0$, the optimal strategy for A is not to opt for strategy ***C*** and make his partner drop out at t=t*; at t=t*, B would respond by continuing participation. This would lead to a

gradual erosion of A's position of dominance and eventually push him onto his Reservation Utility level. Playing strategy B at $t=t^0$ would lead to a one-time relaxation in budget constraint and one-time erosion in bargaining power. If the increase in B's income from status quo to that under strategy B yields a positive value for expression 10′, playing strategy ***B*** strictly dominates strategy ***C***. But this puts the household on an Aggregate Inefficient path immediately, with deliberate subversion of higher future incomes.

We note the extent of the problem here. Had A been able to pull B out of a job with returns to experience at t=t*, the strategy would have been inefficient for the HH, but optimal for A. Since A presumably cannot exercise such control on external agencies, his 2nd best strategy is to pull B out of the labor market altogether at t=t*. This is a sub-optimal strategy for A too. The main complication is that it is in B's interests to not respond to these strategies at t=t*, and continue in her job regime. Foreseeing that, A would not allow her to get into a job rewarding experience, **even at $t=t^0$**, thus foregoing the entire income from $t=t^0$ to t=t*. Hence,

Proposition 3: *Aggregate Inefficient behavior on the dominant decision maker's part is inefficient for the dominant decision maker, his/her spouse and for the household altogether. However, it is a rational strategy when the dominant decision maker cares about his position of dominance. Hence, income subversion tactics by preventing participation in labor markets should be expected in societies where positions of dominance matter, due to socio-economic pressures.*

The above results are the prime motivation behind this paper. It shows that when people compare their in-house welfare levels to their next best options, bargaining power should be treated as endogenous to the system. Since bargaining power of an individual determines his welfare level, it is rational for him to preserve his control over decision making. Naturally, any change that erodes his control in favor of his partner would hurt him, especially when he faces social pressure in maintaining his dominant position. Until now, we have considered bargaining power

only as an idea with economic underpinnings; when we combine this with the fact that in most societies in the world, the male has to come off as the dominant agent inside the HH, the 'weight on the in-house welfare' takes on an entirely new meaning. Indeed, it may be fair to say that bargaining power itself generates utility in such situations (instead of simply affecting welfare, as discussed above). The potential for Aggregate Inefficient behavior would be amplified then. In any case, preservation of bargaining power is incentive for individuals to promote actions which prevent their partners from adopting actions that enhance bargaining power. To diversify the focus from effect of income on bargaining power let us look at the effect of a non-monetary parameter which changes the RU of B. Consider an improvement in divorce laws towards women, say, in the form of higher alimony payments. Relation (10′) clearly outlines how this change affects HH bargaining, even though it could affect B only if she opted out. A has to reallocate resources to B to compensate her for better opportunities outside (since she is better off than before if she opts out now). However, such legislation would simultaneously lower the RU of A as he would need to pay her higher alimony, leaving him with fewer resources to finance his stand alone consumptions. The importance of keeping B in the household has increased (since the cost of separation is much greater),thus allowing the bargaining power to realign towards B; she enjoys a greater say in the allocation of resources along with a better allocation of the given resources.

It is worth pointing out here that none of the results derived above are in conflict with Pareto efficiency in consumption. Indeed this discussion rationalizes Udry's findings in Burkina Faso with Pareto efficiency; sub optimal level of inputs were used in women controlled plots so that men retain 'optimal' control over the generation, and subsequent allocation of resources (and this allocation may have been Pareto efficient). This discussion also ties in the Lundberg-Pollack threat point of non-cooperation, but not divorce, in the family. The RU Augmented model accounts for this, by pointing out that the benchmark in this case is not the RU, but the non-

cooperative welfare level; however, any changes in the RU would still cause changes in the non-cooperative welfare level, and thus realign bargaining weights.

Cross section data can convey information about whether the possibility of Aggregate Inefficiency exists. We have already argued that a prime motivation for such behavior is the preservation of bargaining power. We would need to back out the implications of endogenous bargaining power in cross sectional data; we need to see how the presence of RUs affects the demand systems. Thus we are testing a necessary condition for Aggregate Inefficiency, by empirically testing for the implications of the presence of RUs in HH bargaining. Non rejection of these tests, if they could be designed, would imply that benchmarks are being used while making optimization decisions. And that is a strong motivation to indulge in behaviors that generate Aggregate Inefficiency.

Section 7.4: Testable Implications of RU Augmented Hypothesis

Proportionality and Conditional Demand Tests

In Section 5.1, we examined the two implications of the Collective model;

a) The ratio of marginal response to unit change in ANY distribution factor on two given goods is the same across ALL distribution factors.
b) Once the demand for any good is conditioned on any other good, the effect of distribution factors on the conditioned demand is nil.

It would be instructive to see how these implications change under the RU framework. Given the primacy of RUs in this framework, the reduced form demand function for any good i can be written as,

$$q_i = f_i(p', Y, \overline{V}_A(p', Y_A, Z_A), \overline{V}_B(p', Y_B, Z_B); X) \qquad (15)$$

A cursory comparison of (3) with (15) reveals some salient differences of the demand function under the Collective and RU Augmented; in the latter case, individual incomes affect demands

by their effect on the individual RU. Additionally, distribution factors affect demands by recalibrating individual RUs. It is entirely possible that the vectors of distribution factors that affect A and B's RUs share some common entities; of course, they can also share common elements with the vector of taste shifters, **X**. With these thoughts, we look at the implications from the proportionality test under the RU Augmented framework. Given any two goods, 1and 2, and any distribution factor K (allowed to affect either RU), we have

$$\frac{\frac{\partial q_1}{\partial z_k}}{\frac{\partial q_2}{\partial z_k}} = \frac{\frac{\partial f_1}{\partial \overline{V}_A}\frac{\partial \overline{V}_A}{\partial z_k} + \frac{\partial f_1}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial z_k}}{\frac{\partial f_2}{\partial \overline{V}_A}\frac{\partial \overline{V}_A}{\partial z_k} + \frac{\partial f_2}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial z_k}} \neq \frac{\frac{\partial q_1}{\partial z_l}}{\frac{\partial q_2}{\partial z_l}} \tag{16}$$

The above condition shows that in the RU framework, there is no reason for the ratio of marginal impacts of one factor across two goods to be equal across all distribution factors for the given pair of goods. In fact, there is only one situation where the ratio of coefficients should be equal to each other; consider a pair of distribution factors which affect only one RU and not the other. WLOG let us assume that Z_K and Z_L affect the RU of A but have no impact whatsoever on that for B. It is easy to see from relation (16) that the ratio of responses of good 1 and good 2 to a change in Z_K is independent of the index K. Thus, this ratio will be equal for the given pair of goods across all distribution factors which only affect the RU of A.

We now look at the implication of the RU Augmented model on conditional demands. On lines similar to section 3.1, we can write the demand for, say, good 2 as,

$$q_2 = f_2(p', Y, \overline{V}_A(p', Y_A, Z_A), \overline{V}_B(p', Y_B, Z_B); X)$$

The key difference is that there is no θ to be inverted in the expression above; naturally so, as bargaining powers are now determined inside the system, and are not exogenous to demands. We express any RU as a function of demand; WLOG we work with the RU of A,

$$\overline{V}_A = \overline{V}_A^{-1}(p, Y, q_2; X)$$

We can use the above expression to write the conditioned demand for good 1 (on good 2) as

$$q_1^2 = f_1^2(p, Y, q_2, \overline{V}_B(p, Y_B, Z_B); X) \tag{17}$$

All distribution factors which affect RU of B will still show up in a conditioned demand framework, and thus the proposed exclusion restriction of distribution factors as proposed by the Collective model will fail under the RU scenario.

If the RU approach is indeed being used in a HH, and bargaining powers are determined endogenously, the ratio of responses on a pair of goods due to a change in any distribution factor need not be equal; further, distribution factors will still affect conditional demand. However, a rejection of the implications of the Collective Model on these tests does not validate the RU Augmented framework. It implies that the effects of distribution factors are not channeled through an exogenously determined bargaining power, θ.

Income Identity Test

The motivation for this test is that in a usual regression equation estimating effects of parameters on demand, we look at the coefficients on individual incomes. If the regression equation also has total HH income as a regressor, then the coefficient on individual income is considered as the distributional effect of individual income on demand. However, if total income is included as a regressor, then when we consider the coefficient on individual income, we should treat total income as held constant. This econometric restriction opens up the possibility of another testable implication.

Note that whatever model of HH bargaining we may consider, an identity involving incomes must hold. Usually, we have 3 possible components; the individual salaries/wages of the head and the spouse, and unearned income which must add up to total income; $\mathbf{Y = Y_A + Y_B + Y_{NL}}$

We should recognize that each unit of $\mathbf{Y_{NL}}$ accrues to either A or B; that is, if the HH splits the unearned income stream would split up according to each individual's entitlement. After

recognizing that each additional dollar of non-labor income is controlled by the individuals in the same way as an additional dollar of salary, we could rewrite the above identity as $\mathbf{Y = Y_A + Y_B}$

We now consider a regression equation where we are looking at the coefficient on, say, A's income while total income is also included on the right hand side. To rationalize the change in A's income holding HH income constant, we can consider a simulation where B's income has changed in the opposite direction by exactly the same amount. Thus

$$dY = dY_A + dY_B = 0 \Leftrightarrow \frac{dY_B}{dY_A} = -1$$

Of course, this does not imply that there is a one to one relationship between individual incomes; it is just an implication of treating total income as constant. Let us re-consider the demand systems from the Collective and RU approach once again.

For any good I, the Collective model implies the following demand equation,

$$q_i = f_i(p', Y, \theta(p', Y_A, Y_B, Z))$$

Thus we have, due to a unit change in accrued income of A,

$$\frac{\partial q_i}{\partial Y_A} = \frac{\partial q_i}{\partial \theta}\frac{\partial \theta}{\partial Y_A} = \frac{\partial q_i}{\partial \theta}\frac{\partial \theta}{\partial Y_B}\frac{\partial Y_B}{\partial Y_A} = -\frac{\partial q_i}{\partial \theta}\frac{\partial \theta}{\partial Y_B} = -\frac{\partial q_i}{\partial Y_B}$$
$$(\textit{Due to restriction from Inc Identity}) \qquad (18)$$

A similar implication has been made in Browning et al, 1994 where the authors propose that individual incomes have an equal (in value) and opposite (in sign) effect on the sharing rule, *once total income is controlled for*. This implies that the responses of individual incomes on each demand (provided we are looking at a normal good for either individual) should sum to 0. This is a stronger test than that of proportionality since now we do not need to go across equations, and neither do we need to take ratios to make a judgment.

It is clear why the responses should be equal and opposite. A unit increase in the income of say, A, increases his bargaining power at the cost of B's. This change is similar to a situation where B's income decreased by a unit, causing her weight to go down and allowing A's importance to rise. Had we considered an unit increase in B's income, the change would have gone the opposite way, since bargaining weights would now move in favor of B at the cost of A's. The opposite changes in θ drive the above result.

A case could be made that the marginal response of A's income on the bargaining weight may not be the same as that of B's income. But even under this weaker assumption, it is clear that the response of the weight to an increase in either individual income should have opposite signs. As long as the good under study is a normal good for either agent, the signs of the observed partial derivatives should be opposite. Bourguignon et al, 2009 propose a test based on a similar logic, which posits that individual income effects are of opposite signs.

Under the RU Augmented framework, effect on demand due to changes in individual income, keeping total income constant, would materialize through responses in RU. Given that the response on demand would act through such a route, it is worth examining the mechanics before the implication of the Income Identity test under the RU Augmented framework is established.

Let us consider a thought experiment by which we give money to a partner and take away the same amount from the other partner, keeping total income constant during the exercise. This is the most 'realistic' simulation we can think of to study the effects on demand from a change in individual income, while keeping total income constant. The demand function for the good q_i under RU Augmented framework is expressed as

$$q_i = f_i(p', Y, \overline{V}_A(p', Y_A, Z_A), \overline{V}_B(p', Y_B, Z_B); X)$$

The good is a normal good for both individuals (A and B); thus standard price effects and income effects hold. Moreover, we cannot observe the initial or final allocation of the good for each individual; all we can see is the aggregate change in quantity demanded by the household .Let $\boldsymbol{q_{iA}}$ and $\boldsymbol{q_{iB}}$ be the individual amounts of the good consumed at the initial equilibrium.

Let A's income increase by X$. The observed change in HH demand can be split into two components; the coefficient on total income (**Y)** provides the income effect. *Controlling for this effect simulates a situation where B's income has fallen by X$.* However there are two substitution effects at play here. The first substitution effect is when both partners substitute towards (or away) a normal good (inferior good) when their respective incomes change; this is similar to the S.E. found in individual optimization problem.

The 2nd substitution effect is the reallocation of the good between the two partners, and is the crux of bargaining. The coefficient on A's income ($\mathbf{Y_A}$) provides us with this substitution effect.

The responses on the respective RU, due to the income change can be expressed as

$$\frac{\partial \overline{V}_A}{\partial Y_A}\Delta Y_A, \textit{ where } \Delta Y_A = X; \qquad \frac{\partial \overline{V}_B}{\partial Y_B}\Delta Y_B, \textit{ where } \Delta Y_B = -X$$

Given the income reallocation is a ceteris paribus change, the change in the HH demand for good iat can be decomposed as

$$\Delta q_i = \frac{\partial q_i}{\partial \overline{V}_A}\frac{\partial \overline{V}_A}{\partial Y_A}\Delta Y_A + \frac{\partial q_i}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\Delta Y_B \tag{19}$$

Given the assumption that a positive amount X$ was given to A, and q_i is a normal good for both, we sign the terms on the RHS of the above expression,

$$\begin{matrix}\Delta q_i = \frac{\partial q_i}{\partial \overline{V}_A}\frac{\partial \overline{V}_A}{\partial Y_A}(X) + \frac{\partial q_i}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}(-X) \\ (+)\quad(+)\;(+)\quad\;(+)\;(+)\quad(-)\end{matrix} \tag{20}$$

The real income (RU) of A changes due to a rise in income, and he teases out a higher allocation of the good q_i. The real income of B falls, and so does her demand for good q_i. The net change in HH demand is contingent on the individuals' marginal utility from consuming the good. In fact let us make an assumption about the desirability of Q_1 to A and B, at the initial levels. WLOG, let MU of q_1 (at q_{1A}) be higher for A than the MU of q_1 for B (at q_{1B}). An increase in A's income raises his demand for good 1, while B lowers hers due to lower income. However, in absolute terms, A's change in demand is greater than B's change in demand. Thus

$$\Delta q_1 = \Delta q_{1A} + \Delta q_{2A} > 0 \quad [\because MU_A(at\ q_{1A}) > MU_B(at\ q_{1B})] \tag{21}$$

Let us now consider the regression coefficient on B's income, while total income is held constant; *let B's income increase by X$.* We work through absolutely similar logic, and split up the aggregate response on q_i as,

$$\Delta q_i = \underset{(+)\ (+)}{\frac{\partial q_i}{\partial \bar{V}_A}\frac{\partial \bar{V}_A}{\partial Y_A}}\underset{(-)}{(-X)} + \underset{(+)\ (+)}{\frac{\partial q_i}{\partial \bar{V}_B}\frac{\partial \bar{V}_B}{\partial Y_B}}\underset{(+)}{(X)} \tag{22}$$

Given the initial assumption of Marginal Utilities at the initial equilibrium, we must have,

$$\Delta q_1 = \Delta q_{1A} + \Delta q_{2A} < 0 \quad [\because MU_A(at\ q_{1A}) > MU_B(at\ q_{1B})] \tag{23}$$

It is clear that the expressions in 20 and 22 (or, 21 and 23) are opposite in signs. Once we consider marginal perturbations in income, smoothness of utility functions would imply that the expressions are equal in absolute value (as individual responses on demand due to a marginal income change around the initial equilibrium should be equal and opposite). Let the expression in 20 equal Y. Hence,

$$\beta_A = \frac{\partial q_i}{\partial Y_A} = \frac{\Delta q_i}{\Delta Y_A} = \frac{Y}{X}$$

We know that if expression in 20 equals Y, the expression in 22 is equal and opposite. Also, the change in demand in 22 was triggered by an income allocation which was equal and opposite to that in 20. Thus

$$\beta_B = \frac{\partial q_i}{\partial Y_B} = \frac{\Delta q_i}{\Delta Y_B} = \frac{-Y}{-\Delta Y_A} = \frac{-Y}{-X} = \beta_A$$

For a given level of HH income, reassigning money between the constituent individuals change their RUs and hence, their demands. Indeed, depending on the direction of reassignment, the individuals have to raise or lower their individual demand. However, the coefficients on individual income capture the ratio of demand change to that of income reassignment; for either

coefficient, the numerator and denominator in the ratio are equal and opposite to that in the other ratio. Hence, the coefficients come out with equal sign and value.

We notice that the implication of the income identity test under the RU Augmented framework is opposite to that of the Collective Hypothesis. This provides an avenue to check which framework is validated by the data. As mentioned earlier, if the empirics point towards a demand system generated by the RU Augmented framework, then the scope of Aggregate Inefficient behavior is present in the system. Such behavior cannot be tested by cross sectional data since the behavior concerns the path taken by HHs over multiple time periods. However, the tests on Proportionality, Conditional Demands and Income Identity can be performed using cross-sectional data. In the next chapter, we consider the same sample from the IHDS dataset to consider whether the implications of the RU Augmented framework are validated by the data.

Chapter 8: Evidence for or against the RU Augmented Hypothesis

Due to the similarity between the Collective and the RU Augmented frameworks, we note that much of the empirical analyses done to test the implications of the Collective model automatically carry over to the RU Augmented setting. The demand system under the RU Augmented setting are amenable to tests of proportional responses by distribution factors and the independence of conditional demands from distribution factors.

We use the same dataset and the same specifications to test the RU Augmented approach. Thus, we once again consider households which report some flow of salaried income and are made up of 2 adults. In essence the sample under study in this section is same as the sample studied for the empirical analysis of the Collective model. Shares of expenditure on staple food, other food, public goods, clothing, fuel and other (private, unassigned) goods are considered for our present purposes. We do not repeat the considerations that were made while specifying the demand equations for Specifications 6a-6e; indeed, there is no change in those specifications.

Equation (16) points out that the coefficients of distribution factors need not be proportional when we consider any demand and a pair of distribution factors, unlike the Collective model. Indeed, the RU Augmented posits no restrictions on the proportionality tests, as long as we do not find a pair of distribution factor that affects the RU of one of the agent and not the other. None of the distribution factors (Expenses during marriage and practice of intra-community marriage) considered for the proportionality tests has such a characteristic.

The RU Augmented framework proposes that the bargaining power is determined endogenously, and distribution factors enter through respective Reservation Utilities. Conditioning on one good does not prevent distribution factors from affecting conditioned demands, as the channel of causality is not through a singular index. Thus, relation (17) points out that under such a scenario, conditioned demands would still be affected by distribution factors.

For both tests we note that the Collective model is rejected, while the RU Augmented model is not; we now turn to a detailed discussion on the income identity tests, which posit strong restrictions for either model.

Section 8.1: The Income Identity Test

The first criteria to perform this test is to assure that total income can be treated as constant; econometric restrictions provide an excellent scope to impose this naturally. The most obvious route is to use total income as a regressor in the demand system, along with individual demands. Since the coefficient on any regressor is a partial derivative, considering the coefficient on individual income along with the fact that the effect of total income is controlled for insures that the 1st criteria for the Income Identity test is fulfilled. Note that in the unconditional demand system (especially spec 6c), the effect of total income can be controlled for through the instrumented variable, logged total expenses. The projection of total income in the first stage (on total expenditure) enters the 2nd stage for all the demands, via the coefficient on total expenses. Once again, this implies that total income can be held constant when we consider the effect on individual income. Under the Collective framework, the proposed Income Identity test can be executed with the specifications discussed for the proportionality tests. We could look at either Spec 6b (Total Income included instrument) or Spec 6c (Total Income excluded instrument) and use the coefficients on individual incomes to test if they are equal in value and opposite in sign.

However, a slight change in specification is required in the RU Augmented Framework for the mechanics to be completely sensible. The implication of the income identity test proposes that once we control for total income, individual incomes should have the same coefficient; each coefficient contains both marginal responses in demand due to changes in individual incomes of the two agents. To perform this test, we take any demand, drop one of the two individual incomes (from each demand equation; both incomes are still part of the equation estimating total expenditure) and run the estimation. Thus in one specification, we have, say, A's income on the right hand side; the Income Identity test posits that if total income is controlled for the coefficient on A's income would include the response of both A and B's demands due to income reallocation towards A. In the 2nd specification we drop A's income but include B's income; the coefficient on B's income would include the demand response of both individuals. The test implies that under the RU Augmented, the two coefficients are identical in sign and value. Note that dropping any one of the individual income does not cause any loss of information, since the mechanics behind the test suggest that the information is contained in the coefficients of either individual income.

It is worth noting here that if individual incomes do have significant effects as distribution factors, dropping one or the other from the demands would cause the over identification tests to fail. This would be a serious problem for the test if excluding, say, head income biases the coefficient on spouse income. We have two checkpoints to see if this bias occurs.

First, we note that apart from dropping individual income coefficient, there is absolutely no difference between the specifications suggested here and Spec 6c; hence, the obvious check is to see how robust the coefficient on the included income coefficient is, across specifications. For example, say we are considering staples demand for the income identity test; we drop the income of the head, but include the income of the spouse. We can compare the coefficient on spouse's income in this specification with that (in Staples demand) from Spec 6c, where there were no problems of exclusion restrictions being rejected. If the coefficients are robust, then we can claim that the failure of the exclusion restriction does not cause the coefficient of the included income coefficient to be biased; and this is what the RU Augmented framework proposes. After all, it argues that information on both marginal responses in a demand due to income reallocation between two individuals (while total income is held constant) is contained in the coefficient of either individual income coefficient. Hence including one and not the other should not make any difference. The 2nd checkpoint is of course, the test itself. If the individual coefficients get biased, then there is no reason for them to be equal in value and sign, as the RU Augmented framework predicts.

We also use another specification where total income is an included instrument; this specification is very similar to Spec 6b, apart from the fact that one or the other individual income is dropped. To sum up, the two specifications used to run the Income Identity tests are:

Spec 8a) Excluded instruments from demand equation: Total Income, HH Assets and General CPI.

Spec 8b) Excluded instruments from demand equation: HH Assets and General CPI. Total Income is an included instrument in the demand system

For each demand, one of the individual incomes is dropped (say, B's) and the other is included (say A's) in the demand system (1st and 2nd stages) and estimation is performed. Then B's income is included, A's is dropped, estimation is done again; finally, we compare the coefficient

on A's income form the 1st run with that on B's income from the 2nd run for each demand. To compare coefficients across equations, we use a 3sls setting just for the tests.

Results from the Income Identity Tests

Given any demand D, the propositions from the two frameworks are as follows

- Under the Collective Framework, Head Income(D) + Spouse Income(D)=0
- Under the RU Augmented framework, Head Income(D) – Spouse Income(D)=0

Once again we note that if both individual incomes are insignificant in the given demand, both tests mentioned above cannot be rejected. Thus we perform the tests only on those demands where at least one of the individual income coefficients are significant. We consider Spec 8a and Spec 6c to first look at the robustness of the estimated individual income coefficients. The p-values from the over identification tests are provided for each specification. If the coefficients look reasonably robust across specifications, we perform the above tests across the two equations estimated under spec 8a. We repeat the procedure before performing the tests from spec 8b (which is first compared with spec 6b). The results on the main coefficients and tests are provided below. We remember that for the purpose of testing across equations, we run absolutely the same specifications under a reg3 routine of STATA, specifying 2sls. The detailed estimation results are included in the appendix.

Table 8.1 Dependence of Staple Demand on Individual Incomes

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareStaple	ShareStaple	ShareStaple	ShareStaple	ShareStaple	ShareStaple
Log_Ann_PC_Exp	-0.105***	-0.100***	-0.0845***	-0.104***	-0.102***	-0.0998***
	(0.00728)	(0.00652)	(0.00440)	(0.00797)	(0.00775)	(0.00780)
Log_Tot_Inc				-0.000547	0.00129	0.00723**
				(0.00363)	(0.00343)	(0.00300)
Head_Income	1.51e-07***	1.34e-07***		1.54e-07***	1.28e-07***	
	(3.37e-08)	(3.01e-08)		(4.10e-08)	(3.52e-08)	
Spouse_Income	1.35e-07***		8.55e-08**	1.37e-07***		7.53e-08**
	(3.91e-08)		(3.36e-08)	(4.12e-08)		(3.51e-08)
Constant	0	0	0.463*	0	0	0.573**
	(0)	(0)	(0.264)	(0)	(0)	(0.268)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.575	0.581	0.594	0.576	0.578	0.580
p-value Over ID Test	0.3881	0.0007	0.0000	0.1687	0.0004	0.0000

Note that the over identification tests imply that exclusion restrictions in Specs 6C and 6B were not rejected; that is, we can assume that the estimates of the individual income coefficients from those specifications can be considered as benchmarks. A look at the individual income coefficients across Spec 6C and 8A and those across Specs 6B and 8B reveal that the estimates are reasonably robust. We can now conduct the income identity tests with considerable confidence.

Spec 8A

- Head Income (Staples) + Spouse Income (Staples) = 0: ***p-value = 0.0000***
- Head Income (Staples) - Spouse Income (Staples) = 0: ***p-value = 0.2031***

Spec 8B

- Head Income (Staples) + Spouse Income (Staples) = 0: ***p-value = 0.0000***
- Head Income (Staples) - Spouse Income (Staples) = 0: ***p-value = 0.2080***

Table 8.2 Dependence of Food Demand on Individual Incomes

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareFood	ShareFood	ShareFood	ShareFood	ShareFood	ShareFood
Log_Ann_PC_Exp	-0.0302***	-0.0401***	-0.0598***	-0.0369***	-0.0415***	-0.0562***
	(0.0105)	(0.00962)	(0.00692)	(0.0126)	(0.0124)	(0.0122)
Log_Tot_Inc				0.00490	0.000987	-0.00172
				(0.00525)	(0.00501)	(0.00461)
Head_Income	-1.74e-07***	-1.39e-07***		-1.97e-07***	-1.43e-07***	
	(4.96e-08)	(4.50e-08)		(5.64e-08)	(4.89e-08)	
Spouse_Income	-2.75e-07***		-1.92e-07***	-2.92e-07***		-1.90e-07***
	(7.45e-08)		(7.20e-08)	(7.55e-08)		(7.24e-08)
Constant	0	0	1.337***	0	0	1.311***
	(0)	(0)	(0.431)	(0)	(0)	(0.437)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.329	0.341	0.364	0.339	0.343	0.361
p-value Over ID Test	0.5478	0..0160	0.0028	0.8481	0.0061	0.0009

Note that the over identification tests imply that exclusion restrictions in Specs 6C and 6B were not rejected; that is, we can assume that the estimates of the individual income coefficients from those specifications can be considered as benchmarks. A look at the individual income coefficients across Spec 6C and 8A and those across Specs 6B and 8B reveal that the estimates are reasonably robust. We can now conduct the income identity tests with considerable confidence.

Spec 8A

- Head Income (Food) + Spouse Income (Food) = 0: ***p-value = 0.0005***
- Head Income (Food) - Spouse Income (Food) = 0: ***p-value = 0.3818***

Spec 8B

- Head Income (Food) + Spouse Income (Food) = 0: ***p-value = 0.0006***
- Head Income (Food) - Spouse Income (Food) = 0: ***p-value = 0.4708***

Table 8.3 Dependence of Fuel Demand on Individual Incomes

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareFuel	ShareFuel	ShareFuel	ShareFuel	ShareFuel	ShareFuel
Log_Ann_PC_Exp	-0.00899	-0.0137**	-0.0306***	-0.00927	-0.0114	-0.0210***
	(0.00671)	(0.00610)	(0.00417)	(0.00813)	(0.00798)	(0.00789)
Log_Tot_Inc				0.000206	-0.00157	-0.00451
				(0.00341)	(0.00330)	(0.00293)
Head_Income	-1.31e-07***	-1.14e-07***		-1.32e-07***	-1.07e-07***	
	(3.46e-08)	(3.15e-08)		(3.99e-08)	(3.50e-08)	
Spouse_Income	-1.32e-07***		-7.27e-08**	-1.33e-07***		-6.63e-08*
	(4.05e-08)		(3.67e-08)	(4.10e-08)		(3.64e-08)
Constant	0	0	0.777***	0	0	0.709***
	(0)	(0)	(0.263)	(0)	(0)	(0.266)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.214	0.224	0.248	0.215	0.218	0.237
p-value Over ID Test	0.1413	0.0039	0.0000	0..0494	0.0013	0.0000

Note that the over identification tests imply that exclusion restrictions in Specs 6C is not rejected; however, the one for Spec 6B is rejected at the 95% level. It can be noticed that accordingly the estimate of the coefficient on spouse's income is reasonably divergent across specifications 6B and 8B; also the level of significance suffers a fall. However, the sign is unchanged

Spec 8A

- Head Income (Fuel) + Spouse Income (Fuel) = 0: ***p-value = 0.0007***
- Head Income (Fuel) - Spouse Income (Fuel) = 0: ***p-value = 0.5748***

Spec 8B

- Head Income (Fuel) + Spouse Income (Fuel) = 0: ***p-value = 0.0021***
- Head Income (Fuel) - Spouse Income (Fuel) = 0: ***p-value = 0.5541***

Unfortunately, for the other demands on Public, Private and Clothing goods, the individual income coefficients are insignificant. As mentioned before, income identity tests would be trivially not rejected for either framework under these circumstances. We provide the estimates for all the demands in the appendix, but we do not perform any further tests; we do note however, that even with insignificant coefficients, the signs on individual incomes are rarely opposite to each other.

The income identity tests for Staples, Food Items and Fuels prove conclusively that the implications from the Collective framework are rejected by the data; however, the RU Augmented framework, which makes an equally strong but very different claim, is never rejected by the data. Since we considered only statistically significant coefficients to perform the tests, we can claim that the income identity tests point to a demand system under the RU Augmented framework.

When we consider the previous tests on proportionality, we recall that the evidence for (or against) the Collective framework was mixed. However, since the RU Augmented framework made no stringent claims for any relationship between the proportions of responses on demands due to variation in distribution factors, we cannot reject the RU Augmented framework; however, neither can we say that it is the RU Augmented framework at work.

The same problem crops up when we consider the conditional demand system. The evidence is overwhelmingly against the implications from the Collective Model; however, the RU Augmented model claims that distribution factors cannot be excluded from conditioned demands and nothing more. Once again, non-rejection of such results does not immediately point out that the RU Augmented framework is generating the conditional demand system.

The results from the conditional demand system imply that distribution factors do not enter through a single index; it points to a more complex avenue through which effects of distribution factors are manifested.

The Income Identity tests are of use here, since either hypothesis makes strong claims under such a scenario. The results from the data prove, with confidence, that the implications of the RU framework are never rejected.

Chapter 9: Conclusion

The discussions in the previous chapters are an attempt to provide a better understanding of the nature of bargaining inside a household. We recognize that there would be variety in this, given the socio-economic environment each agent would find themselves in. Assuming a rigorous model of bargaining may not be broadly applicable. We ideally require a framework that makes minimal assumptions and is still able to generate testable implications. The Collective Hypothesis was an important step in this direction.

However, the Collective framework does not allow household choices to affect bargaining powers; distribution factors, which are outside the ambit of the household and individuals' control, play a key role in the Collective framework by redistributing bargaining weights inside the household. We propose the Reservation Utility Augmented Hypothesis, a minimalistic framework which preserves the assumption of Pareto Efficient consumption allocations but allows bargaining power to be determined as an endogenous outcome of the household decisions on resource generation and allocation. We note that this raises the chance of an apparently irrational behavior, whereby the generation of resources is deliberately subverted.

Income subversion tactics can coexist with Pareto Efficiency in consumption; we further note that such tactics are not irrational under the RU Augmented framework. In fact, it is a rational strategy for agents who care about their relative welfare levels inside the household. In short, we all know that improved economic outcomes lead to enhancements in empowerment. However, empowerment is a 'scarce good' in a household, in the sense that increases in the empowerment of one partner comes at the cost of empowerment of the other partner. When social norms amplify the requirement to come off as the dominant partner, the motivations for such Aggregate Inefficient strategies become stronger.

Up until now, we have recognized that bargaining weights may be a function of social norms, but have not explicitly modeled how such norms may enter the framework. A simple modification is now suggested as a first step to introduce the effect of social norms into the RU Augmented framework. We note that individuals' welfare levels are contingent on the environment that the individuals find themselves in. In the RU Augmented model, social norms dictating 'proper

behavior' for individuals, when they are part of the household, enter the in-house welfare levels of the respective individuals. The same social norms affect individual reservation utilities, even if the individuals are part of the household. For example, the RU of a married woman is invariably lower than that of an unmarried woman, even if they are identical in all other respects; the social sanction imposed by loss of networks and a sense of taboo under divorce or separation cause the RU of the married woman to fall as soon as she joins the household. The stronger the sanction, the greater is this reduction; which might be leveraged easily by the dominant decision maker to extract a larger surplus without violating his partner's participation constraint. Once we recognize that social norms affect reservation utilities, the RU Augmented framework implies that changing norms would recalibrate RUs; this would in turn affect the bargaining weights, outcomes and individual welfares.

In our theoretical framework, we observe that purely economic considerations rationalize strategies to cap spousal income beyond the 'bliss point', given that the income of the decision maker has stayed constant. Essentially, at this bliss point, the cost of compensating the spouse for the extra dollar she earns is exactly equal to the benefit that the extra dollar brings to the individual. Any subsequent increase in spousal income will generate a net negative benefit to the individual. We then introduce bargaining power into the system by arguing that rescaled transformations of the Lagrangean on the participation constraint of the spouse are essentially the bargaining weights. This allows bargaining weights be determined endogenously as an outcome of the decision making process, without making them a choice variable in individual preferences. Once we allow bargaining powers to be determined by current decisions, we see that incentives towards income subversion strategies are stronger. Given individual income, continuous increase in spousal income will continually raise the economic cost of compensation; simultaneously, the individual would face erosion in his bargaining weight (which is bound between 0 and 1) while his spouse would gain more and more control over decision making. Any threats to divorce would become increasingly non-credible, as increments to spousal income would make her reservation utility more and more attractive. Indeed, with constant individual income and increasing spousal income, the dominant individual will gradually lose his position of dominance with the household and be subsequently pushed onto his own reservation utility level. Naturally, limiting spousal income is a rational strategy under such considerations. As we note in

Proposition 3, such income subversion tactics are not only inefficient for the spouse or the household, it is also inefficient for the individual who resorts to such tactics.

This position of dominance could be eroded or improved by avenues other than spousal income. For example, a reform in divorce laws proposing alimony payments makes separation unattractive to the dominant partner (who is usually the husband). The situation is worsened by the fact that alimony payments reduce the reservation utility of the husband. It is a rational strategy for a patriarchal society to implement norms that make divorced women more segregated; this reduces the reservation utility of the woman, and her incentives to leverage divorce laws to improve her bargaining position. Such rational strategies also explain the stricter 'Purdah' norms implemented at communities in Bangladesh by religious leaders (Agarwal, 1997) in response to the formation of BRAC cooperatives for women.

The key point is to note the primacy of the individual reservation utility levels in the determination of bargaining power, and subsequent allocation of resources. Even if neither individual can affect the RU of his or her partner directly, the individual could adopt strategies (either by himself or by leveraging social norms) to limit the RU of his partner in future time periods; thereby maintaining the position of dominance in the household. Using dowry as an instrument to reduce the wealth level of the bride's family is an example of leveraging social norms to subvert the post-divorce reservation utility of the woman. Enacting an informal agreement such as using self-income for investment while using spousal income for consumption is another strategy to prevent the spouse from possessing assets with clear property rights in case of a divorce.

While summing up the theoretical findings, it is important to note that these are not in conflict with Pareto Efficiency in consumption allocation. Under Aggregate Inefficiency, total resources and hence, total consumption may well be at sub-optimal levels; but given resources, allocations between individuals are such that one cannot be made better off without making the other worse off. For example, Udry (1996) finds evidence of inefficient allocation of resources towards the agricultural plots controlled by women. This is not evidence in favor of Pareto Inefficiency in consumption allocation. Rather, this is a situation where the dominant decision maker opts for *option B* (page 93). Although property rights to land have been temporarily transferred, the input allocation has been restricted on purpose so that the woman does not enjoy substantial,

continuous gains to her income. Indeed if the input allocation was optimal, it would imply that the dominant decision maker had chosen *option C*. Such a strategy would have been efficient for every entity; however, it would have been an irrational strategy in the long run for the decision maker, leading to increasing returns of income to his spouse and consequent erosion in his position as the dominant individual in the household.

We consider data from the 'India Human Development Survey 2005' to look for empirical evidence for or against the RU Augmented Collective Framework. We use a subset of this data; we consider 2 adult households who report income via salaried jobs or non-labor sources or a combination of both. This allows us to avoid the simultaneity between labor supply and demand functions and allow us to use incomes as key explanatory variables in our demand equations. We note that we do not attempt to empirically validate or disprove the implication of Aggregate Inefficiency; rather we look for properties of the demand system implied by the RU Augmented framework. Essentially, if these implications are validated by the data, then the RU Augmented framework is at work. The subsequent leap of faith is in saying that since this framework rationalizes Aggregate Inefficient behavior, existence of this framework implies the presence of Aggregate Inefficiency; at the very least, validation of implications of the demand system raises the chances of households engaging in Aggregate Inefficient strategies.

We study the shares of expenses on a variety of goods. We note that the proportionality tests and conditional demand tests have different implications for the Collective and the RU Augmented framework; the data rejects the implications that should have been manifested if the Collective framework was at play. However, we recognize that the RU Augmented model does not make strong implications for these tests; non-rejection of these weak implications does not really prove the RU Augmented framework. However, both frameworks make strong and qualitatively opposite claims when income identity tests are conducted on the demand system. Econometric analyses show that the data rejects the implications of the Collective framework, but never rejects those of the RU Augmented framework. Indeed, the coefficients on the individual incomes are always equal to each other in size and sign, which confirms the implications of the RU Augmented Collective framework. It would not be out of place here to mention that in several previous studies supporting the Collective Hypothesis, similar findings have been reported by the authors. For example, Bourguignon et al (1993) and Thomas and Chen (1994),

given total income, the signs of the coefficients on individual incomes are always similar especially when the coefficients are significant. Additionally, the magnitudes of the coefficients are also similar, although the statistical test for this is not performed by the authors. Given the fact that these studies test very similar demand equations on Canadian and Taiwanese data, it can be argued that bargaining processes conforming to the RU Augmented Hypothesis is perhaps more widespread than apparent.

To sum up, the empirical evidence in Chapter 8 of the current research provides significant proof of household optimization processes as predicted by the RU Augmented framework. The same framework proposes income subverting strategies as a rational ploy to maintain dominance in the household in Chapter 7; this is a troubling aspect, as there are no clear policies to crack this conundrum. It is to be noted that although Aggregate Inefficiency is an implication of the RU Augmented framework, the reverse is not necessarily true. The RU Augmented framework proposes Aggregate Inefficiency as a rational outcome when the dominant decision maker faces interventions that target benefits exclusively to his partner. However, we can see that if these benefits cause a 'spillover' for the dominant decision maker himself, the rationale for a strategy leading to inefficient generation of benefits is weakened.

Several programs have proposed that improved empowerment levels are an objective of their interventions. The present research adds value to the current knowledge by proposing that any program which affects bargaining positions of women (thereby affecting her empowerment levels) needs to build in incentives for the male to allow his spouse to participate and/or disincentives to prevent non participation. Note that the man's incentives to prevent participation are also a function of the social pressures to maintain dominant positions, especially in patriarchal societies. Restrictive 'dos and don'ts' on women can be viewed as the price that a woman has to bear, in a perfectly competitive market. Additionally, there exists peer pressure on the husband to ensure that she meets those restrictions. If these restrictions relax, the pressure on males to make their wives adhere to these norms would relax too. We have seen how the need to maintain a position of dominance amplifies Aggregate Inefficient behavior; socio-economic incentives to pursue such strategies could be greatly weakened by reforming such restrictions, thereby ameliorating the need for dominance.

Thus a two pronged policy, essentially a 'pincer move', is needed to weaken social norms and incentivize the male to allow the woman to participate in development programs. However, this is easier said than done. Social norms have stood for years and have shown considerable inertia against laws/policies/programs which propose to improve women's empowerment. Indeed, such norms are perhaps best weakened by starting at the bottom, instead of a top down approach.

The JEEViKA model has, wittingly or otherwise, suggested potential solutions to the tension between poverty reduction and individual empowerment. The provision of cheap credit to SHG members opens up an avenue for the budget constraint of the household to relax. Indeed, if we recall some of the key results from Chapter 5, the debt portfolio of the beneficiary households suggest that uptake of credit for productive purposes is significantly higher. We note that the income generated through such productive ventures need not accrue to the woman only; in a substantial number of households, such loans are used as investment towards livelihoods of the male member(s) in the household. Thus leveraging cheap credit to relax the budget constraint does not lead to a ceteris paribus change in women's income; we have already seen that such changes rationalize strategies geared towards Aggregate Inefficiency. Rather, the ability to raise credit via the SHG network raises the man's relative welfare levels in the household, thereby increasing his tolerance levels for the woman to improve her relative welfare level. More importantly, not allowing his spouse to participate dries up this cheap credit, which directly affects his own welfare. Thus, the personal incentive for the male to discourage the woman from participating in such programs is weakened, as the potential benefits could improve his welfare levels directly.

However, the social pressures remain; once the woman participates in this 'SHG movement', she controls the credit inflow into the household to a substantial extent. Quite obviously, even with this credit leading to productive investments by the male, such situations increase the woman's say in the household. Evidently the male has to relax his dominance to an extent, which might be a deal-breaker under social pressures.

Recall that JEEViKA rolls out every intervention through women's institutions; none of the benefits go from the project to a member directly. These institutions are based in the woman's community and range from strengths of 10-15 women in an SHG to 150-160 women in the VO. This institutional framework creates a platform for the woman to air her demands with respect to

the community and her own household. As these demands are voiced by more and more women, less and less households view this as an improper practice; the social norms that encourage male dominance lose popular support at the grassroots level.

Thus, the presence of JEEViKA institutions in the village raises the RU of a woman, even if she is not a participant. She now has the option of leveraging JEEViKA networks in case her household dissolves. The popularity of women's participation in JEEViKA institutions reduces the social pressure on the man to preserve, or rather, project dominance. Finally, the prospect of cheap credit, which could be leveraged by the woman for the purposes of the man, allows the man to consider the possibility of increasing his in-house welfare by allowing his spouse to participate. In essence, the JEEViKA model provides the male dominant decision makers with a 'Carrot and Stick' policy. Preventing participation is less attractive, given that the RU of women are increased by JEEViKA's presence and the unavailability of the benefits that she could have accessed if she was able to participate. Allowing participation is more attractive, as the man could now leverage the economic benefits to drive a wedge between his in-house welfare and his RU. We now consider if the RU Augmented framework has any implication to further accelerate socio-economic changes by leveraging the JEEViKA model.

We consider the 2-adult household of A and B again, retaining the full flavor of the model that was considered in Chapter 7. We assume a program which targets B for household poverty reduction via a basket of interventions. Let the program intensity for B be denoted by P_B and the corresponding income that B would earn be denoted by $Y_B(P_B)$, where B's income is increasing with respect to the program intensity. Equation 9' points out that such a design would put A's position of dominance under threat; if P_B is accessible only on participation, then A would rationally bar B from participating. The JEEViKA model differs from the above design by allowing the man to access benefits, for example, cheap credit when his spouse participates. However, *JEEViKA does not have an incentive design which encourages men to allow their spouses to engage with the program more intensively*.

Let us now consider a mechanism where program intensity P_A is directed at A. However, A would be able to access any positive program intensity only when he allows B to participate and continue participation; non-participation by B *or* suspension of participation would immediately discontinue P_A. Additionally, P_A is increasing with respect to P_B. Let the income that A earns by

accessing such benefits be given by $Y_A(P_A)$, which is increasing with respect to P_A. The program that A now faces is given by,

$$\underset{\{q_A, q_B, Q\}}{MAX} \quad U^A\{q_1, q_2, q_3\} - \overline{V}_A$$

subject to

$$1)\ U^B\{q_1, q_2, q_3\} \geq \overline{V}_B\{Y_B, Y_B(P_B)\} \qquad \text{[Participation Constraint]}$$

$$2)\ p'q \leq [Y_A + Y_A\{P_A(P_B)\} + Y_B + Y_B(P_B) + Y_{NL}] \qquad \text{[Budget Constraint]}$$

This design builds in incentives for A to allow participation for B, by allowing A to access greater in-house welfare. We can re-write the in-house welfare levels as indirect utility functions and observe how such welfare levels are contingent on the program intensities of either individual.

We consider the design closely to see how the 'carrot and stick' policy is built into it. As B participates more intensively A is able to access higher program benefits, which in turn increases his in-house welfare continuously; thus the program drives an increasing wedge between A's in-house utility and his RU, thereby increasing his tolerance for increasing benefits to B. Additionally, any measure to discourage B's participation is unambiguously welfare reducing for A. Since B's benefits are still available to her if the household dissolves (while A loses all benefits), any threats and measures towards income subversion by A are irrational and non-credible.

Thus, programs like JEEViKA can be used as a policy tool to relax tendencies towards subverting female participation in income generation activities. The clearest sign is the increased voice of women under JEEViKA's ambit in matters related to their own livelihood activity, as evidenced by the data. A disconcerting sign is that indicators which signal the capability of a woman to deal with her environment are usually at a lower level than indicators that signal her control over her own preferences. However, we should recall that in the context of Bihar, the rural woman faces an array of hurdles before she can have a semblance of self-sufficiency on socio-economic parameters. It may be an interesting innovation for programs like JEEViKA to design some interventions along the lines discussed above. The RU Augmented framework

proposes that such designs should accelerate changes by aligning individual interests towards the joint goals of poverty reduction and individual empowerment, without threatening any individual with a complete loss of position.

On the agenda of further research, we should note that this attempt was not able to prove the extent or existence of Aggregate Inefficiency; frankly, this was beyond the scope of the study. However, this problem of income subversion could be tackled scientifically only with a clear understanding of the social and economic factors that affect bargaining power; in essence, we need to know how the extent of Aggregate Inefficiency is affected by distribution factors. Subsequently, with these insights, sustainable policies to encourage empowerment and participation in resource generation can be designed.

Appendix 1: Impacts due to JEEViKA

Table A3.5: TIME CONSTANT VARIABLES measured at VILLAGE LEVEL

HC_Absent	Percentage of HHs in village without a HEALTH CENTER
PDS_Absent	Percentage of HHs in village without a PDS
School_Absent	Percentage of HHs in village without a SCHOOL
TargetPopLevel1	Percentage of HHs in village in Stratum 1 of Target Population [0 < (SC+ST) < 660]
TargetPopLevel2	Percentage of HHs in village in Stratum 2 of Target Population [661 < (SC+ST) < 1320]
TargetPopLevel3	Percentage of HHs in village in Stratum 3 of Target Population [1321 < (SC+ST) < 1980]
TargetPopLevel4	Percentage of HHs in village in Stratum 4 of Target Population [1981 < (SC+ST) < 2640]
TargetPopLevel5	Percentage of HHs in village in Stratum 5 of Target Population [2641 < (SC+ST)]

Table A3.6: TIME CONSTANT VARIABLES measured at HH LEVEL

Caste_SC	Percentage of SC Households
Caste_ST	Percentage of ST Households
Caste_EBC	Percentage of EBC Households
Caste_BC	Percentage of BC Households
Caste_GEN	Percentage of GENERAL Households
Hindu	Percentage of HINDU Households
Muslim	Percentage of MUSLIM Households
Buddhist	Percentage of BUDDHIST Households
Jain	Percentage of JAIN Households
NAdultMales	No. of adult males in HH
NAdultFemales	No. of adult females in HH
TotChildren_SchoolAge	No. of children in HH of school going age , 5-18 years
HH_Head_Ed~n	Education level of HH head

Table A3.7: OUTCOME VARIABLES measured at HH LEVEL at PRE-INTERVENTION VALUES

Tot_Earner_past	No. of individuals engaged in any livelihood activity at some point during 2007
Tot_PermEarner_past	No. of individuals engaged in any livelihood activity all year during 2007
Roof_Past_pucca	Percentage of HHs with Pucca Roof in 2007
Floor_Past_pucca	Percentage of HHs with Pucca Floor in 2007
Wall_Past_pucca	Percentage of HHs with Pucca Wall in 2007
Field_Toilet_past	Percentage of HHs using FIELDS for toilet in 2007
PvtToilet_past	Percentage of HHs using PRIVATE FACILITIES for toilet in 2007
PubToilet_past	Percentage of HHs using PUBLIC FACILITIES for toilet in 2007
rooms_past	No. of rooms in 2007
Land_2007	Land holding in Kathas in 2007
Chair_2007	No. of chairs in 2007
Cot_2007	No. of cots in 2007
Mobile_2007	No. of mobiles in 2007
Watch_2007	No. of watches in 2007
Cycle_2007	No. of cycles in 2007
Cows_2007	No. of cows in 2007
Buffalo~2007	No. of buffaloes in 2007
Bullock~2007	No. of bullocks in 2007
Goats_2007	No. of goats in 2007
months_insecurity_past	No. of months in 2007 during which HH faced food shortage
Act_Beating_Past (in 2ndand 4th spec)	Percentage of respondents capable of any action in 2007 due to issue: woman being beaten
Act_PDS_Past (in 2ndand 4th spec)	Percentage of respondents capable of any action in 2007 due to issue: PDS
Act_School_Past (in 2ndand 4th spec)	Percentage of respondents capable of any action in 2007 due to issue: SCHOOL
Act_Mukhiya_Past (in 2ndand 4th spec)	Percentage of respondents capable of any action in 2007 due to issue: MUKHIYA

Table A3.8 Balance in Pre-Intervention Levels of Household Outcome Variables, across matching modules

	NN, with replacement				CALIPER				RADIUS				KERNEL			
Variable	Treated	Control	t	p>t	Treated	Control	t	p>t	Treated	Control	t	p>t	Treated	Control	t	p>t
Tot_Earner_past	1.7336	1.7542	-0.85	0.396	1.7336	1.7542	-0.85	0.396	1.7336	1.7542	-0.85	0.396	1.7336	1.7542	-0.85	0.396
	1.7361	1.7278	0.34	0.732	1.7255	1.7337	-0.32	0.749	1.7255	1.7196	0.23	0.818	1.7361	1.7191	0.71	0.480
Tot_PermEarner_past	1.6342	1.6995	-2.60	0.009	1.6342	1.6995	-2.60	0.009	1.6342	1.6995	-2.60	0.009	1.6342	1.6995	-2.60	0.009
	1.6376	1.6294	0.32	0.746	1.654	1.6663	-0.46	0.643	1.654	1.6479	0.23	0.820	1.6376	1.6242	0.53	0.594
Roof_Past_pucca	.26999	.24272	1.96	0.051	.26999	.24272	1.96	0.051	.26999	.24272	1.96	0.051	.26999	.24272	1.96	0.051
	.26959	.29175	-1.54	0.125	.25748	.26745	-0.66	0.508	.25748	.25208	0.36	0.718	.26959	.26928	0.02	0.983
Floor_Past_pucca	.07081	.04241	3.85	0.000	.07081	.04241	3.85	0.000	.07081	.04241	3.85	0.000	.07081	.04241	3.85	0.000
	.0701	.06907	0.13	0.900	.05455	.05044	0.54	0.591	.05455	.04973	0.63	0.528	.0701	.07012	-0.00	0.998
Wall_Past_pucca	.27509	.26367	0.81	0.420	.27509	.26367	0.81	0.420	.27509	.26367	0.81	0.420	.27509	.26367	0.81	0.420
	.27423	.27629	-0.14	0.886	.26334	.2563	0.47	0.639	.26334	.2667	-0.22	0.824	.27423	.27411	0.01	0.994
Field_Toilet_past	.91238	.93051	-2.11	0.035	.91238	.93051	-2.11	0.035	.91238	.93051	-2.11	0.035	.91238	.93051	-2.11	0.035
	.91443	.91134	0.34	0.733	.92727	.92199	0.58	0.559	.92727	.91947	0.86	0.392	.91443	.91377	0.07	0.941
PvtToilet_past	.04381	.03321	1.72	0.085	.04381	.03321	1.72	0.085	.04381	.03321	1.72	0.085	.04381	.03321	1.72	0.085
	.04278	.03918	0.57	0.571	.0346	.03578	-0.19	0.853	.0346	.04176	-1.09	0.276	.04278	.04184	0.15	0.884
rooms_past	1.8467	1.8186	0.85	0.393	1.8467	1.8186	0.85	0.393	1.8467	1.8186	0.85	0.393	1.8467	1.8186	0.85	0.393
	1.8464	1.8459	0.02	0.988	1.8217	1.8393	-0.50	0.614	1.8217	1.8111	0.31	0.758	1.8464	1.8297	0.51	0.611
Land_2007	10.097	10.561	-0.44	0.660	10.097	10.561	-0.44	0.660	10.097	10.561	-0.44	0.660	10.097	10.561	-0.44	0.660
	10.113	12.32	-2.12	0.034	9.2373	11.262	-2.08	0.038	9.2373	10.135	-1.03	0.302	10.113	11.325	-1.21	0.227
Chair_2007	.60316	.51865	2.70	0.007	.60316	.51865	2.70	0.007	.60316	.51865	2.70	0.007	.60316	.51865	2.70	0.007
	.5933	.55619	1.18	0.238	.5607	.53842	0.67	0.501	.5607	.56975	-0.27	0.788	.5933	.58934	0.12	0.901
Cot_2007	1.7718	1.8007	-0.72	0.474	1.7718	1.8007	-0.72	0.474	1.7718	1.8007	-0.72	0.474	1.7718	1.8007	-0.72	0.474
	1.7747	1.7397	0.86	0.388	1.7548	1.7196	0.83	0.409	1.7548	1.7476	0.17	0.865	1.7747	1.776	-0.03	0.975
Mobile_2007	.35507	.25652	6.10	0.000	.35507	.25652	6.10	0.000	.35507	.25652	6.10	0.000	.35507	.25652	6.10	0.000
	.34639	.3634	-1.06	0.290	.31613	.32727	-0.68	0.499	.31613	.32655	-0.63	0.531	.34639	.35963	-0.81	0.416
Watch_2007	.32094	.23761	5.16	0.000	.32094	.23761	5.16	0.000	.32094	.23761	5.16	0.000	.32094	.23761	5.16	0.000
	.31753	.31959	-0.12	0.905	.28211	.27155	0.62	0.534	.28211	.28469	-0.15	0.881	.31753	.32113	-0.21	0.837

	NN, with replacement			CALIPER			RADIUS			KERNEL		
Variable	Treated	Control	t p>t	Treated	Control	t p>t	Treated	Control	t p>t	Treated	Control	t p>t
Cycle_2007	.36882	.30301	4.11 0.000	.36882	.30301	4.11 0.000	.36882	.30301	4.11 0.000	.36882	.30301	4.11 0.000
	.36495	.36546	-0.03 0.975	.34076	.34721	-0.38 0.702	.34076	.33244	0.49 0.622	.36495	.36299	0.12 0.905
Cows_2007	.30056	.28615	0.72 0.473	.30056	.28615	0.72 0.473	.30056	.28615	0.72 0.473	.30056	.28615	0.72 0.473
	.29897	.30876	-0.48 0.631	.28328	.31789	-1.60 0.109	.28328	.28266	0.03 0.976	.29897	.28511	0.70 0.483
Buffalo~2007	.24452	.23352	0.59 0.554	.24452	.23352	0.59 0.554	.24452	.23352	0.59 0.554	.24452	.23352	0.59 0.554
	.2433	.28454	-2.09 0.037	.24223	.28856	-2.17 0.030	.24223	.27327	-1.50 0.133	.2433	.25959	-0.87 0.386
Bullock~2007	.20122	.23301	-1.70 0.090	.20122	.23301	-1.70 0.090	.20122	.23301	-1.70 0.090	.20122	.23301	-1.70 0.090
	.20258	.22577	-1.26 0.207	.20645	.23109	-1.25 0.211	.20645	.21003	-0.19 0.853	.20258	.20787	-0.29 0.772
Goats_2007	.56139	.56975	-0.22 0.823	.56139	.56975	-0.22 0.823	.56139	.56975	-0.22 0.823	.56139	.56975	-0.22 0.823
	.56392	.56546	-0.04 0.968	.57302	.59765	-0.57 0.567	.57302	.5744	-0.03 0.974	.56392	.5612	0.07 0.945
months_insecurity_past	1.1885	1.3388	-2.51 0.012	1.1885	1.3388	-2.51 0.012	1.1885	1.3388	-2.51 0.012	1.1885	1.3388	-2.51 0.012
	1.1979	1.1876	0.17 0.863	1.2188	1.2897	-1.10 0.273	1.2188	1.2325	-0.21 0.830	1.1979	1.1314	1.14 0.255
PubToilet_past	.04381	.03628	1.20 0.229	.04381	.03628	1.20 0.229	.04381	.03628	1.20 0.229	.04381	.03628	1.20 0.229
	.04278	.04948	-0.99 0.320	.03812	.04223	-0.61 0.542	.03812	.03876	-0.10 0.923	.04278	.04439	-0.25 0.806

Table A4.1: ATTs, across NN, Radius and Kernel Algorithms: All households reporting women's modules considered

	Nearest Neighbor, with Replacement				Radius Matching, Caliper=0.0005				Kernel Matching, Bandwidth=0.0302			
Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
land_owned	10.85	-0.77	-0.63		10.65	-1.28	-1.18		10.95	-0.87	-0.86	
Del_Land	0.02	-0.04	-0.55		-0.02	0.02	0.47		-0.06	0.04	1.01	
leased_in_2010	4.64	0.98	1.57		4.68	0.67	1.24		4.92	0.70	1.42	
Del_LeaseIn	0.36	-0.46	-1.87	**	0.15	-0.30	-1.17		0.18	-0.27	-1.21	
chair_current	0.74	0.01	0.29		0.70	-0.02	-0.38		0.74	0.01	0.23	
cot_current	2.05	-0.09	-1.58		2.00	-0.05	-1		2.01	-0.05	-1.05	
mobile_current	0.53	0.03	1.23		0.47	0.06	2.57	***	0.52	0.04	2.14	**
watch_current	0.41	0.00	-0.18		0.36	0.01	0.6		0.39	0.02	0.78	
cycle_current	0.48	-0.03	-1.27		0.44	-0.02	-0.74		0.44	0.00	0.14	
cows_current	0.34	0.01	0.29		0.34	-0.01	-0.29		0.32	0.03	1.1	
buffaloes_curr~t	0.27	0.02	0.59		0.30	-0.02	-0.89		0.30	-0.02	-0.76	
bullocks_current	0.20	0.03	1.02		0.22	0.02	0.74		0.22	0.01	0.29	
goats_current	0.54	0.04	0.72		0.59	0.01	0.29		0.57	0.00	0.13	
Del_Chair	0.16	0.01	0.41		0.17	-0.02	-1.1		0.15	0.02	0.98	
Del_Cot	0.20	-0.01	-0.42		0.22	-0.04	-1.61		0.22	-0.03	-1.42	
Del_Mobile	0.17	0.04	2.21	**	0.16	0.05	3.29	***	0.16	0.06	3.91	***
Del_Cycle	0.09	0.00	-0.16		0.08	0.00	-0.19		0.08	0.01	0.73	
Del_Watch	0.07	0.02	1.27		0.07	0.02	1.74	**	0.07	0.02	2.39	***
Del_Cows	0.03	0.02	1.38		0.03	0.01	0.6		0.03	0.02	1.95	**
Del_Buffaloes	0.04	0.00	0.2		0.05	-0.01	-1.26		0.05	-0.01	-1.24	
Del_Bullocks	0.01	0.01	0.92		0.01	0.01	1.45		0.01	0.01	1.88	**
Del_Goats	0.02	-0.01	-0.32		0.03	-0.02	-0.65		0.01	0.01	0.39	
Roof_Pres_Pucca	0.28	0.02	1.16		0.28	0.01	0.29		0.30	0.01	0.58	
Del_Roof	0.03	0.00	0.19		0.03	0.01	1.01		0.03	0.01	1.43	
Floor_Pres_Pucca	0.07	0.00	-0.09		0.06	-0.01	-0.89		0.08	-0.01	-0.92	
Del_Floor	0.01	-0.01	-2	**	0.01	-0.01	-2.01	**	0.01	-0.01	-1.29	
Wall_Pres_Pucca	0.32	0.00	-0.17		0.31	-0.01	-0.54		0.31	0.00	0.04	
Del_Wall	0.04	-0.01	-0.58		0.04	0.00	-0.04		0.04	0.00	0.06	

Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
Field_Toilet_~nt	0.90	-0.01	-0.86		0.91	-0.01	-0.64		0.90	-0.01	-0.91	
Del_Field	-0.02	-0.01	-1.72	**	-0.02	-0.01	-1.88	**	-0.01	-0.02	-2.68	***
Common_Toilet~nt	0.05	0.01	0.73		0.05	0.00	0.44		0.05	0.00	0.33	
Del_Common	0.01	0.01	1.63		0.01	0.01	1.44		0.01	0.01	1.52	
Private_Toile~nt	0.05	0.00	0.46		0.04	0.00	0.45		0.05	0.01	0.94	
Del_Private	0.01	0.00	0.64		0.01	0.00	1.1		0.01	0.01	2.17	***
rooms_present	1.89	0.01	0.13		1.90	-0.02	-0.6		1.88	0.02	0.53	
food_secure_pr~t	0.32	0.03	1.17		0.35	-0.01	-0.27		0.34	0.00	0.11	
Del_Insecure	-0.02	-0.01	-0.82		-0.01	-0.02	-2.16	**	-0.01	-0.02	-2.15	**
months_insecu~nt	0.80	0.08	1.19		0.91	-0.02	-0.33		0.89	-0.01	-0.2	
Del_Month	-0.26	-0.05	-1.13		-0.24	-0.07	-1.59		-0.24	-0.06	-1.73	**
Del_Intensity1	0.68	-0.01	-0.57		0.67	-0.01	-0.33		0.68	-0.01	-0.46	
Del_Intensity2	0.14	-0.01	-0.81		0.15	-0.02	-1.31		0.14	-0.01	-1.04	
Del_Intensity3	0.18	0.03	1.39		0.18	0.02	1.52		0.19	0.02	1.44	
Tot_Earner_Pre~t	1.71	0.03	0.88		1.74	0.00	0.06		1.72	0.02	0.75	
Del_Earner	0.01	0.00	-0.73		0.01	0.00	-0.42		0.01	0.00	-0.38	
Tot_PermEarne~nt	1.62	0.03	0.84		1.67	0.00	-0.02		1.63	0.02	0.66	
Del_Perm_Earner	0.01	0.00	-0.16		0.01	0.00	0.17		0.01	0.00	0.21	
HH_Net_In_Kharif_Ag_Own	-0.01	0.01	1.09		0.00	0.00	-0.04		0.00	0.00	-0.71	
HH_Net_In_Rabi_Ag_Own	0.00	0.00	0.85		0.00	0.00	-0.07		0.00	0.00	-0.38	
HH_Net_In_Zaid_Ag_Own	0.00	-0.01	-1.32		0.00	-0.01	-1.95	**	0.00	-0.01	-1.41	
HH_Net_In_Kharif_Ag_Rent	0.00	0.00	-0.69		0.00	0.00	-1.38		0.00	0.00	-1.17	
HH_Net_In_Rabi_Ag_Rent	0.00	0.00	-1.01		0.00	-0.01	-1.56		0.00	0.00	-1.48	
HH_Net_In_Zaid_Ag_Rent	0.00	0.00	-0.38		0.00	0.00	-0.79		0.00	0.00	-1.58	
HH_Net_In_Kharif_Ag_Lab	-0.01	0.01	1.34		-0.01	0.00	0.82		-0.01	0.01	1.55	
HH_Net_In_Rabi_Ag_Lab	-0.01	0.01	1.42		-0.01	0.00	0.9		-0.01	0.01	1.69	**
HH_Net_In_Zaid_Ag_Lab	0.00	0.00	-1.05		0.00	0.00	-0.44		0.00	0.00	-0.11	
HH_Net_In_Kharif_A_Husb	0.00	0.00	0.93		0.00	0.00	1.02		-0.01	0.00	2.11	**
HH_Net_In_Rabi_A_Husb	-0.01	0.01	1.69	**	-0.01	0.00	1.78	**	-0.01	0.01	2.13	**
HH_Net_In_Zaid_A_Husb	0.00	0.00	1.61		0.00	0.00	1.75	**	0.00	0.00	1.73	**
HH_Net_In_Kharif_Nfarm	0.00	0.00	0.18		0.00	0.01	1.92	**	0.00	0.00	-1.21	
HH_Net_In_Rabi_Nfarm	0.00	0.00	0.35		0.00	0.01	2.1	**	0.00	0.00	-0.98	
HH_Net_In_Zaid_Nfarm	-0.01	0.01	2.07	**	-0.01	0.01	2.77	***	0.00	0.00	0.84	

Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
HH_Net_In_Kharif_Lab_Urban	0.00	0.01	1.29		0.00	0.00	1.14		0.00	0.01	1.77	**
HH_Net_In_Rabi_Lab_Urban	0.00	0.01	1.08		0.00	0.00	0.65		0.00	0.00	1.25	
HH_Net_In_Zaid_Lab_Urban	0.00	0.00	0.12		0.00	0.00	-0.04		0.00	0.00	0.15	
HH_Net_In_Kharif_Lab_Rural	0.00	-0.01	-1.31		0.00	0.00	-0.04		0.00	0.00	-0.65	
HH_Net_In_Rabi_Lab_Rural	0.00	-0.01	-1.2		-0.01	0.00	0.34		0.00	0.00	-0.24	
HH_Net_In_Zaid_Lab_Rural	-0.01	0.01	1.26		-0.01	0.01	1.35		0.00	0.00	0.81	
HH_Net_In_Kharif_Sal	0.01	-0.01	-1.69	**	0.01	-0.01	-2.48	***	0.01	0.00	-1.47	
HH_Net_In_Rabi_Sal	0.01	-0.01	-1.54		0.01	-0.01	-2.43	***	0.01	0.00	-1.49	
HH_Net_In_Zaid_Sal	0.00	0.00	-0.82		0.01	-0.01	-2.33	***	0.00	0.00	-0.27	
Tot_Boy_in_Sch~l	1.06	0.01	0.22		0.99	0.06	1.52		1.04	0.04	1.09	
Tot_Girl_in_Sc~l	0.90	0.02	0.34		0.84	0.05	1.24		0.87	0.04	1.12	
savings_2010	0.24	0.71	39.59	***	0.22	0.73	51.74	***	0.24	0.71	57.01	***
Del_Saving	0.13	0.58	32.73	***	0.12	0.59	37.51	***	0.13	0.58	40.76	***
NFormal_present	0.01	-0.01	-2.71	***	0.01	-0.01	-3.39	***	0.01	-0.01	-2.82	***
Del_NFormal	0.00	-0.01	-2.5	***	0.00	-0.01	-2.88	***	0.00	-0.01	-2.67	***
Formal_present	0.09	-0.06	-5.24	***	0.08	-0.06	-6.47	***	0.09	-0.06	-7.82	***
Del_Formal	0.03	-0.02	-2.8	***	0.02	-0.02	-2.83	***	0.02	-0.02	-2.79	***
SHG_present	0.10	0.82	59.76	***	0.10	0.82	70.54	***	0.11	0.81	77.47	***
Del_SHG	0.09	0.63	38.9	***	0.08	0.63	43.4	***	0.09	0.62	46.94	***
IndebtedOldHC	0.05	-0.02	-1.88	**	0.06	-0.02	-2.65	***	0.06	-0.02	-2.72	***
HC_OldLoan_Total	1346.79	129.43	0.16		1207.54	355.87	0.46		1319.10	157.11	0.23	
IndebtedNewHC	0.44	-0.19	-8.49	***	0.43	-0.18	-9.84	***	0.44	-0.19	-11.16	***
HC_NewLoan_Total	7749.35	-3525.65	-2.38	***	8073.77	-3955.76	-3.73	***	7927.87	-3704.17	-3.98	***
N_Loan	0.69	0.48	13.07	***	0.69	0.48	15.34	***	0.69	0.49	17.17	***
Total_Borrowed	11031.02	813.00	0.47		11077.16	690.71	0.51		11041.88	802.14	0.68	
Tot_Loan_Health	0.29	0.15	5.45	***	0.28	0.17	7.08	***	0.27	0.17	7.73	***
Tot_Amt_Health	3965.45	529.23	0.34		3910.79	804.09	0.71		3449.09	1045.58	1.07	
Tot_Loan_Marital	0.15	-0.01	-0.38		0.15	-0.01	-0.42		0.15	-0.01	-0.58	
Tot_Amt_Marital	2897.10	-782.93	-1.54		2742.44	-664.76	-1.6		2834.64	-720.48	-1.94	**
Tot_Loan_Food	0.07	0.04	2.85	***	0.07	0.04	2.87	***	0.07	0.04	3.33	***
Tot_Amt_Food	544.22	48.00	0.31		833.34	-269.18	-0.83		693.56	-101.34	-0.35	
Tot_Loan_House	0.06	0.05	3.82	***	0.06	0.03	3.04	***	0.06	0.04	4.3	***
Tot_Amt_House	1048.61	127.86	0.47		1059.81	-40.54	-0.17		1277.04	-100.56	-0.45	

Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
Tot_Loan_Durab~s	0.03	0.04	3.37	***	0.03	0.03	3.6	***	0.04	0.03	3.68	***
Tot_Amt_Durables	539.73	-52.69	-0.29		613.84	-119.20	-0.63		560.66	-73.63	-0.44	
Tot_Loan_School	0.01	0.01	0.76		0.01	0.00	0.78		0.01	0.00	0.13	
Tot_Amt_School	48.61	83.85	1.16		56.15	91.83	1.57		76.28	56.18	1.1	
Tot_Loan_Debt	0.01	0.08	9.96	***	0.01	0.08	10.61	***	0.01	0.08	11.38	***
Tot_Amt_Debt	52.85	673.44	7.16	***	43.63	708.99	7.22	***	46.56	679.73	7.85	***
Tot_Loan_Lives~k	0.01	0.06	7.53	***	0.01	0.06	7.67	***	0.01	0.05	7.97	***
Tot_Amt_Livest~k	132.25	426.42	3.68	***	174.14	394.61	4.07	***	165.63	393.05	4.52	***
Tot_Loan_Shop	0.02	0.04	3.86	***	0.02	0.03	3.88	***	0.02	0.04	5.43	***
Tot_Amt_Shop	380.29	228.86	1.26		318.74	231.75	1.68		302.59	306.56	2.46	***
Tot_Loan_Machine	0.00	0.01	1.77	**	0.00	0.01	1.78	**	0.01	0.01	1.77	**
Tot_Amt_Machine	538.42	-328.49	-0.69		485.11	-273.77	-0.95		628.94	-419.01	-1.67	**
Self_Response	0.73	0.17	8.8	***	0.73	0.17	10.72	***	0.74	0.16	11.65	***
age_marriage	15.88	-0.08	-0.29		15.76	-0.08	-0.33		15.89	-0.09	-0.4	
son_education	9.34	0.50	2.26	**	9.22	0.46	2.43	***	9.37	0.47	2.71	***
daughter_educa~n	7.94	0.42	1.96	**	7.94	0.22	1.2		8.10	0.25	1.52	
signature_lite~e	0.35	0.33	13.33	***	0.34	0.33	16.41	***	0.35	0.33	18.79	***
sign_literate	0.19	0.03	1.84	**	0.17	0.04	2.37	**	0.18	0.04	3.16	**
job_card	0.24	0.00	-0.08		0.25	0.00	0.16		0.24	0.00	-0.23	
kirana_present	0.83	0.04	2.09	**	0.83	0.04	2.73	***	0.84	0.03	2.28	**
Del_Kirana	0.05	0.01	1.23		0.06	0.01	0.83		0.06	0.01	1.33	
pds_present	0.65	0.00	0.21		0.66	-0.01	-0.36		0.65	0.00	0.06	
Del_PDS	0.04	0.02	1.55		0.04	0.02	2.22	**	0.04	0.02	2.42	***
health_present	0.81	0.06	3.53	***	0.82	0.05	3.09	***	0.82	0.05	4.09	***
Del_Health	0.06	0.03	2.02	**	0.06	0.02	1.8	**	0.06	0.03	2.58	***
neighbor_present	0.95	0.02	2.55	***	0.96	0.02	2.39	***	0.96	0.01	2	**
Del_Neighbor	0.04	0.02	2.09	**	0.05	0.01	1.43		0.06	0.01	1.08	
relative_present	0.85	0.05	3.19	***	0.85	0.04	2.93	***	0.86	0.03	2.78	***
Del_Relative	0.04	0.03	2.76	***	0.05	0.03	2.49	***	0.05	0.02	2.07	**
panchayat_pres~t	0.03	0.05	5.84	***	0.03	0.06	6.68	***	0.04	0.05	6.47	***
Del_Panchayat	0.00	0.02	3.92	***	0.00	0.02	3.69	***	0.00	0.02	4.05	***
decision_cook~nt	0.93	0.00	-0.4		0.93	0.00	0.08		0.93	0.00	0.02	
Del_Cook	0.04	-0.01	-0.69		0.04	0.00	-0.24		0.03	0.01	0.91	

Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
decision_dura~nt	0.43	0.08	3.56	***	0.41	0.09	4.48	***	0.44	0.07	4.18	***
Del_Durable	0.03	0.01	0.68		0.03	0.01	0.94		0.02	0.02	2.25	**
decision_pers~nt	0.92	0.01	0.99		0.93	0.00	0.45		0.93	0.01	0.64	
Del_Personal	0.05	-0.01	-0.93		0.05	-0.01	-0.98		0.05	0.00	-0.27	
decision_heal~nt	0.70	0.04	2.09	**	0.70	0.03	1.55		0.71	0.04	2.16	**
Del_Health	0.06	0.03	2.02	**	0.06	0.02	1.8	**	0.06	0.03	2.58	***
decision_educ~nt	0.70	0.10	4.54	***	0.69	0.09	4.83	***	0.71	0.09	5.33	***
Del_Education	0.06	0.01	1.27		0.06	0.02	1.6		0.06	0.02	2.26	**
dec_live_pres	0.50	0.05	2.25	**	0.50	0.06	2.78	***	0.49	0.05	3.04	***
Del_Livelihood	0.02	0.02	2.59	***	0.02	0.02	2.37	***	0.02	0.02	2.98	***
dec_employ_pres	0.53	0.06	2.78	***	0.52	0.08	3.81	***	0.52	0.08	4.21	***
Del_Employment	0.03	0.02	1.85	**	0.02	0.01	2.07	**	0.02	0.02	3.06	**
decision_loan~nt	0.58	0.23	10.32	***	0.58	0.23	12.58	***	0.58	0.23	14.22	***
Del_Loan	0.03	0.07	7.09	***	0.03	0.06	6.45	***	0.02	0.07	8.37	***
decision_poli~nt	0.20	0.09	4.61	***	0.19	0.10	6.01	***	0.21	0.09	5.73	***
Del_Politics	0.01	0.04	5.78	***	0.01	0.03	5.24	***	0.01	0.04	5.66	***
beating_actio~nt	0.72	0.11	5.43	***	0.74	0.09	5.67	***	0.75	0.08	5.63	***
Del_Beat_Act	0.16	0.06	3.61	***	0.15	0.08	5.22	***	0.15	0.07	5.3	***
pds_action_pre~t	0.38	0.05	2.33	**	0.39	0.03	1.62		0.38	0.05	3.06	***
Del_PDS_Act	0.10	0.05	3.45	***	0.10	0.05	3.76	***	0.09	0.06	4.75	***
school_action~nt	0.35	0.06	2.73	***	0.34	0.05	2.62	***	0.36	0.06	3.26	***
Del_School_Act	0.09	0.06	4.17	***	0.10	0.05	4.19	***	0.10	0.06	4.86	***
mukhiya_actio~nt	0.26	0.03	1.52		0.26	0.02	1.35		0.26	0.03	1.78	**
Del_Mukhiya_Act	0.06	0.04	3.16	***	0.06	0.03	2.45	***	0.06	0.03	3.31	***
ASelfBPres	0.36	0.11	4.68	***	0.36	0.09	4.52	***	0.38	0.08	4.58	***
Del_Self_beat	0.08	0.07	4.22	***	0.08	0.05	4.01	***	0.09	0.05	4.25	***
AWomBPres	0.39	0.16	6.93	***	0.40	0.14	6.88	***	0.40	0.15	8.72	***
Del_Wom_beat	0.10	0.12	7.22	***	0.10	0.12	8.3	***	0.09	0.13	10.14	***
ASelfPDSPres	0.18	0.01	0.66		0.17	0.02	1.05		0.18	0.02	1.14	
Del_Self_pds	0.05	0.01	0.95		0.05	0.01	0.98		0.05	0.02	1.93	**
AWomPDSPres	0.17	0.05	3.08	***	0.15	0.07	4.52	***	0.14	0.08	6.09	***
Del_Wom_pds	0.05	0.06	5.27	***	0.04	0.07	6.18	***	0.04	0.07	7.27	***
ASelfSPres	0.16	0.02	1.49		0.14	0.03	2.2	**	0.15	0.03	2.2	**

Variable	Controls	Difference	T-stat		Controls	Difference	T-stat		Controls	Difference	T-stat	
Del_Self_school	0.05	0.03	2.34	**	0.05	0.03	2.83	***	0.05	0.03	2.9	***
AWomSPres	0.17	0.06	3.66	***	0.15	0.06	4.26	***	0.16	0.07	5.47	***
Del_Wom_school	0.05	0.07	5.46	***	0.05	0.06	5.38	***	0.05	0.06	6.32	***
ASelfMPres	0.10	0.01	0.72		0.09	0.01	0.87		0.09	0.02	2.01	**
Del_Self_mukhiya	0.03	0.01	1.56		0.03	0.01	1.13		0.03	0.01	2.06	**
AWomMPres	0.12	0.04	2.92	***	0.11	0.04	3.45	***	0.12	0.05	3.99	***
Del_Wom_mukhiya	0.03	0.05	5.15	***	0.03	0.04	4.72	***	0.03	0.04	5.7	***

Significance at 95% denoted by "", significance at 99% denoted by "***".**

Appendix 2: Runs of Matching without Retrospective Levels of Outcomes

Matching Variables: TIME CONSTANT VARIABLES measured at VILLAGE LEVEL

HC_Absent	Percentage of HHs in village without a HEALTH CENTER
PDS_Absent	Percentage of HHs in village without a PDS
School_Absent	Percentage of HHs in village without a SCHOOL
TargetPopLevel1	Percentage of HHs in village in Stratum 1 of Target Population [0 < (SC+ST) < 660]
TargetPopLevel2	Percentage of HHs in village in Stratum 2 of Target Population [661 < (SC+ST) < 1320]
TargetPopLevel3	Percentage of HHs in village in Stratum 3 of Target Population [1321 < (SC+ST) < 1980]
TargetPopLevel4	Percentage of HHs in village in Stratum 4 of Target Population [1981 < (SC+ST) < 2640]
TargetPopLevel5	Percentage of HHs in village in Stratum 5 of Target Population [2641 < (SC+ST)]

Matching Variables: TIME CONSTANT VARIABLES measured at HH LEVEL

Caste_SC	Percentage of SC Households
Caste_ST	Percentage of ST Households
Caste_EBC	Percentage of EBC Households
Caste_BC	Percentage of BC Households
Caste_GEN	Percentage of GENERAL Households
Hindu	Percentage of HINDU Households
Muslim	Percentage of MUSLIM Households
Buddhist	Percentage of BUDDHIST Households
Jain	Percentage of JAIN Households
NAdultMales	No. of adult males in HH
NAdultFemales	No. of adult females in HH
TotChildren_SchoolAge	No. of children in HH of school going age , 5-18 years
HH_Head_Ed~n	Education level of HH head

Balance Diagnostics: Reruns without retrospective levels of outcomes

	NN, with replacement			RADIUS			KERNEL		
Variable	Treated	Control	t p>t	Treated	Control	t p>t	Treated	Control	t p>t
HC_Absent	.58584	.60985	-1.54 0.122	.58526	.60985	-1.58 0.114	.58584	.60985	-1.54 0.122
	.59176	.61922	-1.76 0.078	.60163	.58406	1.09 0.278	.59176	.59914	-0.47 0.637
PDS_Absent	.33082	.32026	0.71 0.477	.33049	.32026	0.69 0.491	.33082	.32026	0.71 0.477
	.33503	.34265	-0.51 0.613	.3393	.33275	0.42 0.674	.33503	.33092	0.27 0.785
School_Absent	.08534	.07039	1.76 0.078	.08526	.07039	1.75 0.080	.08534	.07039	1.76 0.078
	.08643	.08948	-0.34 0.736	.08347	.07909	0.49 0.626	.08643	.08211	0.49 0.626
TPLevel1	.57982	.61036	-1.96 0.050	.57924	.61036	-2.00 0.045	.57982	.61036	-1.96 0.050
	.58719	.60397	-1.07 0.284	.60596	.60004	0.37 0.713	.58719	.58424	0.19 0.851
TPLevel2	.2756	.28457	-0.63 0.529	.27583	.28457	-0.61 0.539	.2756	.28457	-0.63 0.529
	.27911	.28876	-0.67 0.502	.28564	.29157	-0.40 0.691	.27911	.28373	-0.32 0.747
TPLevel3	.06978	.06536	0.56 0.579	.06971	.06536	0.55 0.585	.06978	.06536	0.56 0.579
	.07067	.05287	2.32 0.020	.06938	.07048	-0.13 0.895	.07067	.07011	0.07 0.946
TPLevel5	.03966	.00503	7.44 0.000	.04012	.00503	7.50 0.000	.03966	.00503	7.44 0.000
	.02745	.02644	0.20 0.844	.00271	.00217	0.33 0.739	.02745	.02649	0.19 0.853
TPLevel4	.03514	.03469	0.08 0.938	.03511	.03469	0.07 0.943	.03514	.03469	0.08 0.938
	.03559	.02796	1.36 0.173	.03631	.03574	0.09 0.925	.03559	.03543	0.03 0.978
Caste_SC	.37199	.49522	-7.90 0.000	.37161	.49522	-7.93 0.000	.37199	.49522	-7.90 0.000
	.37672	.38434	-0.49 0.622	.38808	.36978	1.15 0.252	.37672	.37782	-0.07 0.943
Caste_ST	.0241	.01559	1.93 0.054	.02407	.01559	1.92 0.055	.0241	.01559	1.93 0.054
	.02237	.02186	0.11 0.914	.02276	.02006	0.57 0.571	.02237	.02184	0.11 0.910
Caste_EBC	.12801	.10709	2.05 0.040	.12788	.10709	2.04 0.042	.12801	.10709	2.05 0.040
	.12811	.1271	0.10 0.924	.12737	.14247	-1.34 0.180	.12811	.13254	-0.41 0.681
Caste_BC	.41315	.28004	8.91 0.000	.41374	.28004	8.95 0.000	.41315	.28004	8.91 0.000
	.40925	.41332	-0.26 0.796	.40163	.40653	-0.30 0.762	.40925	.40602	0.21 0.836
rel2	.04819	.06536	-2.34 0.019	.04814	.06536	-2.35 0.019	.04819	.06536	-2.34 0.019
	.04881	.0483	0.07 0.941	.04661	.05866	-1.64 0.101	.04881	.04808	0.11 0.916
rel3	0	0	. .	0	0	. .	0	0	. .
	0	0	. .	0	0	. .	0	0	. .

Variable	NN, with replacement Treated Control	t p>t	RADIUS Treated Control	t p>t	KERNEL Treated Control	t p>t
rel4	0 0 0 0	. . . .	0 0 0 0	. . . .	0 0 0 0	. . . .
NAdultMales	1.4629 1.5525 1.4667 1.4143	-3.36 0.001 2.11 0.035	1.4629 1.5525 1.4672 1.4612	-3.36 0.001 0.23 0.817	1.4629 1.5525 1.4667 1.4593	-3.36 0.001 0.29 0.770
NAdultFemales	1.3494 1.4067 1.3528 1.3198	-2.83 0.005 1.71 0.088	1.3495 1.4067 1.3512 1.372	-2.83 0.005 -1.00 0.315	1.3494 1.4067 1.3528 1.3489	-2.83 0.005 0.20 0.840
Tot_School_~e	2.2681 2.1141 2.2578 2.2293	3.04 0.002 0.57 0.569	2.2678 2.1141 2.2379 2.2427	3.03 0.002 -0.09 0.928	2.2681 2.1141 2.2578 2.2265	3.04 0.002 0.61 0.540
HH_Head_Edu~n	1.0939 .86777 1.0834 1.0285	5.13 0.000 1.21 0.228	1.0938 .86777 1.0515 1.0296	5.13 0.000 0.47 0.636	1.0939 .86777 1.0834 1.0266	5.13 0.000 1.25 0.211
rel1	.95181 .93464 .95119 .9517	2.34 0.019 -0.07 0.941	.95186 .93464 .95339 .94134	2.35 0.019 1.64 0.101	.95181 .93464 .95119 .95192	2.34 0.019 -0.11 0.916
Caste_GEN	.06275 .10206 .06355 .05338	-4.52 0.000 1.36 0.174	.06269 .10206 .06016 .06116	-4.53 0.000 -0.13 0.899	.06275 .10206 .06355 .06179	-4.52 0.000 0.23 0.821

Estimated ATTs, including difference-in-difference (Del): Matching without Retrospective levels of Outcomes

	Nearest Neighbor with Replacement				Radius with Caliper=0.0005				Kernel Matching with Default Epanechnikov B-Width			
variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
land_owned	13.01	-2.67	-1.26		11.97	-1.95	-1.55		11.73	-1.38	-1.24	
Del_Land	-0.04	0.02	0.26		-0.03	0.03	0.76		-0.05	0.03	0.71	
leased_in_2010	5.23	0.46	0.71		5.04	0.6	1.16		4.86	0.83	1.78	**
Del_LeaseIn	0.34	-0.41	-1.42		0.13	-0.2	-0.85		0.15	-0.22	-1.02	
chair_current	0.63	0.14	2.43	***	0.66	0.08	1.89	**	0.68	0.08	2.15	**
cot_current	1.92	0.04	0.58		1.99	-0.05	-1.07		1.98	-0.02	-0.56	
mobile_current	0.41	0.15	5.24	***	0.43	0.13	6.26	***	0.43	0.14	7.15	***
watch_current	0.29	0.12	4.02	***	0.31	0.09	4.46	***	0.31	0.1	5.26	***
cycle_current	0.35	0.1	3.54	***	0.41	0.03	1.62		0.39	0.06	3.09	***
cows_current	0.3	0.04	1.34		0.32	0.02	0.69		0.32	0.02	0.99	
buffaloes_curr~t	0.35	-0.06	-1.76	**	0.33	-0.04	-1.51		0.33	-0.05	-2.17	**
bullocks_current	0.25	-0.03	-0.86		0.26	-0.03	-1.49		0.26	-0.03	-1.57	
goats_current	0.49	0.09	1.73	**	0.57	0.01	0.3		0.57	0.01	0.35	
Del_Chair	0.11	0.05	1.83	**	0.13	0.02	1.01		0.14	0.03	1.5	
Del_Cot	0.15	0.03	0.9		0.19	-0.01	-0.41		0.21	-0.03	-1.26	
Del_Mobile	0.16	0.06	2.77	***	0.17	0.04	2.82	***	0.16	0.05	3.81	***
Del_Cycle	0.06	0.02	1.32		0.08	0	-0.07		0.08	0	0.15	
Del_Watch	0.06	0.03	1.81	**	0.07	0.02	1.88	**	0.07	0.02	2.24	**
Del_Cows	0.03	0.02	1.42		0.03	0.01	1.24		0.03	0.02	2.13	**
Del_Buffaloes	0.04	0	-0.12		0.04	0	0.01		0.05	-0.01	-1.63	
Del_Bullocks	0.02	0	0.35		0.01	0.01	1.88	**	0.01	0.01	1.77	**
Del_Goats	0.03	-0.02	-0.71		0.02	-0.01	-0.24		0.02	0	-0.21	
Roof_Pres_Pucca	0.28	0.03	1.12		0.26	0.04	2.53	***	0.27	0.04	2.61	***
Del_Roof	0.03	0	0.15		0.03	0.01	0.97		0.03	0.01	1.08	
Floor_Pres_Pucca	0.06	0.01	1.13		0.06	0.02	2.1	**	0.05	0.02	2.57	***
Del_Floor	0.01	0	-0.52		0.01	0	-0.94		0.01	0	-1.19	
Wall_Pres_Pucca	0.34	-0.02	-0.83		0.3	0.01	0.78		0.31	0.01	0.52	

variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
Del_Wall	0.04	0	-0.05		0.04	0	-0.06		0.04	0	-0.07	
Field_Toilet_~nt	0.91	-0.03	-1.79	**	0.91	-0.02	-2.03	**	0.92	-0.03	-3.38	***
Del_Field	-0.01	-0.02	-2.32	**	-0.01	-0.02	-2.51	***	-0.01	-0.02	-2.92	***
Common_Toilet~nt	0.05	0.01	0.42		0.05	0.01	0.72		0.04	0.01	1.77	**
Del_Common	0.01	0.01	0.93		0.01	0	0.67		0.01	0.01	1.29	
Private_Toile~nt	0.04	0.02	2.14	**	0.04	0.02	2.09	**	0.04	0.02	2.89	***
Del_Private	0	0.01	2.37	***	0.01	0.01	2.91	***	0.01	0.01	2.75	***
rooms_present	1.86	0.05	0.94		1.86	0.04	0.97		1.86	0.05	1.44	
food_secure_pr~t	0.38	-0.04	-1.7	**	0.39	-0.05	-2.7	***	0.39	-0.05	-2.9	***
Del_Insecure	-0.01	-0.03	-1.89	**	-0.02	-0.02	-1.64		-0.01	-0.02	-2.69	***
months_insecu~nt	1.06	-0.18	-2.24	**	1.07	-0.2	-3.49	***	1.06	-0.18	-3.55	***
Del_Month	-0.28	-0.03	-0.57		-0.33	0.04	0.89		-0.3	-0.01	-0.42	
Del_Intensity1	0.66	0.01	0.45		0.64	0.03	1.63		0.64	0.03	1.64	
Del_Intensity2	0.14	-0.01	-0.72		0.14	-0.02	-1.34		0.14	-0.02	-1.63	
Del_Intensity3	0.21	0	0.07		0.22	-0.01	-0.76		0.21	-0.01	-0.53	
Tot_Earner_Pre~t	1.69	0.06	1.45		1.71	0.04	1.46		1.7	0.05	1.81	**
Del_Earner	0.01	0	0.2		0.01	0	-0.4		0.01	0	-0.39	
Tot_PermEarne~nt	1.63	0.02	0.4		1.65	0	0.02		1.64	0	0.15	
Del_Perm_Earner	0	0.01	1.32		0	0.01	1.45		0	0.01	1.27	
H~K_Pri_AgOwn_In	0	0	-0.51		0	0	-1.15		0	0	-0.4	
H~R_Pri_AgOwn_In	0	0	-0.29		0	0	-0.99		0	0	-0.37	
H~Z_Pri_AgOwn_In	0	-0.01	-1.01		0	-0.01	-1.8	**	0	-0.01	-1.54	
HH_Net_Del_K_P~t	0	-0.01	-1.56		0	0	-1.08		0	0	-1.61	
HH_Net_Del_R_P~t	0	-0.01	-1.32		0	0	-1.18		0	-0.01	-1.86	**
HH_Net_Del_Z_P~t	0	0	-0.93		0	0	-1.16		0	0	-1.46	
H~K_Pri_AgLab_In	-0.01	0	0.71		-0.01	0	0.71		-0.01	0	0.95	
H~R_Pri_AgLab_In	-0.01	0	0.81		-0.01	0	0.86		-0.01	0	1.11	
H~Z_Pri_AgLab_In	0	0	-0.6		0	0	0.04		0	0	-0.13	
H~K_Pri_AHusb_In	0	0	0.58		0	0	1.49		0	0	1.99	**
H~R_Pri_AHusb_In	0	0	0.58		0	0	1.26		0	0	1.87	**

variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
H~Z_Pri_AHusb_In	0	0	0.95		0	0	1.45		0	0	1.87	**
H~K_Pri_NFarm_In	0	0	-0.77		0	0	-0.08		0	0	-0.68	
H~R_Pri_NFarm_In	0	0	-0.63		0	0	0.13		0	0	-0.44	
H~Z_Pri_NFarm_In	0	0	0.23		0	0	1.64		0	0	1.01	
H~K_Pri_ClabU_In	0	0.01	1.53		0	0.01	1.46		0	0.01	1.63	
H~R_Pri_ClabU_In	0	0.01	1.31		0	0	1.04		0	0	1.12	
H~Z_Pri_ClabU_In	0	0	0.39		0.01	0	-0.19		0.01	0	-0.18	
H~K_Pri_ClabR_In	-0.01	0	0.41		0	0	0.05		0	0	0.01	
H~R_Pri_ClabR_In	-0.01	0	0.65		-0.01	0	0.83		-0.01	0	0.82	
H~Z_Pri_ClabR_In	-0.01	0.01	1.08		0	0	0.92		0	0	1.07	
HH_~K_Pri_Sal_In	0	0	-0.16		0	0	-0.65		0.01	0	-1.98	**
HH_~R_Pri_Sal_In	0	0	-0.42		0	0	-0.82		0.01	-0.01	-2.02	**
HH_~Z_Pri_Sal_In	0	0	0		0	0	-0.25		0	0	-0.63	
Tot_Boy_in_Sch~l	0.99	0.08	1.5		1	0.06	1.55		0.99	0.09	2.47	***
Tot_Girl_in_Sc~l	0.89	0.02	0.33		0.87	0.03	0.73		0.87	0.04	1.17	
savings_2010	0.2	0.75	37.57	***	0.21	0.74	56.96	***	0.22	0.73	63.96	***
Del_Saving	0.1	0.6	32.62	***	0.11	0.59	40.3	***	0.11	0.59	43.69	***
NFormal_present	0.01	-0.01	-1.62		0.01	-0.01	-2.91	***	0.01	-0.01	-3.92	***
Del_NFormal	0	-0.01	-2.92	***	0	-0.01	-4.12	***	0	-0.01	-3.59	***
Formal_present	0.06	-0.04	-2.75	***	0.07	-0.04	-4.72	***	0.08	-0.05	-7.1	***
Del_Formal	0.01	-0.01	-0.75		0.02	-0.02	-2.56	***	0.02	-0.02	-2.96	***
SHG_present	0.09	0.82	53.73	***	0.1	0.82	74.8	***	0.1	0.82	84.39	***
Del_SHG	0.08	0.64	37.94	***	0.08	0.64	46.49	***	0.08	0.63	50.08	***
IndebtedOldHC	0.04	-0.01	-1		0.06	-0.03	-3.13	***	0.06	-0.03	-3.45	***
HC_OldLoan_Total	825.04	614.27	0.99		1253.02	281.4	0.4		1261.65	177.66	0.28	
IndebtedNewHC	0.43	-0.19	-7.36	***	0.43	-0.17	-9.81	***	0.44	-0.19	-12.16	***
HC_NewLoan_Total	8770.53	-4529.81	-2.27	**	7573.5	-3208.2	-3.28	***	8214.09	-3973.37	-4.75	***
N_Loan	0.66	0.51	12.84	***	0.67	0.5	17.05	***	0.69	0.48	18.06	***
Total_Borrowed	11180.5	589.78	0.28		10277.5	1571.56	1.28		10990.4	779.84	0.72	
Tot_Loan_Health	0.26	0.18	6.47	***	0.28	0.16	7.39	***	0.28	0.16	7.72	***

variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
Tot_Amt_Health	4175.05	255.55	0.14		3810.04	704.17	0.69		4006.25	424.35	0.47	
Tot_Loan_Marital	0.15	-0.01	-0.43		0.15	0	-0.26		0.15	-0.01	-0.54	
Tot_Amt_Marital	2858.3	-757.8	-1.35		2801.01	-653.37	-1.68	**	2671.56	-571.05	-1.67	**
Tot_Loan_Food	0.08	0.03	1.91	**	0.08	0.03	2.83	***	0.08	0.03	3.12	***
Tot_Amt_Food	931.54	-342.45	-1.58		745.5	-138.93	-0.46		813.2	-224.11	-0.88	
Tot_Loan_House	0.05	0.05	4.35	***	0.05	0.05	4.68	***	0.05	0.05	4.89	***
Tot_Amt_House	1173.69	-21.53	-0.07		852.33	230.92	1.05		1146.46	5.7	0.03	
Tot_Loan_Durab~s	0.03	0.04	3.73	***	0.03	0.04	4.07	***	0.04	0.03	3.38	***
Tot_Amt_Durables	378.62	102.03	0.45		576.19	-78.96	-0.46		691.14	-210.49	-1.4	
Tot_Loan_School	0.02	-0.01	-0.68		0.01	0	0.17		0.01	0	0.4	
Tot_Amt_School	112.75	15.95	0.18		68.61	68.73	1.29		69.92	58.77	1.23	
Tot_Loan_Debt	0.01	0.08	10.54	***	0.01	0.08	10.87	***	0.01	0.08	11.41	***
Tot_Amt_Debt	42.15	671.1	7.16	***	37.56	664.45	7.5	***	46.44	666.81	7.95	***
Tot_Loan_Lives~k	0.02	0.05	5.34	***	0.01	0.05	7.78	***	0.01	0.05	8.01	***
Tot_Amt_Livest~k	163.53	383.32	3.7	***	150.5	408.17	4.51	***	161.98	384.87	4.69	***
Tot_Loan_Shop	0.02	0.04	4.72	***	0.01	0.04	5.46	***	0.02	0.04	5.59	***
Tot_Amt_Shop	233.11	370.39	1.81	**	195.77	397.89	3.11	***	253.19	350.31	3.05	***
Tot_Loan_Machine	0	0.01	1.62		0	0.01	2.03	**	0	0.01	2.35	***
Tot_Amt_Machine	137.13	67.34	0.36		248.57	-35.24	-0.13		390.97	-186.5	-0.84	
Self_Response	0.75	0.15	6.83	***	0.74	0.16	10.97	***	0.74	0.16	11.78	***
age_marriage	15.38	0.43	1.34		15.39	0.28	1.16		15.76	0.05	0.23	
son_education	9.3	0.56	2.28	**	9.01	0.75	4.21	***	9.19	0.66	4.06	***
daughter_educa~n	7.62	0.76	3.13	***	7.67	0.59	3.4	***	7.89	0.49	3.09	***
signature_lite~e	0.35	0.34	11.37	***	0.33	0.35	18.57	***	0.32	0.37	21.75	***
sign_literate	0.17	0.05	2.62	***	0.15	0.06	3.9	***	0.16	0.06	4.86	***
job_card	0.23	0.01	0.28		0.23	0.01	0.71		0.24	0	0.01	
kirana_present	0.87	0	-0.16		0.85	0.02	1.19		0.84	0.02	1.64	
Del_Kirana	0.05	0.01	0.95		0.05	0.02	1.63		0.06	0.01	1.24	
pds_present	0.7	-0.05	-1.97	**	0.67	-0.01	-0.61		0.67	-0.02	-1.17	
Del_PDS	0.04	0.02	1.66	**	0.03	0.02	2.53	***	0.04	0.02	2.17	**

variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
health_present	0.82	0.05	2.56	***	0.82	0.05	3.57	***	0.81	0.06	4.7	***
Del_Health	0.05	0.03	2.46	***	0.06	0.03	2.39	***	0.06	0.03	2.98	***
neighbor_present	0.96	0.01	0.92		0.96	0.01	1.55		0.96	0.01	2.09	**
Del_Neighbor	0.05	0.01	1.06		0.05	0.01	1.01		0.06	0.01	0.76	
relative_present	0.89	0.01	0.49		0.86	0.04	3.19	***	0.86	0.04	3.51	***
Del_Relative	0.04	0.03	2.02	**	0.05	0.02	2.18	**	0.06	0.01	1.58	
panchayat_pres~t	0.02	0.07	6.88	***	0.03	0.06	7.21	***	0.03	0.06	7.27	***
Del_Panchayat	0	0.02	2.8	***	0	0.02	3.89	***	0	0.02	4.24	***
decision_cook~nt	0.92	0.01	0.37		0.92	0	0.36		0.92	0.01	0.71	
Del_Cook	0.01	0.02	2.01	**	0.03	0.01	0.78		0.03	0	0.24	
decision_dura~nt	0.42	0.09	3.42	***	0.42	0.09	4.69	***	0.41	0.1	5.72	***
Del_Durable	0.02	0.01	1.49		0.03	0.01	1.75	**	0.02	0.01	1.99	**
decision_pers~nt	0.93	0	0.15		0.93	0	0.49		0.93	0.01	0.67	
Del_Personal	0.05	0	-0.2		0.05	0	-0.56		0.05	0	-0.23	
decision_heal~nt	0.71	0.03	1.2		0.72	0.02	1.1		0.71	0.03	1.82	**
Del_Health	0.05	0.03	2.48	***	0.06	0.03	2.39	***	0.06	0.03	2.98	***
decision_educ~nt	0.7	0.09	3.96	***	0.69	0.09	5.43	***	0.69	0.1	6.76	***
Del_Education	0.05	0.03	2.31	**	0.05	0.02	2.39	***	0.05	0.02	2.66	***
dec_live_pres	0.47	0.08	3.06	***	0.49	0.07	3.43	***	0.49	0.06	3.64	***
Del_Livelihood	0.02	0.02	1.99	**	0.03	0.02	2.08	**	0.03	0.02	2.45	***
dec_employ_pres	0.52	0.07	2.75	***	0.51	0.09	4.83	***	0.5	0.09	5.01	***
Del_Employment	0.02	0.02	2.04	**	0.02	0.02	3.18	***	0.02	0.02	2.76	***
decision_loan~nt	0.59	0.22	8.89	***	0.58	0.23	13.41	***	0.57	0.23	15	***
Del_Loan	0.02	0.07	6.56	***	0.03	0.07	7.5	***	0.03	0.07	8.63	***
decision_poli~nt	0.18	0.11	5.34	***	0.18	0.11	6.94	***	0.19	0.1	6.7	***
Del_Politics	0.01	0.03	3.63	***	0.01	0.03	5.14	***	0.01	0.03	5.51	***
beating_actio~nt	0.75	0.09	3.83	***	0.73	0.1	6.12	***	0.74	0.09	6.5	***
Del_Beat_Act	0.17	0.05	2.51	***	0.15	0.07	4.65	***	0.15	0.07	5.29	***
pds_action_pre~t	0.39	0.05	1.96	**	0.38	0.06	3.12	***	0.38	0.06	3.66	***
Del_PDS_Act	0.11	0.04	2.23	**	0.1	0.05	3.83	***	0.1	0.05	4.68	***

variable	controls	difference	tstat	sig	controls	difference	tstat	sig	controls	difference	tstat	sig
school_action~nt	0.33	0.08	3.4	***	0.31	0.1	5.49	***	0.3	0.11	6.81	***
Del_School_Act	0.11	0.05	2.66	***	0.1	0.05	4.04	***	0.1	0.05	4.38	***
mukhiya_actio~nt	0.26	0.03	1.38		0.26	0.03	2.07	**	0.25	0.04	2.72	***
Del_Mukhiya_Act	0.07	0.03	1.92	**	0.07	0.03	2.49	***	0.07	0.03	3.04	***
ASelfBPres	0.39	0.08	2.95	***	0.37	0.09	4.99	***	0.37	0.1	5.72	***
Del_Self_beat	0.09	0.05	2.74	***	0.09	0.05	4.04	***	0.09	0.06	4.76	***
AWomBPres	0.37	0.18	6.81	***	0.39	0.16	8.59	***	0.39	0.16	9.67	***
Del_Wom_beat	0.09	0.13	7.75	***	0.08	0.14	9.95	***	0.09	0.13	10.78	***
ASelfPDSPres	0.15	0.04	2.06	**	0.16	0.03	2.03	**	0.17	0.03	2.16	**
Del_Self_pds	0.03	0.03	2.47	***	0.04	0.02	1.96	**	0.04	0.02	2.27	**
AWomPDSPres	0.13	0.1	5.14	***	0.13	0.09	6.74	***	0.12	0.1	7.72	***
Del_Wom_pds	0.03	0.08	6.53	***	0.04	0.07	6.99	***	0.04	0.07	7.68	***
ASelfSPres	0.11	0.07	3.78	***	0.12	0.06	4.55	***	0.12	0.06	4.7	***
Del_Self_school	0.04	0.03	2.38	***	0.05	0.03	2.94	***	0.05	0.02	2.71	***
AWomSPres	0.14	0.09	4.66	***	0.13	0.1	7.17	***	0.13	0.1	8.11	***
Del_Wom_school	0.04	0.07	5.35	***	0.05	0.07	6.6	***	0.05	0.06	6.76	***
ASelfMPres	0.09	0.03	1.68	**	0.09	0.02	2.08	**	0.08	0.03	2.92	***
Del_Self_mukhiya	0.03	0.01	0.91		0.03	0.01	1.96	**	0.02	0.02	2.32	**
AWomMPres	0.1	0.07	3.92	***	0.1	0.07	5.24	***	0.1	0.06	5.75	***
Del_Wom_mukhiya	0.02	0.05	4.9	***	0.03	0.04	5.5	***	0.03	0.05	6.19	***

Not matching on retrospective levels of outcome variables tend to make the ATTs stronger, especially for the variables that were used (at retrospective levels) in the probit equation. This can be seen clearly for assets, where chairs, cycles and goats have been significantly affected by treatment. We note that the Delta on these outcomes are not significant, implying that the difference at current level was also driven by difference at retrospective level. To remove this difference, it makes sense to balance at pre-treatment levels so that we do not overestimate effects.

Appendix 3: Derivations related to the RU Augmented Framework

1) Proof on 2nd order Conditions for Maxima

We have HX= - θ, where the bordered Hessian H is

$$H=\begin{bmatrix} 0 & 0 & -p_1 & -p_2 & -p_3 \\ 0 & 0 & U_1^B & U_2^B & U_3^B \\ -p_1 & U_1^B & a_{11} & a_{12} & a_{13} \\ -p_2 & U_2^B & a_{21} & a_{22} & a_{23} \\ -p_3 & U_3^B & a_{31} & a_{32} & a_{33} \end{bmatrix}$$

where U_i^B *is the* 1*st derivative of B's Utility Function w.r.t good i &* a_{ij} *is the sum of the* 2*nd derivatives of A & B's utility functions*

To check if the FOCs are necessary and sufficient for maximization, we examine the 4th and 5th leading principal minors of H.

$$H_4=\begin{vmatrix} 0 & 0 & -p_1 & -p_2 \\ 0 & 0 & U_1^B & U_2^B \\ -p_1 & U_1^B & a_{11} & a_{12} \\ -p_2 & U_2^B & a_{21} & a_{22} \end{vmatrix}=(U_1^B p_2-U_2^B p_1)^2\geq 0$$

$$H_5=\begin{vmatrix} 0 & 0 & -p_1 & -p_2 & -p_3 \\ 0 & 0 & U_1^B & U_2^B & U_3^B \\ -p_1 & U_1^B & a_{11} & a_{12} & a_{13} \\ -p_2 & U_2^B & a_{21} & a_{22} & a_{23} \\ -p_3 & U_3^B & a_{31} & a_{32} & a_{33} \end{vmatrix}=\sum_{i,j,k=1}^{3} a_{ii}(U_j^B p_k-U_k^B p_j)^2+\sum_{i,j,k=1}^{3} 2a_{jk}(U_i^B p_j-U_j^B p_i)(U_i^B p_k-U_k^B p_i)\ \forall i\neq j\neq k$$

$$Let\ (U_1^B p_3 - U_3^B p_1) = \alpha; (U_2^B p_1 - U_1^B p_2) = \beta; (U_3^B p_2 - U_2^B p_3) = \gamma$$

Hence, $H_5 = a_{11}\gamma^2 + a_{22}\alpha^2 + a_{33}\beta^2 + 2a_{23}\alpha\beta + 2a_{31}\beta\gamma + 2a_{12}\gamma\beta$

Due to concavity of utility functions, we have

$$a_{ii} < 0 \ \&\ a_{ii}a_{jj} > a_{ij}^2 \quad \therefore (-1)\sqrt{a_{ii}^{+}a_{jj}^{+}} < a_{ij}\ (where\ a_{ii}^{+} > 0\ \&\ \sqrt{a_{ii}^{+}}\ is\ real)$$

Hence, $H_5 < H_5^*$, where

$$H_5^* = (-1)[a_{11}^{+}\gamma^2 + a_{22}^{+}\alpha^2 + a_{33}^{+}\beta^2 + 2\sqrt{a_{22}^{+}a_{33}^{+}}\alpha\beta + 2\sqrt{a_{33}^{+}a_{11}^{+}}\beta\gamma + 2\sqrt{a_{11}^{+}a_{22}^{+}}\gamma\beta\ ] = (-1)\ [\sqrt{a_{11}^{+}}\gamma + \sqrt{a_{11}^{+}}\alpha + \sqrt{a_{11}^{+}}\beta]^2 < 0$$

Therefore, the 5th order principal minor in non-positive and the 4th order principal minor is non-negative. This implies that the optimization program yields a maxima.

2) F.O.Cs for Rescaled Lagrangean of the RU Augmented Framework

The Rescaled Lagrangean can be related to the original by

$$\widetilde{L} = \frac{L}{1+\mu} = \frac{1}{1+\mu}U^A + \frac{\mu}{1+\mu}[U^B - \overline{V}_B] + \frac{\lambda}{1+\mu}[Y_A + Y_B - p'q]$$

$$\frac{\partial \widetilde{L}}{\partial q_i} = \frac{1}{(1+\mu)}\frac{\partial L}{\partial q_i} = 0 \Leftrightarrow \frac{1}{1+\mu^*}[\frac{\partial U^A}{\partial q_i^*} + \mu\frac{\partial U^B}{\partial q_i^*} - \lambda^* p_i] = 0 \qquad \text{(A1)}$$

$$\frac{\partial \widetilde{L}}{\partial \lambda} = \frac{1}{(1+\mu)}\frac{\partial L}{\partial \lambda} = 0 \Leftrightarrow \frac{1}{1+\mu^*}[Y_A + Y_B - p'q^*] = 0 \qquad \text{(A2)}$$

Hence, it can be seen that with respect to the consumption vector and the income multiplier, the partial of the original and the transformed Lagrangean are set to 0 at the optimum. With respect to μ, the derivative of the transformed Lagrangean is computed and then set to 0, the condition for the original Lagrangean. Thus,

$$\frac{\partial L}{\partial \mu} = (1+\mu)\frac{\partial \widetilde{L}}{\partial \mu} + \widetilde{L} = 0 \Leftrightarrow \frac{\partial \widetilde{L}}{\partial \mu} = -\frac{\widetilde{L}}{1+\mu} \quad \text{(A3)}$$

Some calculations show for the transformed Lagrangean, the necessary FOC with respect to μ is

$$U^B(q_A, q_B, Q) - \overline{V}_B = 0$$

3) Derivation of Equation 9′

From the Envelope Theorem, for a unit change in B's income, the effect on A's welfare as captured by the transformed Lagrangean,

$$\frac{d\widetilde{L}}{dY_B} = \sum \frac{\partial \widetilde{L}}{\partial x}\frac{\partial x^*}{\partial Y_B} + \frac{\partial \widetilde{L}}{\partial Y_B} \text{ (Where x reflects choice variables)} \quad \text{(A4)}$$

Conditions (A1) and (A2) imply that w.r.t. goods and the income multiplier, the partial derivative of the Lagrangean goes to 0. (A3) gives us the required expression for the partial w.r.t. the multiplier on B's RU. Thus the above differential equation simplifies to,

$$\frac{d\widetilde{L}}{dY_B} = \frac{\partial \widetilde{L}}{\partial \mu}\left[\frac{\partial \mu^*}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \frac{\partial \widetilde{L}}{\partial Y_B} = -\frac{\widetilde{L}}{1+\mu}\left[\frac{\partial \mu^*}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \frac{\partial \widetilde{L}}{\partial Y_B} \quad \text{(A5)}$$

But we know at the optimum, from the FOCs (A2) and (A3), that both constraints bind. Hence, the above expression simplifies to,

$$\frac{d\widetilde{L}}{dY_B} = -\frac{U_A}{(1+\mu)^2}\left[\frac{\partial \mu^*}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \frac{\partial \widetilde{L}}{\partial Y_B} = U_A \frac{\partial}{\partial \mu}\left(\frac{1}{1+\mu}\right)\left[\frac{\partial \mu^*}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \frac{\partial \widetilde{L}}{\partial Y_B} \Leftrightarrow \frac{d\widetilde{L}}{dY_B} = U_A \frac{\partial(1-\theta)}{\partial \mu}\left[\frac{\partial \mu^*}{\partial \overline{V}_B}\frac{\partial \overline{V}_B}{\partial Y_B}\right] + \lambda(1-\theta) - \theta\frac{\partial \overline{V}_B}{\partial Y_B}$$

Thus, we have Equation 9′.

Appendix 4: Empirical Analysis for Collective and RU Augmented Framework

Table A6.1: Estimated Demand for Staple goods

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; All Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareStaple	ShareStaple	ShareStaple	ShareStaple	ShareStaple	ShareStaple
Log_Ann_PC_Exp	-0.105***	-0.100***	-0.0845***	-0.104***	-0.102***	-0.0998***
	(0.00728)	(0.00652)	(0.00440)	(0.00797)	(0.00775)	(0.00780)
Log_Tot_Inc				-0.000547	0.00129	0.00723**
				(0.00363)	(0.00343)	(0.00300)
Head_Income	1.51e-07***	1.34e-07***		1.54e-07***	1.28e-07***	
	(3.37e-08)	(3.01e-08)		(4.10e-08)	(3.52e-08)	
Spouse_Income	1.35e-07***		8.55e-08**	1.37e-07***		7.53e-08**
	(3.91e-08)		(3.36e-08)	(4.12e-08)		(3.51e-08)
NL_Inc	1.33e-07	1.18e-07	5.13e-08	1.33e-07	1.18e-07	6.82e-08
	(9.63e-08)	(9.00e-08)	(7.06e-08)	(9.66e-08)	(9.09e-08)	(7.80e-08)
Head_Age	-0.000212	-0.000277	-0.000240	-0.000212	-0.000274	-0.000227
	(0.000311)	(0.000307)	(0.000306)	(0.000310)	(0.000309)	(0.000311)
Spouse_Age	0.000707**	0.000811***	0.000791**	0.000705**	0.000814***	0.000813***
	(0.000316)	(0.000311)	(0.000310)	(0.000315)	(0.000311)	(0.000314)
totalboy_0to5	-0.0143***	-0.0132***	-0.00961***	-0.0142***	-0.0136***	-0.0128***
	(0.00259)	(0.00254)	(0.00239)	(0.00255)	(0.00254)	(0.00254)
totalboy_6to12	-0.00911***	-0.00831***	-0.00574***	-0.00898***	-0.00865***	-0.00835***
	(0.00188)	(0.00180)	(0.00159)	(0.00192)	(0.00189)	(0.00189)
totalboy_13to18	-0.00370**	-0.00334**	-0.00170	-0.00359**	-0.00361**	-0.00379**
	(0.00171)	(0.00168)	(0.00157)	(0.00177)	(0.00177)	(0.00176)
totalboy_19to21	-0.00365	-0.00327	-0.00128	-0.00352	-0.00359	-0.00361
	(0.00308)	(0.00306)	(0.00299)	(0.00312)	(0.00312)	(0.00313)
totalgirl_0to5	-0.0133***	-0.0120***	-0.00866***	-0.0131***	-0.0124***	-0.0120***
	(0.00288)	(0.00276)	(0.00253)	(0.00289)	(0.00284)	(0.00283)
totalgirl_6to12	-0.0112***	-0.0106***	-0.00832***	-0.0111***	-0.0109***	-0.0109***
	(0.00196)	(0.00188)	(0.00171)	(0.00198)	(0.00196)	(0.00199)
totalgirl_13to18	-0.00741***	-0.00688***	-0.00492***	-0.00728***	-0.00718***	-0.00715***
	(0.00184)	(0.00180)	(0.00166)	(0.00198)	(0.00198)	(0.00196)
totalgirl_19to21	-0.00384	-0.00365	-0.00182	-0.00374	-0.00390	-0.00370

	(0.00312)	(0.00311)	(0.00300)	(0.00309)	(0.00310)	(0.00306)
Head_Edu	-0.000592*	-0.000671**	-0.000696**	-0.000595*	-0.000661**	-0.000613*
	(0.000316)	(0.000310)	(0.000308)	(0.000316)	(0.000313)	(0.000316)
Spouse_Edu	-0.000129	-8.52e-05	-0.000294	-0.000135	-7.13e-05	-0.000162
	(0.000255)	(0.000254)	(0.000244)	(0.000255)	(0.000255)	(0.000252)
MP1	-0.00329	-0.00320	-0.00314	-0.00328	-0.00323	-0.00345
	(0.00229)	(0.00227)	(0.00224)	(0.00228)	(0.00228)	(0.00229)
Log_Avg_Groom_Exp	0.00118	0.000562	0.000122	0.00115	0.000650	0.000754
	(0.00167)	(0.00164)	(0.00159)	(0.00167)	(0.00166)	(0.00165)
Log_Avg_Bride_Exp	0.00222	0.00228	0.00148	0.00218	0.00239	0.00226
	(0.00193)	(0.00191)	(0.00184)	(0.00195)	(0.00194)	(0.00193)
Log_Index_Food	0.125***	0.118***	0.0678*	0.125***	0.119***	0.0690*
	(0.0307)	(0.0305)	(0.0354)	(0.0305)	(0.0304)	(0.0354)
Log_Index_Sin	-0.0336	-0.0335	-0.0460*	-0.0331	-0.0346	-0.0560**
	(0.0299)	(0.0300)	(0.0257)	(0.0300)	(0.0300)	(0.0261)
Log_Index_Fuel	-0.0543***	-0.0534***	-0.0404***	-0.0542***	-0.0536***	-0.0412***
	(0.0162)	(0.0163)	(0.0146)	(0.0162)	(0.0163)	(0.0144)
Log_Index_Clothing	0.0491	0.0451	-0.0234	0.0482	0.0473	-0.0126
	(0.0376)	(0.0374)	(0.0345)	(0.0377)	(0.0375)	(0.0348)
Log_Index_Misc	0.0887	0.0915	0.112***	0.0892	0.0904	0.102***
	(0.0722)	(0.0728)	(0.0284)	(0.0710)	(0.0712)	(0.0283)
Constant	0	0	0.463*	0	0	0.573**
	(0)	(0)	(0.264)	(0)	(0)	(0.268)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.575	0.581	0.594	0.576	0.578	0.580
p-value (Over Id Test)	0.3881	0.0007	0.0000	0.1687	0.0004	0.0000

Table A6.2: Estimated Demand for Food (other than Staple)

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareOthFood	ShareOthFood	ShareOthFood	ShareOthFood	ShareOthFood	ShareOthFood
Log_Ann_PC_Exp	-0.0302***	-0.0401***	-0.0598***	-0.0369***	-0.0415***	-0.0562***
	(0.0105)	(0.00962)	(0.00692)	(0.0126)	(0.0124)	(0.0122)
Log_Tot_Inc				0.00490	0.000987	-0.00172
				(0.00525)	(0.00501)	(0.00461)
Head_Income	-1.74e-07***	-1.39e-07***		-1.97e-07***	-1.43e-07***	
	(4.96e-08)	(4.50e-08)		(5.64e-08)	(4.89e-08)	
Spouse_Income	-2.75e-07***		-1.92e-07***	-2.92e-07***		-1.90e-07***
	(7.45e-08)		(7.20e-08)	(7.55e-08)		(7.24e-08)
NL_Inc	-1.79e-07	-1.49e-07	-5.50e-08	-1.82e-07	-1.49e-07	-5.90e-08
	(2.04e-07)	(1.93e-07)	(1.82e-07)	(2.01e-07)	(1.92e-07)	(1.85e-07)
Head_Age	0.000195	0.000327	0.000246	0.000199	0.000329	0.000243
	(0.000509)	(0.000505)	(0.000505)	(0.000506)	(0.000505)	(0.000506)
Spouse_Age	-0.000519	-0.000732	-0.000561	-0.000496	-0.000729	-0.000566
	(0.000546)	(0.000540)	(0.000538)	(0.000542)	(0.000539)	(0.000538)
totalboy_0to5	-0.00882**	-0.0111***	-0.0157***	-0.0101**	-0.0114**	-0.0149***
	(0.00434)	(0.00425)	(0.00399)	(0.00450)	(0.00448)	(0.00437)
totalboy_6to12	-0.00457	-0.00620**	-0.00956***	-0.00575*	-0.00646**	-0.00894***
	(0.00298)	(0.00289)	(0.00268)	(0.00315)	(0.00312)	(0.00309)
totalboy_13to18	-0.00606**	-0.00680**	-0.00976***	-0.00706**	-0.00701**	-0.00926***
	(0.00283)	(0.00276)	(0.00259)	(0.00297)	(0.00296)	(0.00290)
totalboy_19to21	-0.00774	-0.00852	-0.0111**	-0.00891	-0.00877	-0.0106*
	(0.00572)	(0.00565)	(0.00550)	(0.00576)	(0.00575)	(0.00566)
totalgirl_0to5	-0.00240	-0.00502	-0.00931**	-0.00384	-0.00534	-0.00852*
	(0.00429)	(0.00415)	(0.00389)	(0.00449)	(0.00445)	(0.00444)
totalgirl_6to12	-0.00459	-0.00594*	-0.00961***	-0.00579*	-0.00620*	-0.00898***
	(0.00312)	(0.00305)	(0.00287)	(0.00334)	(0.00333)	(0.00332)
totalgirl_13to18	-0.0106***	-0.0116***	-0.0142***	-0.0117***	-0.0119***	-0.0136***
	(0.00310)	(0.00305)	(0.00285)	(0.00333)	(0.00333)	(0.00326)
totalgirl_19to21	-0.00188	-0.00227	-0.00512	-0.00278	-0.00245	-0.00467
	(0.00611)	(0.00603)	(0.00591)	(0.00610)	(0.00607)	(0.00600)
Head_Edu	-0.00111**	-0.000945*	-0.000835	-0.00108*	-0.000937*	-0.000855
	(0.000559)	(0.000554)	(0.000552)	(0.000558)	(0.000555)	(0.000555)
Spouse_Edu	0.000564	0.000475	0.000834*	0.000622	0.000486	0.000803

	(0.000500)	(0.000496)	(0.000482)	(0.000501)	(0.000499)	(0.000492)
MP1	0.00145	0.00127	6.96e-05	0.00136	0.00125	0.000145
	(0.00379)	(0.00377)	(0.00373)	(0.00377)	(0.00377)	(0.00375)
Log_Avg_Groom_Exp	-0.00221	-0.000957	-0.000931	-0.00195	-0.000889	-0.00108
	(0.00322)	(0.00319)	(0.00312)	(0.00321)	(0.00321)	(0.00315)
Log_Avg_Bride_Exp	-0.00388	-0.00400	-0.00292	-0.00347	-0.00392	-0.00311
	(0.00331)	(0.00329)	(0.00321)	(0.00330)	(0.00330)	(0.00325)
Log_Index_Food	-0.0145	-0.00110	-0.0871	-0.0116	-0.000401	-0.0874
	(0.0523)	(0.0516)	(0.0555)	(0.0518)	(0.0516)	(0.0558)
Log_Index_Sin	0.0934*	0.0932*	0.0492	0.0893*	0.0924*	0.0516
	(0.0503)	(0.0503)	(0.0393)	(0.0500)	(0.0501)	(0.0398)
Log_Index_Fuel	0.0510**	0.0491*	0.0679***	0.0500**	0.0489*	0.0681***
	(0.0253)	(0.0253)	(0.0200)	(0.0253)	(0.0254)	(0.0201)
Log_Index_Clothing	-0.00447	0.00382	-0.0717	0.00349	0.00547	-0.0743
	(0.0718)	(0.0709)	(0.0604)	(0.0713)	(0.0709)	(0.0611)
Log_Index_Misc	-0.0207	-0.0266	-0.0289	-0.0249	-0.0275	-0.0267
	(0.132)	(0.132)	(0.0479)	(0.129)	(0.129)	(0.0485)
Constant	0	0	1.337***	0	0	1.311***
	(0)	(0)	(0.431)	(0)	(0)	(0.437)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.329	0.341	0.364	0.339	0.343	0.361
p-value (Over Id Test)	0.5478	0.0160	0.0028	0.8481	0.0061	0.0009

Table A6.3: Estimated Demand for Fuel

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	Tot Inc Excl; Head Inc included	Tot Inc Excl; Spouse Inc included	Tot Inc Incl; Both Ind Inc included	Tot Inc Incl; Head Inc included	Tot Inc Incl; Spouse Inc included
VARIABLES	ShareFuel	ShareFuel	ShareFuel	ShareFuel	ShareFuel	ShareFuel
Log_Ann_PC_Exp	-0.00899	-0.0137**	-0.0306***	-0.00927	-0.0114	-0.0210***
	(0.00671)	(0.00610)	(0.00417)	(0.00813)	(0.00798)	(0.00789)
Log_Tot_Inc				0.000206	-0.00157	-0.00451
				(0.00341)	(0.00330)	(0.00293)
Head_Income	-1.31e-07***	-1.14e-07***		-1.32e-07***	-1.07e-07***	
	(3.46e-08)	(3.15e-08)		(3.99e-08)	(3.50e-08)	
Spouse_Income	-1.32e-07***		-7.27e-08**	-1.33e-07***		-6.63e-08*
	(4.05e-08)		(3.67e-08)	(4.10e-08)		(3.64e-08)
NL_Inc	-2.30e-07*	-2.16e-07*	-1.41e-07	-2.31e-07*	-2.16e-07*	-1.52e-07
	(1.28e-07)	(1.19e-07)	(1.09e-07)	(1.28e-07)	(1.20e-07)	(1.12e-07)
Head_Age	0.00119***	0.00125***	0.00123***	0.00119***	0.00125***	0.00122***
	(0.000281)	(0.000280)	(0.000275)	(0.000281)	(0.000281)	(0.000277)
Spouse_Age	-0.000967***	-0.00107***	-0.00101***	-0.000966***	-0.00107***	-0.00102***
	(0.000304)	(0.000302)	(0.000295)	(0.000305)	(0.000304)	(0.000299)
totalboy_0to5	-0.00646**	-0.00754***	-0.0114***	-0.00651**	-0.00707**	-0.00945***
	(0.00272)	(0.00266)	(0.00245)	(0.00281)	(0.00279)	(0.00271)
totalboy_6to12	-0.00552***	-0.00631***	-0.00914***	-0.00557***	-0.00590***	-0.00751***
	(0.00187)	(0.00182)	(0.00168)	(0.00196)	(0.00194)	(0.00194)
totalboy_13to18	-0.00953***	-0.00988***	-0.0121***	-0.00957***	-0.00955***	-0.0108***
	(0.00165)	(0.00164)	(0.00154)	(0.00172)	(0.00171)	(0.00169)
totalboy_19to21	-0.00486	-0.00523*	-0.00731**	-0.00491	-0.00484	-0.00586*
	(0.00307)	(0.00301)	(0.00287)	(0.00313)	(0.00312)	(0.00306)
totalgirl_0to5	-0.000413	-0.00167	-0.00542**	-0.000473	-0.00116	-0.00334
	(0.00261)	(0.00251)	(0.00234)	(0.00279)	(0.00276)	(0.00275)
totalgirl_6to12	-0.00705***	-0.00770***	-0.0106***	-0.00710***	-0.00728***	-0.00899***
	(0.00195)	(0.00190)	(0.00177)	(0.00210)	(0.00209)	(0.00207)
totalgirl_13to18	-0.00874***	-0.00925***	-0.0113***	-0.00878***	-0.00888***	-0.00996***
	(0.00169)	(0.00166)	(0.00155)	(0.00183)	(0.00182)	(0.00182)
totalgirl_19to21	-0.00800**	-0.00819**	-0.0103***	-0.00804**	-0.00789**	-0.00915***
	(0.00323)	(0.00320)	(0.00313)	(0.00325)	(0.00324)	(0.00321)
Head_Edu	-0.000357	-0.000279	-0.000171	-0.000356	-0.000292	-0.000223
	(0.000318)	(0.000314)	(0.000310)	(0.000319)	(0.000317)	(0.000316)

Spouse_Edu	-3.41e-05	-7.67e-05	0.000160	-3.17e-05	-9.37e-05	7.73e-05
	(0.000277)	(0.000276)	(0.000268)	(0.000280)	(0.000280)	(0.000276)
MP1	-0.00344	-0.00352	-0.00433**	-0.00344	-0.00349	-0.00413*
	(0.00218)	(0.00217)	(0.00213)	(0.00219)	(0.00218)	(0.00216)
Log_Avg_Groom_Exp	-0.00707***	-0.00647***	-0.00612***	-0.00706***	-0.00658***	-0.00651***
	(0.00182)	(0.00180)	(0.00172)	(0.00183)	(0.00183)	(0.00177)
Log_Avg_Bride_Exp	0.00277	0.00271	0.00347*	0.00278	0.00258	0.00299
	(0.00198)	(0.00197)	(0.00189)	(0.00201)	(0.00201)	(0.00196)
Log_Index_Food	0.00372	0.0101	-0.0340	0.00383	0.00892	-0.0348
	(0.0280)	(0.0275)	(0.0325)	(0.0281)	(0.0279)	(0.0328)
Log_Index_Sin	0.0386	0.0385	0.0125	0.0384	0.0398	0.0187
	(0.0291)	(0.0292)	(0.0226)	(0.0293)	(0.0295)	(0.0234)
Log_Index_Fuel	-0.000136	-0.00103	0.00859	-0.000174	-0.000682	0.00905
	(0.0138)	(0.0137)	(0.0117)	(0.0139)	(0.0139)	(0.0119)
Log_Index_Clothing	-0.0344	-0.0304	-0.0665*	-0.0341	-0.0332	-0.0733**
	(0.0468)	(0.0464)	(0.0359)	(0.0476)	(0.0474)	(0.0371)
Log_Index_Misc	0.0286	0.0258	0.0202	0.0284	0.0273	0.0260
	(0.0820)	(0.0825)	(0.0334)	(0.0811)	(0.0812)	(0.0343)
Constant	0	0	0.777***	0	0	0.709***
	(0)	(0)	(0.263)	(0)	(0)	(0.266)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.214	0.224	0.248	0.215	0.218	0.237
p-value (Over Id Test)	0.1413	0.0039	0.0000	0.0494	0.0013	0.0000

Table A6.4: Estimated Demand for Public Goods

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	Tot Inc Excl; Head Inc included	Tot Inc Excl; Spouse Inc included	Tot Inc Incl; Both Ind Inc included	Tot Inc Incl; Head Inc included	Tot Inc Incl; Spouse Inc included
VARIABLES	ShareHHPub	ShareHHPub	ShareHHPub	ShareHHPub	ShareHHPub	ShareHHPub
Log_Ann_PC_Exp	0.0583***	0.0554***	0.0531***	0.0548***	0.0535***	0.0527***
	(0.00994)	(0.00948)	(0.00728)	(0.0125)	(0.0124)	(0.0130)
Log_Tot_Inc				0.00247	0.00128	0.000206
				(0.00565)	(0.00555)	(0.00509)
Head_Income	-3.67e-08	-2.63e-08		-4.82e-08	-3.17e-08	
	(5.68e-08)	(5.51e-08)		(6.49e-08)	(6.17e-08)	
Spouse_Income	-8.04e-08		-6.78e-08	-8.87e-08		-6.81e-08
	(8.36e-08)		(8.23e-08)	(8.48e-08)		(8.22e-08)
NL_Inc	-2.01e-07	-1.92e-07	-1.81e-07	-2.03e-07	-1.93e-07	-1.80e-07
	(2.97e-07)	(2.98e-07)	(3.00e-07)	(2.98e-07)	(2.99e-07)	(3.00e-07)
Head_Age	-0.000748	-0.000710	-0.000741	-0.000746	-0.000707	-0.000740
	(0.000519)	(0.000517)	(0.000519)	(0.000520)	(0.000518)	(0.000520)
Spouse_Age	0.000167	0.000105	0.000148	0.000179	0.000108	0.000148
	(0.000580)	(0.000575)	(0.000581)	(0.000579)	(0.000575)	(0.000580)
totalboy_0to5	0.0143***	0.0136***	0.0131***	0.0136***	0.0132***	0.0130***
	(0.00440)	(0.00433)	(0.00416)	(0.00468)	(0.00466)	(0.00476)
totalboy_6to12	-0.00103	-0.00151	-0.00187	-0.00163	-0.00184	-0.00195
	(0.00298)	(0.00294)	(0.00277)	(0.00324)	(0.00323)	(0.00330)
totalboy_13to18	-0.00831***	-0.00853***	-0.00882***	-0.00882***	-0.00880***	-0.00888***
	(0.00289)	(0.00288)	(0.00285)	(0.00316)	(0.00316)	(0.00324)
totalboy_19to21	0.00250	0.00227	0.00191	0.00191	0.00195	0.00184
	(0.00591)	(0.00591)	(0.00584)	(0.00607)	(0.00607)	(0.00610)
totalgirl_0to5	0.00410	0.00334	0.00295	0.00338	0.00292	0.00285
	(0.00415)	(0.00408)	(0.00386)	(0.00451)	(0.00449)	(0.00461)
totalgirl_6to12	-0.000363	-0.000758	-0.00110	-0.000971	-0.00110	-0.00118
	(0.00303)	(0.00301)	(0.00289)	(0.00328)	(0.00327)	(0.00338)
totalgirl_13to18	-0.00119	-0.00150	-0.00180	-0.00173	-0.00180	-0.00187
	(0.00300)	(0.00298)	(0.00289)	(0.00323)	(0.00323)	(0.00330)
totalgirl_19to21	-0.00170	-0.00182	-0.00221	-0.00216	-0.00206	-0.00226
	(0.00618)	(0.00619)	(0.00615)	(0.00623)	(0.00624)	(0.00625)
Head_Edu	0.000704	0.000751	0.000732	0.000719	0.000761	0.000735
	(0.000581)	(0.000580)	(0.000584)	(0.000582)	(0.000582)	(0.000588)
Spouse_Edu	-0.000701	-0.000727	-0.000660	-0.000672	-0.000713	-0.000656

	(0.000522)	(0.000521)	(0.000520)	(0.000523)	(0.000522)	(0.000524)
MP1	0.0107***	0.0107***	0.0107***	0.0107***	0.0107***	0.0107***
	(0.00401)	(0.00401)	(0.00401)	(0.00401)	(0.00401)	(0.00402)
Log_Avg_Groom_Exp	-0.00664**	-0.00628*	-0.00639**	-0.00651**	-0.00619*	-0.00637**
	(0.00322)	(0.00321)	(0.00320)	(0.00325)	(0.00324)	(0.00324)
Log_Avg_Bride_Exp	0.00610*	0.00607*	0.00629*	0.00631*	0.00617*	0.00631*
	(0.00333)	(0.00333)	(0.00332)	(0.00334)	(0.00335)	(0.00334)
Log_Index_Food	-0.0117	-0.00784	-0.000482	-0.0103	-0.00688	-0.000447
	(0.0459)	(0.0455)	(0.0481)	(0.0457)	(0.0453)	(0.0480)
Log_Index_Sin	0.0289	0.0289	0.0308	0.0269	0.0278	0.0305
	(0.0510)	(0.0516)	(0.0401)	(0.0511)	(0.0515)	(0.0409)
Log_Index_Fuel	0.0194	0.0189	0.0167	0.0190	0.0186	0.0167
	(0.0237)	(0.0236)	(0.0176)	(0.0238)	(0.0238)	(0.0175)
Log_Index_Clothing	-0.0858	-0.0834	-0.0711	-0.0818	-0.0812	-0.0708
	(0.0692)	(0.0692)	(0.0484)	(0.0698)	(0.0696)	(0.0488)
Log_Index_Misc	-0.0193	-0.0210	-0.0245	-0.0215	-0.0222	-0.0248
	(0.142)	(0.144)	(0.0413)	(0.139)	(0.140)	(0.0415)
Constant	0	0	-0.0769	0	0	-0.0737
	(0)	(0)	(0.354)	(0)	(0)	(0.368)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.223	0.223	0.223	0.223	0.223	0.223
p-value (Over Id Test)	0.3420	0.3713	0.4735	0.1592	0.2161	0.2873

Table A6.5: Estimated Demand for Private Goods (Apart from Clothing)

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	**Tot Inc Excl; Head Inc included**	**Tot Inc Excl; Spouse Inc included**	**Tot Inc Incl; Both Ind Inc included**	**Tot Inc Incl; Head Inc included**	**Tot Inc Incl; Spouse Inc included**
VARIABLES	ShareOthHHGoods	ShareOthHHGoods	ShareOthHHGoods	ShareOthHHGoods	ShareOthHHGoods	ShareOthHHGoods
Log_Ann_PC_Exp	0.0210***	0.0203***	0.0145***	0.0299***	0.0299***	0.0304***
	(0.00470)	(0.00396)	(0.00284)	(0.00590)	(0.00577)	(0.00573)
Log_Tot_Inc				-0.00646***	-0.00645***	-0.00754***
				(0.00240)	(0.00226)	(0.00225)
Head_Income	-4.64e-08*	-4.38e-08**		-1.63e-08	-1.65e-08	
	(2.47e-08)	(2.05e-08)		(2.73e-08)	(2.10e-08)	
Spouse_Income	-2.07e-08		-4.90e-09	9.97e-10		5.77e-09
	(6.98e-08)		(6.30e-08)	(7.15e-08)		(6.35e-08)
NL_Inc	2.20e-09	4.43e-09	2.79e-08	6.39e-09	6.28e-09	1.03e-08
	(1.39e-07)	(1.41e-07)	(1.39e-07)	(1.41e-07)	(1.42e-07)	(1.42e-07)
Head_Age	-0.000213	-0.000203	-0.000204	-0.000218	-0.000218	-0.000218
	(0.000219)	(0.000220)	(0.000218)	(0.000223)	(0.000223)	(0.000224)
Spouse_Age	2.81e-05	1.22e-05	3.48e-06	-2.16e-06	-1.37e-06	-1.88e-05
	(0.000234)	(0.000239)	(0.000233)	(0.000240)	(0.000245)	(0.000242)
totalboy_0to5	0.00489**	0.00472**	0.00342**	0.00664***	0.00664***	0.00671***
	(0.00192)	(0.00188)	(0.00166)	(0.00213)	(0.00213)	(0.00210)
totalboy_6to12	0.000759	0.000636	-0.000300	0.00231	0.00232	0.00243*
	(0.00132)	(0.00126)	(0.00110)	(0.00150)	(0.00149)	(0.00147)
totalboy_13to18	0.00227	0.00221	0.00162	0.00360**	0.00360**	0.00380**
	(0.00142)	(0.00138)	(0.00129)	(0.00157)	(0.00157)	(0.00158)
totalboy_19to21	0.00617*	0.00611*	0.00543	0.00772**	0.00772**	0.00786**
	(0.00343)	(0.00339)	(0.00335)	(0.00354)	(0.00355)	(0.00354)
totalgirl_0to5	0.00262	0.00243	0.00117	0.00452**	0.00452**	0.00464**
	(0.00194)	(0.00182)	(0.00155)	(0.00214)	(0.00210)	(0.00206)
totalgirl_6to12	0.00219*	0.00209*	0.00126	0.00378***	0.00378***	0.00399***
	(0.00128)	(0.00120)	(0.00112)	(0.00142)	(0.00141)	(0.00141)
totalgirl_13to18	0.000829	0.000749	5.23e-05	0.00225	0.00225*	0.00237*
	(0.00124)	(0.00118)	(0.00111)	(0.00137)	(0.00137)	(0.00136)
totalgirl_19to21	0.00176	0.00173	0.00112	0.00295	0.00295	0.00308
	(0.00281)	(0.00280)	(0.00275)	(0.00289)	(0.00290)	(0.00289)
Head_Edu	0.000286	0.000298	0.000321	0.000248	0.000248	0.000235
	(0.000222)	(0.000224)	(0.000222)	(0.000228)	(0.000230)	(0.000231)
Spouse_Edu	-7.96e-05	-8.63e-05	-2.72e-05	-0.000157	-0.000156	-0.000165

	(0.000223)	(0.000221)	(0.000221)	(0.000227)	(0.000225)	(0.000228)
MP1	-0.000189	-0.000203	-0.000260	-6.00e-05	-5.96e-05	6.90e-05
	(0.00161)	(0.00161)	(0.00161)	(0.00165)	(0.00164)	(0.00165)
Log_Avg_Groom_Exp	0.00351**	0.00361**	0.00384***	0.00317**	0.00316**	0.00318**
	(0.00148)	(0.00142)	(0.00143)	(0.00151)	(0.00147)	(0.00149)
Log_Avg_Bride_Exp	-0.00423***	-0.00424***	-0.00400***	-0.00476***	-0.00476***	-0.00481***
	(0.00142)	(0.00142)	(0.00143)	(0.00147)	(0.00146)	(0.00147)
Log_Index_Food	-0.00712	-0.00612	0.00753	-0.0109	-0.0109	0.00626
	(0.0231)	(0.0232)	(0.0229)	(0.0237)	(0.0238)	(0.0238)
Log_Index_Sin	-0.0202	-0.0203	-0.0177	-0.0148	-0.0148	-0.00728
	(0.0188)	(0.0191)	(0.0147)	(0.0198)	(0.0200)	(0.0159)
Log_Index_Fuel	0.00623	0.00609	0.00267	0.00748	0.00749	0.00345
	(0.0102)	(0.0102)	(0.00673)	(0.0106)	(0.0106)	(0.00711)
Log_Index_Clothing	-0.0134	-0.0128	0.00567	-0.0239	-0.0240	-0.00560
	(0.0375)	(0.0371)	(0.0292)	(0.0382)	(0.0380)	(0.0300)
Log_Index_Misc	0.00885	0.00842	0.00221	0.0144	0.0144	0.0119
	(0.0660)	(0.0666)	(0.0233)	(0.0660)	(0.0661)	(0.0239)
Constant	0	0	-0.103	0	0	-0.217
	(0)	(0)	(0.164)	(0)	(0)	(0.175)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.038	0.039	0.050	0.009	0.009	0.007
p-value (Over Id Test)	0.0154	0.0222	0.0055	0.6766	0.9164	0.6879

Table A6.6: Estimated Demand for Clothing

	SPEC 6C	SPEC 8A		SPEC 6B	SPEC 8B	
	Tot Inc Excl; Both Ind Inc included	Tot Inc Excl; Head Inc included	Tot Inc Excl; Spouse Inc included	Tot Inc Incl; Both Ind Inc included	Tot Inc Incl; Head Inc included	Tot Inc Incl; Spouse Inc included
VARIABLES	ShareClothing	ShareClothing	ShareClothing	ShareClothing	ShareClothing	ShareClothing
Log_Ann_PC_Exp	0.00708**	0.00859**	0.00801***	0.00551	0.00611	0.00574
	(0.00347)	(0.00344)	(0.00245)	(0.00461)	(0.00461)	(0.00462)
Log_Tot_Inc				0.00114	0.00165	0.00107
				(0.00192)	(0.00192)	(0.00182)
Head_Income	5.22e-09	-2.23e-10		-9.59e-11	-7.22e-09	
	(1.70e-08)	(1.73e-08)		(1.80e-08)	(1.85e-08)	
Spouse_Income	4.22e-08		3.95e-08	3.83e-08		3.80e-08
	(3.32e-08)		(3.34e-08)	(3.33e-08)		(3.35e-08)
NL_Inc	-1.16e-07**	-1.21e-07**	-1.20e-07**	-1.17e-07**	-1.21e-07**	-1.17e-07**
	(5.62e-08)	(5.73e-08)	(5.65e-08)	(5.54e-08)	(5.60e-08)	(5.51e-08)
Head_Age	-0.000201	-0.000221	-0.000203	-0.000200	-0.000217	-0.000201
	(0.000172)	(0.000172)	(0.000173)	(0.000172)	(0.000171)	(0.000172)
Spouse_Age	0.000160	0.000193	0.000161	0.000166	0.000196	0.000164
	(0.000190)	(0.000188)	(0.000190)	(0.000189)	(0.000187)	(0.000189)
totalboy_0to5	0.00109	0.00144	0.00130	0.000782	0.000944	0.000835
	(0.00157)	(0.00155)	(0.00145)	(0.00171)	(0.00171)	(0.00172)
totalboy_6to12	0.00270**	0.00295***	0.00286***	0.00243*	0.00252**	0.00247*
	(0.00113)	(0.00113)	(0.00104)	(0.00127)	(0.00127)	(0.00128)
totalboy_13to18	0.00253**	0.00264**	0.00265***	0.00230*	0.00229*	0.00234**
	(0.00107)	(0.00108)	(0.00103)	(0.00117)	(0.00118)	(0.00119)
totalboy_19to21	0.00513**	0.00525**	0.00524**	0.00486**	0.00484**	0.00489**
	(0.00230)	(0.00230)	(0.00229)	(0.00239)	(0.00239)	(0.00240)
totalgirl_0to5	0.00379**	0.00419**	0.00401***	0.00346**	0.00365**	0.00351**
	(0.00161)	(0.00163)	(0.00153)	(0.00174)	(0.00175)	(0.00174)
totalgirl_6to12	0.00217**	0.00238**	0.00233**	0.00189	0.00194	0.00194
	(0.00103)	(0.00101)	(0.000957)	(0.00120)	(0.00120)	(0.00122)
totalgirl_13to18	0.00377***	0.00394***	0.00389***	0.00352***	0.00355***	0.00356***
	(0.00121)	(0.00121)	(0.00119)	(0.00131)	(0.00131)	(0.00133)
totalgirl_19to21	-0.00148	-0.00142	-0.00137	-0.00169	-0.00173	-0.00165
	(0.00170)	(0.00171)	(0.00169)	(0.00178)	(0.00178)	(0.00179)
Head_Edu	0.000375*	0.000350*	0.000366*	0.000382*	0.000363*	0.000378*
	(0.000200)	(0.000199)	(0.000199)	(0.000201)	(0.000200)	(0.000201)
Spouse_Edu	-0.000731***	-0.000718***	-0.000740***	-0.000718***	-0.000700***	-0.000720***

	(0.000184)	(0.000183)	(0.000184)	(0.000182)	(0.000181)	(0.000181)
MP1	-0.00197	-0.00194	-0.00192	-0.00199	-0.00198	-0.00196
	(0.00144)	(0.00144)	(0.00144)	(0.00144)	(0.00144)	(0.00144)
Log_Avg_Groom_Exp	-0.000363	-0.000555	-0.000402	-0.000302	-0.000441	-0.000308
	(0.00101)	(0.00100)	(0.00100)	(0.00101)	(0.00100)	(0.00101)
Log_Avg_Bride_Exp	-0.00158	-0.00156	-0.00160	-0.00148	-0.00142	-0.00149
	(0.00116)	(0.00116)	(0.00116)	(0.00117)	(0.00117)	(0.00117)
Log_Index_Food	-0.0380**	-0.0400**	-0.0348*	-0.0373**	-0.0388**	-0.0346*
	(0.0178)	(0.0177)	(0.0190)	(0.0178)	(0.0177)	(0.0188)
Log_Index_Sin	0.0328*	0.0329*	0.0346**	0.0319*	0.0315*	0.0331**
	(0.0186)	(0.0189)	(0.0150)	(0.0185)	(0.0186)	(0.0152)
Log_Index_Fuel	-0.000937	-0.000653	-0.00169	-0.00116	-0.00101	-0.00180
	(0.00821)	(0.00826)	(0.00713)	(0.00820)	(0.00823)	(0.00711)
Log_Index_Clothing	-0.0244	-0.0257	-0.0213	-0.0225	-0.0228	-0.0197
	(0.0253)	(0.0256)	(0.0211)	(0.0252)	(0.0252)	(0.0211)
Log_Index_Misc	0.0296	0.0305	0.0297**	0.0286	0.0289	0.0283*
	(0.0487)	(0.0496)	(0.0149)	(0.0475)	(0.0478)	(0.0149)
Constant	0	0	-0.0538	0	0	-0.0375
	(0)	(0)	(0.145)	(0)	(0)	(0.148)
Observations	3,371	3,371	3,371	3,371	3,371	3,371
R-squared	0.064	0.056	0.059	0.071	0.068	0.070
p-value (Over Id Test)	0.7404	0.5409	0.8882	0.5761	0.4223	0.8554

Statistics on 1st Stage Regression for Specification 5C:

Staple Demand, Excluded Instruments: HH Assets, Logged Total Income, Logged General CPI

F(3, 3300) = 92.26, Partial R-Squared = 0.1291

Statistics on 1st Stage Regression for Specification 5B:

Staple Demand, Excluded Instruments: HH Assets, Logged General CPI

F(3, 3300) = 98.54, Partial R-Squared = 0.0885

Table A6.7 Conditional Demand System: Conditioning Good-Staples; Specification 5D

Excluded Instruments-General CPI, Logged Total Expenditure and Income, Price of Staple Goods

VARIABLES	(1) ShareOthFood	(2) ShareFuel	(3) ShareHHPub	(4) ShareOthHHGoods	(5) ShareClothing
ShareStaple	0.145	0.279***	-0.231	-0.0648	-0.207***
	(0.180)	(0.107)	(0.168)	(0.0806)	(0.0631)
Log_Ann_PC_Exp	-0.0218	0.0194*	0.0292*	0.0151*	-0.0161***
	(0.0180)	(0.0105)	(0.0167)	(0.00834)	(0.00618)
Head_Income	-1.70e-07***	-1.68e-07***	1.29e-08	-4.15e-08	4.09e-08**
	(5.12e-08)	(3.79e-08)	(5.45e-08)	(2.64e-08)	(1.79e-08)
Spouse_Income	-2.92e-07***	-1.73e-07***	-2.02e-08	-1.11e-08	7.72e-08**
	(7.46e-08)	(4.43e-08)	(8.48e-08)	(6.90e-08)	(3.35e-08)
NL_Inc	-1.51e-07	-2.75e-07**	-1.68e-07	-2.62e-09	-8.31e-08
	(2.02e-07)	(1.40e-07)	(3.12e-07)	(1.41e-07)	(5.49e-08)
Head_Age	0.000332	0.00125***	-0.000781	-0.000229	-0.000214
	(0.000511)	(0.000305)	(0.000526)	(0.000222)	(0.000177)
Spouse_Age	-0.000704	-0.00115***	0.000317	7.57e-05	0.000273
	(0.000554)	(0.000330)	(0.000597)	(0.000237)	(0.000200)
totalboy_0to5	-0.00650	-0.00315	0.0108**	0.00424**	-0.00200
	(0.00459)	(0.00293)	(0.00463)	(0.00202)	(0.00162)
totalboy_6to12	-0.00422	-0.00312	-0.00362	0.000339	0.000477
	(0.00307)	(0.00202)	(0.00306)	(0.00133)	(0.00119)
totalboy_13to18	-0.00644**	-0.00910***	-0.00939***	0.00238	0.00175
	(0.00291)	(0.00178)	(0.00296)	(0.00150)	(0.00120)
totalboy_19to21	-0.00799	-0.00444	0.00209	0.00619*	0.00434*
	(0.00580)	(0.00315)	(0.00589)	(0.00343)	(0.00231)
totalgirl_0to5	-0.00282	0.00317	6.55e-05	0.00196	0.000681
	(0.00447)	(0.00293)	(0.00441)	(0.00208)	(0.00180)
totalgirl_6to12	-0.00363	-0.00370	-0.00402	0.00168	-0.000597
	(0.00344)	(0.00231)	(0.00329)	(0.00141)	(0.00117)
totalgirl_13to18	-0.00978***	-0.00702***	-0.00390	0.000367	0.00216*
	(0.00322)	(0.00184)	(0.00303)	(0.00134)	(0.00126)
totalgirl_19to21	-0.00290	-0.00804**	-0.00243	0.00171	-0.00244
	(0.00617)	(0.00325)	(0.00628)	(0.00289)	(0.00173)
Head_Edu	-0.000850	-0.000147	0.000620	0.000261	0.000281
	(0.000600)	(0.000363)	(0.000616)	(0.000236)	(0.000215)

Spouse_Edu	0.000577	2.71e-06	-0.000691	-0.000122	-0.000750***
	(0.000511)	(0.000302)	(0.000540)	(0.000232)	(0.000198)
MP1	0.00118	-0.00191	0.00947**	-0.000554	-0.00292*
	(0.00381)	(0.00234)	(0.00412)	(0.00163)	(0.00150)
Log_Avg_Groom_Exp	-0.00318	-0.00741***	-0.00570*	0.00357**	1.52e-05
	(0.00321)	(0.00195)	(0.00321)	(0.00149)	(0.00101)
Log_Avg_Bride_Exp	-0.00241	0.00261	0.00623*	-0.00420***	-0.00119
	(0.00330)	(0.00218)	(0.00334)	(0.00142)	(0.00118)
Log_Index_Food	-0.0159	-0.0297	0.0184	0.000224	-0.0111
	(0.0809)	(0.0487)	(0.0792)	(0.0372)	(0.0287)
Log_Index_Sin	0.0930**	0.0472*	0.0229	-0.0225	0.0262*
	(0.0438)	(0.0268)	(0.0434)	(0.0158)	(0.0157)
Log_Index_Fuel	0.0581	0.0153	0.00554	0.00288	-0.0126
	(0.0379)	(0.0232)	(0.0380)	(0.0164)	(0.0139)
Log_Index_Clothing	-0.00476	-0.0477	-0.0670	-0.0114	-0.0119
	(0.0527)	(0.0346)	(0.0433)	(0.0269)	(0.0171)
Log_Index_Misc	-0.0422	0.00310	-0.000941	0.0153	0.0469
	(0.253)	(0.161)	(0.274)	(0.125)	(0.0956)
Constant	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)
Observations	3,333	3,333	3,333	3,333	3,333
R-squared	0.332	0.106	0.226	0.035	0.045
p-value (Over Id Test)	0.1636	0.0243	0.2811	0.0035	0.9668

Statistics 1st Stage Regression Spec 5D: Excluded Instruments: HH Assets, Total Income and General CPI, Price Staple Goods

Demand Staple: Shea's Partial R-squared = 0.0385 Shea's Adjusted Partial R-squared = 0.0175

Logged Total Expenditure Shea's Partial R-squared = 0.0667 Shea's Adjusted Partial R-squared = 0.0464

Table A6.8 Conditional Demand System: Conditioning Good-Staples; Specification 5E

Excluded Instruments-General CPI, Logged Total Expenditure and Income, Price of Staple Goods, Spouse Income

VARIABLES	(1) ShareOthFood	(2) ShareFuel	(3) ShareHHPub	(4) ShareOthHHGoods	(5) ShareClothing
ShareStaple	0.0268	0.209**	-0.240	-0.0689	-0.177***
	(0.176)	(0.102)	(0.167)	(0.0852)	(0.0622)
Log_Ann_PC_Exp	-0.0407**	0.00813	0.0279*	0.0144*	-0.0112*
	(0.0171)	(0.00946)	(0.0163)	(0.00832)	(0.00607)
Head_Income	-1.29e-07***	-1.44e-07***	1.57e-08	-3.99e-08*	3.01e-08*
	(4.57e-08)	(3.34e-08)	(5.22e-08)	(2.18e-08)	(1.76e-08)
NL_Inc	-1.21e-07	-2.58e-07**	-1.66e-07	-1.51e-09	-9.08e-08*
	(1.89e-07)	(1.27e-07)	(3.12e-07)	(1.43e-07)	(5.47e-08)
Head_Age	0.000442	0.00132***	-0.000774	-0.000224	-0.000244
	(0.000497)	(0.000296)	(0.000523)	(0.000221)	(0.000175)
Spouse_Age	-0.000848	-0.00124***	0.000307	7.00e-05	0.000311
	(0.000542)	(0.000320)	(0.000592)	(0.000237)	(0.000198)
totalboy_0to5	-0.00949**	-0.00492*	0.0106**	0.00413**	-0.00121
	(0.00443)	(0.00280)	(0.00450)	(0.00201)	(0.00159)
totalboy_6to12	-0.00641**	-0.00442**	-0.00378	0.000258	0.00105
	(0.00296)	(0.00192)	(0.00298)	(0.00129)	(0.00116)
totalboy_13to18	-0.00726***	-0.00959***	-0.00945***	0.00235*	0.00197*
	(0.00278)	(0.00170)	(0.00290)	(0.00142)	(0.00117)
totalboy_19to21	-0.00875	-0.00488	0.00203	0.00616*	0.00454**
	(0.00568)	(0.00305)	(0.00589)	(0.00339)	(0.00230)
totalgirl_0to5	-0.00629	0.00111	-0.000175	0.00183	0.00160
	(0.00426)	(0.00273)	(0.00428)	(0.00196)	(0.00178)
totalgirl_6to12	-0.00584*	-0.00501**	-0.00418	0.00160	-1.65e-05
	(0.00332)	(0.00218)	(0.00322)	(0.00133)	(0.00113)
totalgirl_13to18	-0.0113***	-0.00792***	-0.00401	0.000310	0.00256**
	(0.00313)	(0.00175)	(0.00301)	(0.00130)	(0.00124)
totalgirl_19to21	-0.00340	-0.00834***	-0.00247	0.00169	-0.00231
	(0.00602)	(0.00315)	(0.00628)	(0.00288)	(0.00172)
Head_Edu	-0.000805	-0.000119	0.000623	0.000263	0.000268
	(0.000577)	(0.000347)	(0.000606)	(0.000231)	(0.000211)
Spouse_Edu	0.000409	-9.69e-05	-0.000702	-0.000128	-0.000706***
	(0.000502)	(0.000291)	(0.000534)	(0.000227)	(0.000192)

MP1	0.000581	-0.00227	0.00943**	-0.000576	-0.00277*
	(0.00373)	(0.00226)	(0.00410)	(0.00163)	(0.00150)
Log_Avg_Groom_Exp	-0.00198	-0.00669***	-0.00562*	0.00361**	-0.000305
	(0.00319)	(0.00191)	(0.00319)	(0.00143)	(0.00100)
Log_Avg_Bride_Exp	-0.00259	0.00251	0.00622*	-0.00421***	-0.00114
	(0.00327)	(0.00211)	(0.00334)	(0.00142)	(0.00117)
Log_Index_Food	0.00878	-0.0151	0.0201	0.00113	-0.0175
	(0.0684)	(0.0395)	(0.0651)	(0.0319)	(0.0235)
Log_Index_Sin	0.0893**	0.0451*	0.0226	-0.0227	0.0271*
	(0.0452)	(0.0271)	(0.0454)	(0.0167)	(0.0164)
Log_Index_Fuel	0.0505*	0.0107	0.00500	0.00261	-0.0107
	(0.0292)	(0.0174)	(0.0285)	(0.0122)	(0.0105)
Log_Index_Clothing	0.00483	-0.0420	-0.0664	-0.0110	-0.0144
	(0.0507)	(0.0337)	(0.0413)	(0.0263)	(0.0166)
Log_Index_Misc	-0.0351	0.00725	-0.000446	0.0155	0.0451
	(0.227)	(0.143)	(0.250)	(0.115)	(0.0868)
Constant	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)
Observations	3,333	3,333	3,333	3,333	3,333
R-squared	0.350	0.153	0.226	0.035	0.051
p-value (Over Id Test)	0.0077	0.0000	0.3830	0.0039	0.3664

Statistics 1st Stage Regression Spec 5E: Excluded Instruments: HH Assets, Total Income and General CPI, Price Staple Goods and Spouse Income

Demand Staple:	Shea's Partial R-squared = 0.0404	Shea's Adjusted Partial R-squared = 0.0195
Logged Total Expenditure	Shea's Partial R-squared = 0.0743	Shea's Adjusted Partial R-squared = 0.0541

References

Agarwal, B. (1997). "Bargaining"and Gender Relations: Within and Beyond the Household. *Feminist economics*, *3*(1), 1-51.

Anderson, S., and Eswaran, M. (2009). What determines female autonomy? Evidence from Bangladesh. *Journal of Development Economics*, *90*(2), 179-191.

Basu, K. (2006). Gender and Say: a Model of Household Behaviour with Endogenously Determined Balance of Power*. *The Economic Journal*, *116*(511), 558-580.

Banerjee, A. V., Duflo, E., Glennerster, R., and Kinnan, C. (2009). The Miracle of Microfinance?: Evidence from a Randomized Evaluation.

Blundell, R., Chiappori, P. A., Magnac, T., and Meghir, C. (2007). Collective labour supply: Heterogeneity and non-participation. *The Review of Economic Studies*, *74*(2), 417-445.

Blundell, R., Chiappori, P. A., and Meghir, C. (2005). Collective labor supply with children. *Journal of Political Economy*, *113*(6), 1277-1306.

Bobonis, G. J. (2009). Is the allocation of resources within the household efficient? New evidence from a randomized experiment. *Journal of Political Economy*, *117*(3), 453-503.

Bourguignon, F., Browning, M., Chiappori, P. A., and Lechene, V. (1993). Intra household allocation of consumption: A model and some evidence from French data. *Annales d'Economie et de Statistique*, 137-156.

Bourguignon, F., Browning, M., and Chiappori, P. A. (2009). Efficient intra-household allocations and distribution factors: Implications and identification. *The Review of Economic Studies*, *76*(2), 503-528.

Browning, M., Bourguignon, F., Chiappori, P. A., and Lechene, V. (1994). Income and outcomes: A structural model of intrahousehold allocation. *Journal of Political economy*, 1067-1096.

Browning, M., and Chiappori, P. A. (1998). Efficient intra-household allocations: A general characterization and empirical tests. *Econometrica*, 1241-1278.

Browning, M., Chiappori, P. A., and Lechene, V. (2006). Collective and unitary models: A clarification. *Review of Economics of the Household*, *4*(1), 5-14.
Bruhn, M., and McKenzie, D. (2008). In pursuit of balance: Randomization in practice in development field experiments. *World Bank Policy Research Working Paper Series, Vol*

Caliendo, M., and Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of economic surveys*, *22*(1), 31-72.

Chiappori, P. A. (1988). Rational household labor supply. *Econometrica: Journal of the Econometric Society*, 63-90

Chiappori, P. A. (1992). Collective labor supply and welfare. *Journal of Political Economy*, 437-467.

Chiappori, P. A., Fortin, B., and Lacroix, G. (2002). Marriage market, divorce legislation, and household labor supply. *Journal of political Economy*, *110*(1), 37-72.

Chiappori, P. A. (2011). Collective labor supply with many consumption goods. *Review of Economics of the Household*, *9*(2), 207-220.

Dauphin, A., Lahga, E., Fortin, B., and Lacroix, G. (2011). Are Children Decision-Makers within the Household?*. *The Economic Journal*, *121*(553), 871-903.

Dehejia, R. H., and Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and statistics*, *84*(1), 151-161.

Dehejia, R. (2005). Practical propensity score matching: a reply to Smith and Todd. *Journal of Econometrics*, *125*(1), 355-364.

Dercon, S., and Krishnan, P. (2000). In sickness and in health: Risk sharing within households in rural Ethiopia. *Journal of Political Economy*, *108*(4), 688-727.

Djebbari, H. (2005). The impact on nutrition of the intrahousehold distribution of power.

Donni, O., and Moreau, N. (2007). Collective Labor Supply A Single-Equation Model and Some Evidence from French Data. *Journal of Human Resources*, *42*(1), 214-246.

Donni, O. (2009). A simple approach to investigate intrahousehold allocation of private and public goods. *The Review of Economics and Statistics*, *91*(3), 617-628

Donni, O., and Moreau, N. (2003). Collective female labor supply: a conditional approach. *Manuscript, CIRPEE, Université du Québec à Montréal*

Feigenberg, B., Field, E. M., and Pande, R. (2010). *Building social capital through microfinance* (No. w16018). National Bureau of Economic Research.

Heckman, J. J., Ichimura, H., and Todd, P. (1998). Matching as an econometric evaluation estimator. *The Review of Economic Studies*, *65*(2), 261-294.

Heinrich, C., Maffioli, A., and Vazquez, G. (2010). A primer for applying propensity-score matching. *SPD Working Papers*

Kabeer, N. (2002). Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and change*, *30*(3), 435-464.

Kazianga, H., and Udry, C. (2006). Consumption smoothing? Livestock, insurance and drought in rural Burkina Faso. *Journal of Development Economics*, *79*(2), 413-446.

Lancaster, G., Maitra, P., and Ray, R. (2006). Endogenous Intra-household Balance of Power and its Impact on Expenditure Patterns: Evidence from India. *Economica*, *73*(291), 435-460

Luke, N., and Munshi, K. (2007). Social affiliation and the demand for health services: Caste and child health in South India. *Journal of development economics*, *83*(2), 256-279.

Luke, N., and Munshi, K. (2011). Women as agents of change: Female income and mobility in India. *Journal of Development Economics*, *94*(1), 1-17.

Lundberg, S. J., Pollak, R. A., and Wales, T. J. (1997). Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of Human Resources*, 463-480.

Lundberg, S., and Pollak, R. A. (1993). Separate spheres bargaining and the marriage market. *Journal of Political Economy*, 988-1010

Lundberg, S., and Pollak, R. A. (1996). Bargaining and distribution in marriage. *The Journal of Economic Perspectives*, *10*(4), 139-158.

Michaud, P. C., and Vermeulen, F. (2011). A collective labor supply model with complementarities in leisure: Identification and estimation by means of panel data. *Labour*

Economics, *18*(2), 159-16

Pitt, M. M., and Khandker, S. R. (1998). The impact of group-based credit programs on poor households in Bangladesh: does the gender of participants matter?. *Journal of political economy*, *106*(5), 958-996.

Ray, R., and Basu, K. (2001). The collective model of the household and an unexpected implication for child labor: Hypothesis and an empirical test. *World Bank Policy Research Working Paper*, (2813).

Rosenbaum, P. R., and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41-55.

Smith, J. A., and Todd, P. E. (2001). Reconciling conflicting evidence on the performance of propensity-score matching methods. *The American Economic Review*, *91*(2), 112-118.

Thomas, D., Contreras, D., and Frankenberg, E. (2002). Distribution of power within the household and child health. *Santa Monica: RAND. Mimeo*.

Thomas, D., and Chen, C. L. (1994). *Income shares and shares of income: Empirical tests of models of household resource allocations*. RAND

Udry, C. (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy*, 1010-1046.

Vermeulen, F. (2002). Collective household models: principles and main results. *Journal of Economic Surveys*, *16*(4), 533-564

Vermeulen, F. (2005). And the winner is... An empirical evaluation of unitary and collective labour supply models. *Empirical Economics*, *30*(3), 711-734.