ESSAYS ON POVERTY IN INDIA AND THE U.S.

by

RAMAPRASAD RAJARAM

(Under the direction of William D. Lastrapes)

ABSTRACT

This study consists of three empirical works that analyze the implications of poverty. The first paper estimates whether female-headed households are poorer than their male-headed counterparts in India, using household data from the National Family Health Survey (NFHS) for the year 2005-06. I use different poverty measures that reflect people's permanent income rather than the official measure based on consumption expenditure, employ probit and logit estimations, and find very limited evidence of female-headed households being poorer than male-headed households. Specifically, poverty measures based on the housing condition and the wealth indices show that female-headed households are less poor than male-headed households. Based on the standard of living index measure of poverty, female-headed households are only marginally poorer than their male-headed counterparts.

The second paper investigates whether the influence of female autonomy on safe maternal and child healthcare differs across rich and poor households in India. We employ a proportional odds model, and find that women with autonomy do not have significantly higher odds of seeking proper maternal and child healthcare. At the same time, women from rich households have higher odds of seeking proper maternal and child healthcare than others. When the households are categorized into different wealth and standard of living quintiles, there is no

evidence for any systematic patterns of relationship between autonomy variables and healthcare seeking behavior. The results also point to the fact that female education is a significant determinant of safe maternal and child healthcare, regardless of the economic status of the household.

The third paper estimates the effects of initial (1979) level of poverty and income inequality on subsequent economic growth (between 1979 and 1999) for the U.S. counties using the U.S. decennial Census data for the years 1980 and 2000. I use the Augmented Solow model of growth, employ spatial regression analysis, and find that counties with lower levels of income inequality and poverty in 1979 experienced higher economic growth between 1979 and 1999 than others. At the same time, counties that experienced higher economic growth between 1979 and 1999 had lower levels of poverty and income inequality in 1999, suggesting the existence of a positive association between poverty and income inequality reduction, and higher economic growth. The results also show that spatial parameters are significant determinants of growth, income inequality and poverty.

INDEX WORDS: Poverty, Gender inequality, Maternal health, Child health, Public policy, Economic growth, Income inequality, Spatial regressions, India, U.S.

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DEDICATION

This dissertation is dedicated to my wife Divya, who has been a prime source of motivation throughout my graduate studies.

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TABLE OF CONTENTS

Page

List of Figures

List of Tables

Chapter 1

Introduction

Understanding the causes and implications of poverty on an economy has been an ongoing issue in development economics, and existing research has extensively addressed both of these issues in different settings with inconclusive results. Poverty, which is concerned with human sufferings, is an extremely important issue to study with half of the world's population living under US $2.50 a day, approximately 640 million children living without adequate shelter, and another 650 million children having no access to safe water or access to health services. Thus, it is important for academicians and policy makers to explore the sources and repercussions of poverty. I aim to understand the micro and macroeconomic repercussions of poverty in my dissertation.

The first chapter focuses on the relationship between gender and poverty in India, a country where the two issues are extremely important. The second analyzes the role of poverty in the relationship between health care utilization and female autonomy in rural India. The third investigates the relationship among poverty, income inequality and economic growth in the U.S. counties.

Poverty is a subjective concept and can be measured in different ways. On the one hand, there are objective indicators such as consumption, income or wealth. On the other, there are indicators that are harder to measure such as social status, self-esteem, or freedom. Most studies use objective measures, which by definition, are easier to quantify than subjective ones. Almost all studies on the relationship between poverty and gender in rural India use the consumption expenditure measure of poverty provided by the National Sample Survey (NSS) of India, and

present evidence that female-headed households and households with single women are poorer than others. The studies argue that gender bias against women (single women in particular) is perhaps the reason for the poor economic condition of such households.

I attempt to advance this literature in my first chapter by exploiting the data from the National Family Health Survey (NFHS) of India, which no study has used, to the best of my knowledge, for any kind of poverty analysis. I also use different kinds of poverty measures that reflect household's permanent rather than temporary economic status: a wealth index, a standard of living index, and a measure of housing condition that are readily available from the National Family Health Survey (NFHS). Although each poverty measure has its' own merits and limitations, I argue that poverty measures that reflect people's permanent income is more informative and relevant in rural India than consumption-based measures of poverty. The results from my analysis, which uses asset-based measures of poverty, provide very limited evidence for a relationship between the gender of the household head and the economic status of the household, contrary to many existing studies that use consumption-based measure of poverty.

The second chapter investigates whether the influence of female autonomy on safe maternal and child healthcare differs across rich and poor households in India. While some studies have addressed the relationship between female autonomy and maternal or child health care, no study, to my knowledge has specifically looked into the influence of poverty on this relationship. The results from this analysis reveal that women from richer households have higher odds of seeking proper maternal and child healthcare than others. I also use different asset based measures of poverty, and the results differ only marginally across different measures. The results also provide evidence that female education is a significant determinant of safe maternal and child healthcare, regardless of the economic status of the household.

In my third chapter, I aim to understand the macroeconomic implications of poverty on economic growth in developed countries by analyzing the relationship among poverty, income inequality and economic growth in the U.S. counties. I use an augmented Solow model of growth, and employ spatial analysis to address the issue. No study to my knowledge has addressed this specific relationship at the county level. The results provide evidence that counties with lower levels of income inequality and poverty in 1979 experienced higher economic growth between 1979 and 1999 than others. At the same time, counties that experienced higher economic growth between 1979 and 1999 had lower levels of poverty and income inequality in 1999, suggesting the existence of a positive correlation among poverty and income inequality reduction, and higher economic growth.

The results from the three studies provide some important policy perspectives. First, in India, while there are current welfare-programs specifically targeted at women in pursuit of reducing poverty such as Housing and Shelter Program, National Policy for the Empowerment of Women -2001, there does not seem to be an immediate need to add to the existing ones. Second, there could be improvements in the maternal welfare programs, either quantitatively or qualitatively, or both, to improve proper maternal and child healthcare access to women from poor households in India. Similarly, in the US, policies aimed at promoting economic growth can potentially yield an additional benefit of decreasing subsequent levels of poverty and income inequality.

Chapter 2

Women and Poverty In Rural India: Evidence From The National Family Health Survey

2.1 Introduction

Targeting female-headed households in pursuit of reducing poverty remains contentious and lacks empirical support. Women, who are usually the bread-winners in female-headed households, may face gender discrimination with respect to education, earnings, rights, and economic opportunities (Barros et al. 1997), making a case for targeting female-headed households to reduce poverty. On the other hand, there are practical issues related to identifying the actual head of the household, and female headship is not always correlated with poverty (Buvivnic and Gupta 1997), which presents a case against focusing exclusively on female-headed households to reduce poverty.

Approximately 420 million people in India (41.6% of the population) were living under U.S. $1.25 in 2005 (based on Purchasing Power Parity), World Bank 2008. More than a quarter of the world's poor people live in India, and gender-bias against women is deeply ingrained in the society, potentially placing female-headed households at potentially a greater risk of poverty. Thus, studying the relationship between female-headed households and poverty in India makes it instructive and important from both an academic and a practical perspective, which is the purpose of this study. Eradicating poverty and eliminating gender-bias are issues central to economic development, and they are intrinsic goals in themselves. They are even more important and challenging in a socially and economically diverse country like India.

Buvinic and Gupta (1997) maintain that compared to men, women's lower average earnings and less access to remunerative jobs and productive resources such as land and capital contribute to their economic vulnerability. In India, such gender-related economic gaps are largely determined by age-old customs and traditions (based on social, religious and economic reasons) that have led people to accord lower status to women (Arokiasamy and Pradhan 2006, Das Gupta et al. 2003). For instance, in India, many parents perceive the cost of educating a girl as a burden compared to educating a boy owing to practices such as dowry, and lost labor for household chores.[1]

Social and cultural motives in India also restrict women's access to work and education, and hence women do not participate in labor market as freely as men (Dreze and Sen 1995, Dunlop and Velkoff 1999). Moreover, with ideologies entrenched in patriarchy, women's access to family inheritance and productive assets is limited or absent (Agarwal 1999). In addition, several practices and customs are still prevalent in India that symbolize the subordination of women to men, making gender-bias against women an intrinsic social issue as well.[2] Thus, socio-economic gender bias against women in India may place female-headed households at a greater risk of poverty, in which females are usually the primary earners. Consequently, many studies in India show that female-headed households are poorer compared to male-headed households (Dreze and Srinivasan 1997, Meenakshi and Ray 2002, and Gangopadhyay and Wadhwa 2003).

[1] In India, when a woman marries, she is supposed to live with her husband's family ever after. Thus, at the time of marriage, the bride's family pays huge amount of money in cash and kind (called dowry) as a compensation to the groom's family to take good care of the bride.

[2] Practices such as Sati, Dowry, Purdah, to name a few. Sati is a Hindu religious practice in which a widow immolates herself on the husband's funeral pyre. Purdah is predominantly an Islamic practice in which a woman conceals her body from head to toe with a 'Purdah' garment. The purpose of such a practice is to keep women separated from men.

Although the question addressed in this study is similar to the ones mentioned above, the current study differs from the literature in important ways. First, to the best of our knowledge, ours is the first study to use the data from the National Family Health Survey (NFHS) of India to address the question in hand, although NFHS data is extensively used in the health field.[3] Thus, I aim to advance the literature by exploiting the information required for the current analysis from NFHS, which no study has used for any kind of poverty analysis. The existing studies in the literature use data from the National Sample Survey (NSS) for India, and several studies criticize NSS for the inconsistencies in data collection (Deaton and Kozel 2005).

Second, by using this data set, I could use different asset-based poverty measures readily available from NFHS that better reflect people's permanent rather than transitory income. In particular, I measure poverty based on direct observations on housing, wealth, and standard of living of households provided by the National Family Health Survey (NFHS) data set, while the existing studies use per-capita expenditure to measure poverty. I aim to contribute to the literature by utilizing this information on household's long-run economic status to address the relationship between gender of the household head and the household's economic status. Although these measures have limitations, I discuss in detail in section 2.3 why these dimensions of poverty are more informative of people's living condition than the official poverty measure based on per-capita expenditure, particularly in rural India.

While headship can be measured in different ways (as explained in detail in section 2.3), I use the self-reported headship of households enumerated by NFHS. I employ the generalized linear models (probit and logit), use different asset-based measures of poverty, and find very limited evidence for female-headed being any poorer than the male-headed counterparts in rural India. Based on only one poverty measure, the standard of living index, I find that female-headed

[3] Detailed discussion of the NFHS data set is provided in Section 2.3.

households are marginally poorer than male-headed households. However, the difference in poverty status between the two household types is quantitatively very small to warrant urgent policy measures targeting female-headed households to reduce poverty. The other two poverty measures show that female-headed households are less likely to be poor than others. As I emphasize later, the results are not to be interpreted as there is no gender discrimination against women in India. The results could probably mean that even though such discriminations may exist, they do not show up in the data set that I use.

2.2 Female-Headed Households and Poverty

The evidence on whether female-headed households are poorer than the male-headed counterparts is mixed. Swarup and Rajput 1994 show that in India, lack of access to family property and assets, and deficient micro-credit facilities contribute to the poor economic conditions of female-headed households. Meenakshi and Ray (2002) find that female-headed households face a greater risk of being exposed to poverty in the presence of size economies and child-adult ratio. Size economies refer to the economies of scale that a household can achieve when household size is large. Gangopadhyay and Wardhwa (2003) also provide evidence that female-headed households are poorer than male-headed counterparts in India.

Dreze and Srinivasan (1997), on the other hand, find no evidence that female-headed households or widows in rural India are significantly poorer than male-headed households, based on standard head count ratio, which measures the number of people living below the poverty line. However, their results change when accounting for the average households size and child-

adult ratio. Their results however are not sensitive to the choice of poverty line. Several other studies have addressed the same issue for other countries.[4]

In India, households with single women as the head can potentially face even a higher risk of poverty than others because of the cultural and social stigmas attached to their marital status. For instance, a widow or a divorcee does not participate in many social functions and festivals because people perceive her presence as inauspicious.[5] Moreover, if an employer is particularly orthodox in his or her values and beliefs, which is likely to be the case in rural India, then widows and divorcees could have fewer economic opportunities compared to married women, other things equal. Although the data used in this analysis does not have information on whether the female head is single, as per the Indian Census 2001, more than 76% of the female heads are single (widows, divorcees or unmarried women).

2.3 Defining Female-headed Households and Measuring Poverty:

Defining Household Head

Defining head of the household is difficult both because of the ambiguity in defining the term "head" when left to the judgment of the family members, and the various implicit meanings loaded in that term. Fuwa (2000) categorizes headship based on demographic, economic or self-reported factors. Demographic factors focus on the presence of a husband in the family, economic factors take into account the economic contribution of each family member, and self-reported factors are the survey respondent's perception of who the household head is.[6] NFHS publishes data on headship based on self-reported survey. Various studies use different measures

[4] See Appleton (1996), Buvinic and Gupta (1997), Barros et al. (1997), Fuwa (2000), and Senada and Sergio (2007).
[5] Even today, many people hold superstitious believes against widows in India. For example, people avoid seeing widows before attending any important occasion, such as attending a marriage or a job interview. In many Hindu and Islamic traditions, there are several restrictions on a single woman's attire and diet as well.
[6] For a detailed discussion and review of measuring headship, see Senada and Sergio 2007.

of headship in different contexts, as there seems to be no ideal or universally accepted definition of the term. Most studies on India use the self-reported categorization of headship.

Data collected from self-reported surveys can be problematic. First, errors could arise when misidentifying the gender of the household head. Although a woman may in principle be the head, the husband or any other male member could have all the decision making power within the household. Buvinic and Gupta (1997) argue that in developing countries, owing to strong patriarchal values, households are more likely to be classified as male-headed when in reality they are female-headed. Such errors would make the number of female-headed households from self-reported survey serve as a lower bound.

Second, as per the definition of NFHS, headship is not necessarily dependent on the earning capacity of the head. For the purposes of this study, information on whether the household head is the only earning member would help identify whether gender discrimination affects the economic status of households (through the heads' earning capacity). This information is not available from the NFHS, and thus I follow the literature by using the self-reported data on headship. While it is also of interest to determine the economic status of individual women, I do not have the data for undertaking such an analysis. Since I do not have variables that can capture intra-household discrimination, I assume that all members of the household share the same level of economic status as the household.

Measuring Poverty

Poverty can be measured in different ways. On the one hand, there are objective indicators such as income level, possession of assets, or total consumption expenditure. On the other, there are indicators that are harder to measure such as social status, self-esteem, or freedom. Sen (1976) postulates that poverty measurement follows two sequential steps: first,

identifying the poor, based on specific criteria, and second, aggregating the poor people into an overall indicator of poverty. Consequently, Foster, Greer and Thorbecke (1984) developed a class of poverty measures (FGT measure) that incorporates both the level and depth of poverty for a given population, which satisfy a range of poverty axioms and possess several desirable properties of a poverty measure. One could obtain the head count ratio, poverty gap ratio or the squared gap ratio for specific parametric values of the FGT measure.[7]

The traditional method to identifying poor people is with respect to a dimension-specific poverty line, which reveals whether a person is deprived in that specific dimension (Alkire and Foster 2008). Alternatively, the multi-dimensional poverty indices identify poor people based on whether a person is deprived in more than one dimension.[8] Many economists have insisted on the importance of using multi-dimensional measures of poverty, which throw light on the overall level of deprivation, over per-capita income or consumption expenditure (Bourguignon and Chakravarthy 2003). Other studies have used different dimensions of poverty to address different questions.[9]

Dreze and Srinivasan (1997), Meenakshi and Ray (2002), Gangopadhyay and Wadhwa (2003) use the Indian official poverty measure, which is based on people's consumption expenditure, to verify whether female-headed households are poorer than male-headed counterparts. The Indian Planning Commission defines a person to be poor if she or he does not

[7] Head count ratio is the percentage of population falling under a specific income or expenditure level, poverty gap is the aggregate income required to move people above a specific poverty line and squared poverty is average of the squared normalized income shortfalls below the poverty line.
[8] Identifying and measuring poverty is a separate branch of literature, and for a detailed discussion see Alkire and Foster (2008), Duclos et al. (2006), and Foster and Sen (1997).
[9] Deutsch and Silber (2005) argue that information on durable goods and assets are more reliable indicators of peoples' standard of living than income-based measures of poverty. Filmer and Pritchett (2001) construct a wealth index for India using asset ownership indicators to predict children's school enrollment. Duclos et al. (2006), and Bourguignon and Chakravarthy (2003), among many others, have used a multidimensional approach to identify the poor in different countries.

have sufficient income to afford 2100 calories of food intake everyday in urban areas and 2400 calories in rural areas. This measure of poverty is both dimension-specific and does not necessarily reflect the chronic living condition of people. Therefore, I use three different measures of poverty: housing condition (which is dimension-specific but is likely to reflect people's permanent income), wealth and standard of living index that are both multi-dimensional and informative on people's permanent income. NFHS does not collect data on consumption expenditure.

Information on permanent income is particularly important for people who live on the margins of poverty. For instance, a person who lives slightly below the poverty line in one year can rise above the poverty line (and thus no longer be considered poor) in the next year, even if his or her consumption expenditure increases only by a small fraction. In rural India, agriculture is the primary means of livelihood for most people, and vagaries of monsoon cause agricultural output to fluctuate from one year to another. Therefore, subsistence farmers, and farmers who can barely manage to sell their produce in the market are likely to move in and out of the government specified poverty line depending on how the agricultural output fluctuates around the long-term trend.

On the other hand, poverty measure based on household's possession of assets or housing condition is more likely to reveal lifetime wealth or income, and thus reflect the chronic living standard of people. At least such measures are likely to be more consistent in indicating the living standards of people than poverty measures based on consumption expenditure.

Moreover, several studies question the methods employed by the National Sample Survey in collecting data on consumption expenditure, which the Indian government uses to measure poverty (Deaton and Kozel 2005). The studies particularly criticize the change in the recall

period used in different surveys and thus contend that the poverty estimates published by the Indian government are flawed. Recall period refers to a respondent's verbal report of how much money he or she spent on specific food items over a given time in the past. In some NSS surveys this recall period was 7 days, in some others it was 365 days, and in some others it was both. Such errors can potentially be reduced when estimating poverty based on housing conditions or possession of assets. Ravallion (1998) emphasizes the importance of including the cost of basic needs, besides the food expenditure, while defining poverty lines. Thus, I use three different measures of poverty that are readily available from NFHS, namely, housing condition, wealth and standard of living indices. NFHS constructs the two indices using household's asset possession, where a lower value of the index indicates a low standard of living and vice-versa (explained in detail under "methods and regression results" section).

Limitations of the poverty measures

While housing condition represents a dimension-specific poverty measure, the wealth and the standard of living indices are multi-dimensional poverty measures. The three main approaches to identify poor people on a multi-dimensional setting are the 'uni-dimensional' approach, the 'union' approach and the 'intersection' approach. Under the uni-dimensional approach, several indicators of wellbeing are pooled to form a single aggregate variable and if the variable falls below a cut-off for a person, then he or she is identified as poor. Under the union approach, a person is considered poor if he or she is deprived even in just one dimension. The intersection approach requires a person to be deprived in all dimensions to be categorized as poor.

The wealth and the standard of living index falls under the uni-dimensional approach that has an important limitation. This approach considers dimensional deprivations only to the extent

that it can affect the aggregate indicator. To illustrate, a person will not be counted as poor if his or her aggregate poverty score falls above a cut-off even though he or she is deprived in 7 out of 10 dimensions. As Alkire and Foster (2008) argue, "there is minimal scope for valuing deprivations per se, which is often viewed as an essential characteristic of a multi-dimensional approach" (pp 1). The housing condition represents a dimension-specific poverty measure that does not even account for deprivations beyond the housing condition of people.

Moreover, ordinal measures of poverty, such as the ones used in this study, in general do not necessarily satisfy two axioms of poverty - monotonicity and distributional sensitivity. Monotonicity implies that if the income of one poor person increases even marginally then total poverty should decrease, and distributional sensitivity implies that transferring income from a poor person to a rich person should leave the economy strictly poorer.[10]

2.4 Model, Data and Measuring the Variables:

To test whether female-headed households are poorer than others, I estimate the following model, which is standard in the literature:

$$P_i = \alpha_0 + \alpha_1 G_i + \alpha_2 Caste_i + \alpha_3 HH_i + \alpha_4 State_i + \varepsilon_i \text{ ----- (1)}$$

where, P_i denotes the poverty status of household i. G_i is a vector of gender binary variables, $Caste_i$ measures caste of the household head, HH_i measures household characteristics, and $State_i$ measures whether the household is located in one of the four southern states in India, and ε_i is the error term.

I use the National Family Health Survey (NFHS of India) data for all the variables used in the study in contrast to most studies on poverty and gender that use National Sample Survey

[10] To satisfy monotonicity, the income rise should be sufficient to move the households from one category to the next higher level.

data (NSS of India). The NFHS is a division of Demographic Health Survey (DHS) that conducts individual and household level survey for over eighty developing countries mainly to provide data in the areas of health, demographics and nutrition.[11] NFHS has conducted three surveys in India in 1992-93 (NFHS-1), 1998-99 (NFHS-2), and 2005-06 (NFHS-3). I use the recent most data – 2005-06 in this analysis. NFHS surveys men and women between the ages of 15-49 separately. Data from both the samples is the same for the variables used in this analysis; however, since the sample size in the latter is higher, I use the data from the women's survey.

The 2005-06 survey covers households from all the 29 states in India. The rural sample consists of approximately 45,000 households, which is less than 1% of the total rural population. Datt and Ravallion (1998) argue that focusing on Indian rural poverty is more important than focusing on urban poverty because more than three-quarters of India's poor live in rural areas. Moreover, controlling for migration is important as it could potentially affect the relationship between gender of the household head and poverty, and data on net migration are not available in the current data set both for rural and urban areas. However, Haub and Sharma (2006) maintain that the rate of rural migration is far less than that of urban migration in India.[12]

Since NFHS does not collect data on households' consumption expenditure, I cannot compare our results to those using consumption-based measures of poverty. Yet another limitation of the data set is that, information on the marital status of the household head (whether the head is a widow, divorcee or unmarried) is not available. This information could potentially

[11] Women between the ages of 15-49 were interviewed in the survey. We had to merge the household data with the individual data (and drop the redundant observations) to get information on all the variables used in the study.
[12] Moreover, most of the items included in constructing both the wealth and standard of living indices are not necessarily pertinent for urban analysis. For instance, possession of assets such as household's ownership of tractor, livestock, animal drawn cart, thresher, agricultural land or irrigated land is only relevant in rural India, where agriculture is the mainstay occupation. Thus, using these poverty measures may not exhibit much variation in poverty status among urban households.

help in identifying whether marital status has a role to play in the relationship between gender of the household head and poverty.

NFHS assigns categorical values to each of the three poverty measures I use in this analysis: housing condition, wealth and standard of living indices. NFHS classifies houses into three broad categories, namely, "pucca", "semi-pucca", and "kutcha", based on roof, floor and wall materials used in houses. Kutcha houses have the least expensive materials used in roofs, floors and walls. Pucca houses use the most expensive of materials for roof, floor and walls, and semi-pucca houses constitute the intermediate category. The materials used in kutcha houses include palm leaves, grass, mud, unburnt brick, to name a few. This category also includes households with either no roofs or no walls or both, i.e. homeless.[13]

NFHS constructs the wealth index using Principle Component Analysis (PCA) based on data from household's ownership of 33 different assets, which also includes dwelling characteristics such as source of drinking water, electricity supply, materials used in houses, whether the household members have a bank account, to name a few.[14] PCA is a linear combination of weighted observations (in this case different assets), where the weights are assigned in such a way to account for maximum amount of variation in the observations.[15] After each asset is assigned a weight through PCA, the resulting scores are standardized in relation to a normal distribution, and the wealth index is the sum of these scores – a low score indicates less wealth, and vice-versa. These scores are then categorized into five groups (quintiles) numbered

[13] Details of materials used in different housing structures and the list of items used to construct the wealth and the standard of living indices are explained in the Appendix.
[14] For more details on how NFHS assigns the weights through PCA, please visit www.measuredhs.com – report #6.
[15] For a detailed discussion of PCA please refer Jackson J.E. (1991)

one through five, with one representing households having low score values (poor households), and five representing households having high scores (rich households).[16]

The standard of living index, which the NFHS constructs, is the sum of weights assigned to 27 different assets that households possess. The weights are developed by the International Institute of Population Sciences (IIPS) research team in India "based upon their considerable knowledge of the relative significance of ownership of these items, rather than on a more formal analysis" (Smith et al. 2003 pp 11). Similar to the wealth index, a low SOL score represents less asset possession by households and vice-versa. The final scores are categorized into three groups numbered from one to three, where one represents households with low SOL scores (poor households), and three, high SOL scores (rich households). The way I use these three poverty variables varies with the method used to estimate equation (1), and is explained under the "methods" section.

NFHS determines the head of the household based on who the survey respondent considers the head to be. The gender variable also includes whether the interviewed woman had at least a primary education or higher. I include this variable as a number of studies show that the returns to education are higher for women than for men (Morrison et al. 2007, World Bank 2001, Schultz 2002). I score a value of one if the household head is female, and if the interviewed woman had a primary education or higher, respectively (and zero otherwise).

Other Control Variables

Many studies present evidence that the incidence of poverty for households that belong to the "Schedule Caste (SC)" or "Schedule Tribe (ST)", the two ("socially lower") castes that have been historically discriminated against, is much higher compared to others (Gang et al., 2008). Caste is determined at birth, and changing ones' caste is considered culturally "offensive",

[16] We use both the raw scores and the quinitiles (the 5 categorical values), and the results do not change.

especially in rural India. NFHS provides data on whether the household head belongs to SC/ST and I use a binary variable to measure whether the household head (and therefore the household) belongs to one of these castes (score a value of one if the head belongs to one of these social groups).

Buvinic and Gupta (1997), Dreze and Srinivasan (1997), and Ray (2000) show that the relationship between female-headed households and poverty depends on the household size and the child-adult ratio (children defined as the population between the age group of 0-5). Moreover, Dreze and Srinivasan find the relationship between household size and poverty to be non-linear, and thus I also include a squared term for the household size. While I construct the child-adult ratio, I use the household size data directly from NFHS. It is very common, especially in rural India for extended members of the family to live together in a household, a tradition based on centuries-old social and cultural norms. Information on whether the household is a nuclear or a joint family is not provided by NFHS, which makes it difficult in this study to identify whether poverty can cause household size.

Dyson and Moore (1983), among many others, show that the level of female autonomy is much higher in southern than in northern India. Since the level of female autonomy, which can potentially determine the household head, varies significantly across northern and southern states, I use a binary variable to identify whether the household is located in a southern state.

2.5 Methods and Regression Results:

Table 2.1A gives the summary statistics of the variables used in the study. Female-headed households constitute 13.2% of the sample. The poverty statistics for all households taken together vary widely depending on the measure of poverty. When poverty is measured by

the housing condition (households living in kutcha houses), 16.8% of the total number of households are poor. 45.2% of the households fall under the poorest two quintiles of the wealth index, and 30.2% of the households fall in the poorest quintile based on the standard of living index. 11.5% of households live under poverty based on all the three measures. About 44% of the interviewed women have a primary education or higher, 36% of the household heads belong to SC or ST, and 18% of the households in the sample live in the southern states of India. The average child-adult ratio is 0.43 and the average household size is 5.5.

Linear Probability Model (LPM)

A simple way to verify whether female-headed households are poorer than male-headed households is to compare the percentage of male and female-headed households that are poor. This exercise can be thought of as a result from LPM that does not control for other factors. Table 2.1B classifies households' poverty status based on the gender of the household head. 15% of the female-headed households and 17% of the male-headed households live in kutcha houses. Similarly, higher percentage of male-headed households (45.7%) fall under the two poorest category of the wealth index quintile compared to female-headed households (43.3%). However, based on the standard of living index, a higher percentage of female-headed households (36.6%) fall under the poorest quintile compared to others (29%).

When a household is categorized as poor only when a) it lives in a kutcha house, b) it falls under the two poorest wealth index quintile, and c) it falls in the poorest standard of living index quintile, female-heads (11.2%) seem to be marginally better off than male-heads (11.8%). Based on this rudimentary analysis, which does not control for factors that could potentially alter the relationship between gender of the household head and poverty, there is no strong evidence that female-headed households are poorer compared to male-headed households. While the ratios

mentioned above seem to be counter-intuitive, these statistics are consistent with Dreze and Srinivasan (1997) who measure poverty by consumption expenditure.[17]

Methods and Regression Results

I employ both probit and logit methods to estimate equation (1).[18] As mentioned earlier, the set of controls used in equation (1) are standard in the literature. Both probit and logit are estimated by Maximum Likelihood Estimation. While probit assumes a standard normal distribution of the error term, the logit model assumes a logistic distribution. However, the estimates from both logit and probit are qualitatively similar, and I present the results only for the logistic regression.

As mentioned earlier, NFHS provides data on housing condition, wealth index and standard of living index as categorical variables. I first estimate equation (1) using probit and logit by assigning binary values to the respective poverty measures: for the housing measure, I assign one to P_i in equation (1) if the household lives in kutcha houses and zero otherwise. Similarly, I assign one to P_i if the household falls under the two poorest quintiles of the wealth index and zero otherwise.[19] For the standard of living index, I assign one to P_i if the household falls under the poorest standard of living category and zero otherwise.

Since the coefficient estimates from the probit or the logit models do not facilitate a straightforward interpretation, I report the odds ratio, marginal effects (that have the same sign as the coefficient estimate), and the p-values of the coefficients from logistic regression in Table

[17] They show that 57.7% of female-headed households are classified as poor based on head-count ratio compared to 63.8% of male-headed households, 15.8% classified as poor under 'poverty gap' index compared to 17.3% male-headed households, and 6.1% classified as poor under 'squared poverty gap' index compared to 6.4% male headed-households.

[18] Subsequently, we employ the ordered probit and ordered logit models to exploit the categorical data set of the dependent variable, which is explained later.

[19] As a robustness check, we also use the poorest quintile in the wealth index instead of the two poorest quintiles and the results do not change.

2.3.[20] Columns (1), (2), and (3) have housing condition, wealth index and standard of living index as the dependent variables, respectively. Column (4) reports the result for households classified as poor under all three measures. If female-headed households are poorer than the male-headed households, I would expect a positive sign on the coefficient. However, columns (1), (2) and (4) show contrary evidence.

The odds ratio in column (1) for female-headed households, which is less than one, indicates that the probability of female-headed households living in kutcha houses is less likely compared to male-headed counterparts. Similarly, the marginal effect indicates that a change in the gender of the household head from male to female reduces the probability of the household living under kutcha houses by 2%. This effect is not only very small in magnitude, but also suggests that female-headed households are less likely to be poor, and the coefficients are statistically significant at the 1% level.[21] Column (2) also reveals a similar result. These two results are opposed to the findings of many studies that use poverty line based on consumption expenditure of households.

However, column (3) demonstrates that when poverty is measured by the standard of living index, female-headed households are more likely to be poor compared to male-headed households (odds ratio greater than 1). Although the coefficient estimate is statistically significant at well below the 1% level, the magnitude of the marginal effect (4%) is extremely small to make a compelling case for policy interventions specifically targeting female-headed households to reduce poverty. These three results, taken together do not provide strong evidence that female-headed households are particularly worse-off than male-headed counterparts,

[20] Unlike the slope parameters of a linear regression model, the coefficient estimates from probit or logit do not quantify the marginal effect of the independent variable on the dependent variable. The results are similar on employing both probit and logit, and since odds ratio are directly obtainable from logistic regression, we present only those results.

[21] While calculating the marginal effects, the value of other variables are kept at their mean values

whichever way poverty is measured. Households' asset possession that is used to construct the standard of living index and the wealth indices largely overlap. Thus, the weights assigned to different items under the alternate indices could possibly cause the results to differ significantly. Column (4), which categorizes households as poor based on all three measures of poverty, namely households that a) live in kutcha houses, b) fall under the two poorest wealth index quintiles, and c) fall under the poorest standard of living index quintile, also provides no evidence of female-headed households being poorer than others.

The results do not necessarily imply that there is no gender discrimination against women: while such discrimination may exist, it does not manifest in the data set that I use. There could be several other reasons for the results I get: It is possible that the head of the household is not necessarily the sole earning member, the information for which is not available. Therefore, even though the female head may face economic discrimination, the earnings of other household members can compensate for the same. It is also possible that in female-headed households, some members of the household may be migrating workers who remit money regularly, again for which I do not have the data.

Columns (1) through (4) suggest that whether female-headed households are poorer than male-headed households depends on the choice of the poverty measure. Which of the poverty measures is more useful for policy implication is both subjective and beyond the scope of this study. Hirway (2003) argues that it is not very instructive to compare and match one kind of poverty measure to another, especially when poverty measures are ordinal in nature. As seen in the results above, different measures of poverty yield different results and poverty based on all the three measures differ significantly from individual poverty measures.

However, the results offer an important suggestion to policy makers. While targeting specific sub-group of population to reduce poverty, policies could first identify poor people on more than just one measure of poverty. Targeting priority could subsequently be given to the sub-group that is categorized as poor under most or all the measures. The reason is that, implementing anti-poverty policies based only on one measure (or the official measure alone) can potentially ignore various other dimensions of deprivation that people may experience.

Table 2.3 also shows that households with educated women are less likely to be living in poor households compared to others, as revealed by a very small odds ratio, and a very large marginal effect (12%). The odds ratio is statistically significant at well below the 1% level. This outcome is consistent across all measures of poverty revealing the inverse relationship between female education and poverty. As expected, households belonging to the socially lower castes (SC and ST), have a higher odds of being poor compared to other households. The coefficient estimates are statistically significant at less than the 1% level.

Table 2.3 also shows that households with higher child-adult ratio have a higher probability of being poor under all measures of poverty and the coefficient estimates are statistically significant at less than the 1% level in all the columns.[22] This result is consistent with that of Dreze and Srinivasan (1997), who find that the per capita expenditure is lower in households with higher child-adult ratio compared to other households.

Household size in all the columns is negatively associated with poverty. Households with more number of members are less likely to be poor, and the coefficient estimates are statistically significant in all the columns. This result is again consistent with Dreze and Srinivasan (1997) and Meenakshi and Ray (2002) who argue that households with more household members could

[22] Odds-ratios for continuous variables do not have a nice interpretation as binary variables, as there is no natural baseline group for comparing the odds. However, for continuous variable it still indicates the odds-ratio for a unit change in the variable. This ratio is the same for any pair of adjacent values of the variable.

achieve economies of scale in household consumption. Dreze and Srinivasan claim that such economies could exist owing to the presence of increasing returns to domestic technology, role of collective goods in consumption and use of bulk discounts in household purchases. Households living in southern states of India are less likely to be poor compared to the ones in the northern states.

To exploit the categorical nature of the data available from NFHS, I employ the ordered logit and probit, and present the results for the former in Table 2.4. Category-1 in Table 2.4 (A) represent households living under kutcha houses, 2 represent households living under semi-pucca houses and 3, households living under pucca houses. Similar to Table 2.4 (A), in Table 2.4 (B) and 2.4 (C), the categories are ordered from the poorest to the richest households based on the wealth and the standard of living indices, respectively. The results in Table 2.4 are consistent with the ones obtained in Table 2.3.

Columns (1), (2), and (3) provide evidence that female heads are concentrated more on pucca houses (the most expensive of the three housing categories) than kutcha or semi-pucca houses, as shown by a positive marginal effect on the pucca houses category and a negative effect on the other two. The coefficient estimates on all the three columns are statistically significant at or less than the 1% level. Column (1) indicates that female-headed counterparts are 1% less likely to be living in kutcha houses than the other two categories. Note that the marginal effects across the categories have to sum up to zero.[23] To illustrate, if the probability of female-heads living in poor houses is less, then their chance of living in rich houses have to be greater by the same amount.

[23] Since we round off the values to two nearest decimals, the marginal effects do not exactly sum to zero for all the variables always.

As in Table 2.3, when poverty is measured using the wealth index (table 2.4(B)), female-headed households are less likely to be in the poorest two quintiles compared to the richer three categories. On the other hand, when poverty is measured using the standard of living index (table 2.4 (C)), female-headed households are 2% more likely to be living in the poorest category than the other two categories. The marginal effects of all the other control variables are consistent with the results obtained in Table 2.3.

2.6 Conclusions

This paper, to the best of our knowledge, is the first to use the NFHS dataset to analyze whether female-headed households are poorer than male-headed counterparts in rural India. Using this data set enables us to exploit different asset-based measures of poverty, namely housing condition, wealth index and standard of living index that are more likely to reflect people's chronic living standards compared to the official measure based on consumption expenditure.

The results from this study provide very limited evidence that female-headed households are any poorer than other households. Only based on the standard of living index measure of poverty female-headed households are marginally poorer than the rest. Based on the other two poverty measures, female-headed households are less likely to be poor than the male-headed counterparts. Even though the results using different poverty measures are not significantly different, these results do offer an important suggestion to policy makers. Policies targeting specific population groups in pursuit of reducing poverty could prioritize the target groups based on the population that is counted as poor under most measures of poverty. This requires policy makers to first identify poor people based on more than just one measure of poverty.

The results should not be interpreted to surmise that there exists no gender discrimination against women in India – even though such discriminations may exist, they do not show up in the data set that I use. Differences in poverty status among female and male-headed households (based on all the three poverty measures) are not quantitatively significant to warrant any addition to the existing anti-poverty policies specifically focused on female-headed households. Overall, the results from this analysis do not provide evidence to support the claim that female-headed households are any poorer than male-headed households in India, and that they require special assistance.

2.7 References

Agarwal, B. 1999. "Widows versus Daughters or Widows as Daughters? Property, Land and Economic Security in Rural India", *Modern Asian Studies*, 32(1), 1-48.

Alkire, S., and Foster., J. 2008. "Counting and Multidimensional Poverty Measurement", *Oxford Poverty and Human Development Initiative*, *Working paper* – 7.

Appleton, S. 1996. "Women-headed Households and Household Welfare: An Empirical Deconstruction for Uganda", *World Development*, Vol. 24 (12) 1811-1827.

Arokiasamy, P., and Pradhan, J. 2006. "Gender Bias Against Female Children in India: Regional Differences and their Implications for MDGs", [Unpublished] Presented at the *2006 Annual Meeting of the Population Association of America, Los Angeles, California*, March 30 - April 1, 2006. 22 p.

Barros, R., Fox, L., and Mendonca, R. 1997. "Female-Headed Households, Poverty, and the Welfare of Children in Urban Brazil", *Economic Development and Cultural Change*, Vol. 45 (2), 231-57.

Burguignon, F., and Chakravarthy, S. R. 2003. "The Measurement of Multidimensional Poverty", *Journal of Economic Inequality*, 1, 25-49.

Buvinic, M., and Gupta, G.R. (1997): "Female-Headed Households and Female-Maintained Families: Are They Worth Targeting to Reduce Poverty in Developing Countries?", *Economic Development and Cultural Change*, Vol. 45 (2), 259-80.

Das Gupta, M., Zhenghua, J., Zhenming, X., Bohua, L., Chung, W., and Ok. B. 2003. "Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea," *Journal of Development Studies,* 40(2): 153–87.

Datt, G., and Ravallion, M. 1998. "Why Have Some Indian Done Better than Others at Reducing Rural Poverty?", *Economica*, 65, 17-38.

Deaton, A., and Kozel, V. 2005. "Data and Dogma: The Great Indian Poverty Debate", *World Bank Research Observer*, 20(2), 177-99.

Deutsch, J., and Silber, J. 2005. "Measuring Multi-Dimensional Poverty: An Empirical Comparison of Various Approaches", *The Review of Income and Wealth*, 51 145-174.

Dreze, J., and Sen, A. 1995. "India Economic Development and Social Opportunity," Oxford University Press.

Dreze, J., and Srinivasan, P.V. 1997. "Widowhood and Poverty in Rural India: Some Inferences from Household Survey Data", *Journal of Development Economics*, 217-234.

Duclos J.-Y., D. Sahn, and S. D. Younger , 2006. "Robust Multidimensional Spatial Poverty Comparisons in Ghana, Madagascar, and Uganda", *The World Bank Economic Review* 20, 91-113.

Dyson, T. and Moore, M. 1983. "On Kinship Structure, Female Autonomy, and Demographic Behavior in India", Population and Development Review, 9(1): 35-60.

Dunlop, J.E., and Velkoff, V.A. 1999. "Women and the Economy in India", U.S. Census Bureau, Official Statistics December 3.

Filmer, D. and L. Pritchett. 2001. "Estimating wealth effects without expenditure data-or tears: An application to educational enrollments in states of India", *Demography* 38(1):115-132.

Foster, J., Greer, J., and Thorbecke, E. 1984. "A Class of Decomposable Poverty Measures", *Econometrica* 52, 761-766.

Foster, J., and Sen, A. K. 1997. "On Economic Inequality: After a Quarter Century", *On Economic Inequality,* by Amartya Sen, Oxford: Claredon Press.

Fuwa, N. 2000. "The Poverty and Heterogeneity among Female Household Heads Revisited: The Case of Panama ", *World Development,* Vol. 28(8), 1515-1542.

Gang, I, N., Sen, K., and Yun M, S. 2008. "Poverty in Rural India: Caste and Tribe", *Review of Income and Wealth*, 54: 50-70.

Gangopadhyay, S., and Wadhwa, W. 2003. "Are Indian Female-headed Households more Vulnerable to Poverty", *India Development Foundation*.

Government of India, Indian Census 2001.

Haub, C., and Sharma, O.P. 2006. "India's Population Reality: Reconciling Change and Tradition", *Population Bulletin* 61: 3-20.

Hirway, I. 2003. "Identification of the Poor: Flaws in Government Surveys", *Economic and Political Weekly*, 38(45), 4803-38.

Meenakshi, J.V. and Ray, R. 2002. "Impact of household size and family composition on poverty in rural India", *Journal of Policy Modeling*.

Morrison, A., Raju, D., and Sinha, N. (2007) "Gender Equality, Poverty and Economic Growth", Policy Research Working Paper 4349, Washington DC: The World Bank Gender and Development Group, Poverty Reduction and Economic Management Network

Ravallion, M. 1998. "Poverty Lines in Theory and Practice" *LSMS Working Paper 133, World Bank*, Washington, D.C.

Ray, R. 2000, "Poverty, Household Size and Child Welfare in India", *Economic and Political Weekly*, 35, 3511-3520.

Sen, A. K. 1976. "Poverty: An Ordinal Approach to Measurement", *Econometrica*, 44 219-231.

Senada, S., and Sergio, E. 2007. "Poverty amongst Female-headed Households in Bosnia and Herzegovina: an empirical analysis", *South East European Journal of Economics and Business.* 2(1), 69-88.

Schultz, T. P. 2002. "Why governments should invest more to educate girls", *World Development* 30(2): 207-225.

Smith, D. G., Gordon, D., Kelly, M., Nandy, S., Subramaniam, S. V. 2003. "Inequalities in health in India: the methodological construction of indices and measures", Report submitted to UK Department for International Development., 2003.

Swarup, H., and Rajput, P. 1994. Women and Globalization: reflections, options, and Strategies, Ashok Publications: New Delhi

World Bank. 2001. *Engendering development: Through gender equality in rights, resources, and voice*. New York: Oxford University Press.

World Bank press release 2008. *http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:21882162~pagePK:64165401~piPK:64165026~theSitePK:469382,00.html*, visited August 2008.

Table: 2.1 Number and percentage of variables used in the study

	Number of households (in percentage)
Female-headed households	5,940 (13.2)
Male-headed households	39,044 (86.8)
Households living in “kutcha” houses	7,559 (16.8)
Households living in Poverty based on wealth index	20,417 (45.4)
Households living in Poverty based on standard of living index	13,601 (30.2)
Households living in poverty under all three measures of poverty	5,084 (11.5)
Households with at least one woman having a primary education or higher	19,862 (44.1)
Households with the head belonging to the socially lower caste	16,147 (35.9)
Households living in the southern states of India	7,971 (17.7)
Average child-adult ratio in each household	0.43
Average household size (number of members in each household)	5.5
All India Rural Total Households	44,984 (100)

Table 2.2 Poverty status by household type

	Female-headed households (in percentage)	Male-headed households (in percentage)
Total households	**5,940 (100)**	**39,044 (100)**
Households living in kutcha houses	913 (15.4)	6,646 (17.0)
Households living in two poorest wealth index quintiles	2,577 (43.4)	17,840 (45.6)
Households living in the poorest standard of living index quintiles	2,175 (36.6)	11,426 (29.2)
Households living under poverty based on all three measures of poverty	704 (11.8)	4,380 (11.2)

Table 2.3 Odds Ratio from Logit Estimation: Dependent Variable: Different measures of poverty in rural India for 44984 households in 2005-06 (p-values in parenthesis, marginal effects in bold and italicized)

	(1)	(2)	(3)	(4)
Dependent Variable	Housing Condition	Wealth Index	Standard of Living Index	All three measures
Female-headed households*	0.88 (0.001) ***-0.02***	0.88 (<0.001) ***-0.03***	1.28 (<0.001) ***0.04***	0.99 (0.917) ***-0.000***
Women's education*	0.37 (<0.001) ***-0.12***	0.18 (<0.001) ***-0.39***	0.19 (<0.001) ***-0.30***	0.23 (<0.001) ***-0.12***
Caste of the household head*	1.65 (<0.001) ***0.07***	1.78 (<0.001) ***0.14***	1.98 (<0.001) ***0.14***	1.70 (<0.001) ***0.04***
Child-adult ratio	1.24 (<0.001) ***0.03***	1.46 (<0.001) ***0.10***	1.58 (<0.001) ***0.09***	1.37 (<0.001) ***0.03***
Household size	0.96 (0.015) ***-0.01***	0.94 (<0.001) ***-0.02***	0.79 (<0.001) ***-0.05***	0.90 (<0.001) ***-0.008***
Household size Square	1.01 (0.676) ***-0.00***	1.01 (0.954) ***-0.00***	1.001 (<0.001) ***0.001***	0.99 (0.729) ***0.000***
Households living in southern India*	0.64 (<0.001) ***-0.05***	0.67 (<0.001) ***-0.10***	0.98 (0.56) ***-0.003***	0.75 (<0.001) ***-0.02***
Constant	-1.23 (<0.001)	0.36 (<0.001)	0.32 (<0.001)	-1.40 (<0.001)
Pseudo- Rsquare	0.06	0.15	0.15	0.09

**The marginal effect is for discrete change of the dummy variable from 0 to 1*

Table 2.4 Marginal Effects in Ordered Logit: Dependent Variable: Different Measures of Poverty in Rural India in 2005-06 (p-values in parenthesis)

A) Housing Condition (Y=1 represent the poorest and Y=3 the least poor category in which households are placed) for **44628 households**[@]

	(1)	(2)	(3)
Categories	Y=1	Y=2	Y=3
Female-headed Households*	-0.01 (<0.001)	-0.01 (0.001)	0.02 (0.001)
Women's education*	-0.12 (<0.001)	-0.10 (<0.001)	0.22 (<0.001)
Caste of the household head*	0.07 (<0.001)	0.04 (<0.001)	-0.11 (<0.001)
Child-adult ratio	0.03 (<0.001)	0.02 (<0.001)	-0.04 (<0.001)
Household size	-0.002 (0.100)	-0.001 (0.100)	0.003 (0.100)
Household size Square	-0.000 (0.300)	-0.000 (0.300)	0.000 (0.300)
State in which the household is located*	-0.10 (<0.001)	-0.13 (<0.001)	0.23 (<0.001)

B) Wealth Index (Y=1 represent the poorest and Y=5 the least poor category in which households are placed) for 44984 households

	(1)	(2)	(3)	(4)	(5)
Categories	Y=1	Y=2	Y=3	Y=4	Y=5
Female-headed Households*	-0.02 (<0.001)	-0.02 (<0.001)	0.01 (<0.001)	0.02 (<0.001)	0.01 (<0.001)
Women's education*	-0.25 (<0.001)	-0.17 (<0.001)	0.06 (<0.001)	0.21 (<0.001)	0.15 (<0.001)
Caste of the household head*	0.09 (<0.001)	0.06 (<0.001)	-0.04 (<0.001)	-0.07 (<0.001)	-0.04 (<0.001)
Child-adult ratio	0.05 (<0.001)	0.04 (<0.001)	-0.02 (<0.001)	-0.05 (<0.001)	-0.02 (<0.001)
Household size	-0.01 (<0.001)	-0.01 (<0.001)	0.002 (<0.001)	0.01 (<0.001)	0.004 (<0.001)
Household size Square	-0.00 (0.458)	-0.000 (0.458)	0.000 (0.458)	0.000 (0.458)	0.000 (0.458)
State in which the household is located*	-0.04 (<0.001)	-0.03 (<0.001)	0.01 (<0.001)	0.04 (<0.001)	0.02 (<0.001)

C) Standard of Living Index (Cut-off Y=1 represent the poorest and Y=3 the least poor category in which household are placed) for 44010 Households^

	(1)	(2)	(3)
Categories	Y=1	Y=2	Y=3
Female-headed Households*	0.02 (<0.001)	-0.001 (0.093)	-0.02 (<0.001)
Women's education	-0.32 (<0.001)	-0.03 (<0.001)	0.34 (<0.001)
Caste of the household head	0.15 (<0.001)	-0.001 (<0.001)	-0.14 (<0.001)
Child-adult ratio	0.09 (<0.001)	0.002 (0.021)	-0.10 (<0.001)
Household size	-0.03 (<0.001)	-0.001 (0.022)	0.003 (<0.001)
Household size Square	0.000 (<0.001)	-0.000 (0.039)	0.000 (<0.001)
State in which the household is located	-0.01 (0.123)	-0.000 (0.283)	0.01 (0.127)

@ Housing condition category was not available for 356 households

^ Standard of living category was not available for 974 households

***** *The marginal effect is for discrete change of the dummy variable from 0 to 1*

Appendix:

a) *Materials used in kutcha houses*

Flooring materials: Mud, clay, earth, sand, dung, raw wood planks, palm, bamboo and other rudimentary materials.

Wall materials: cane, palm, trunks, mud, grass, reeds, thatch, bamboo and stone with mud, plywood, cardboard, unburnt bricks, raw or reused wood or other rudimentary materials, including houses with no walls.

Roof materials: thatch, bamboo, mud, palm leaves, grass, plastic, polythene sheets, raw wood planks, timber, unburnt bricks and loosely packed stones, including houses with no roofs.

b) *Wealth Index*

The list of items used to construct the wealth index include the source of drinking and non-drinking water, toilet and electricity facilities, type of cooking fuel, floor, roof and wall materials used in houses, type of windows, household possession of items, number of *de jure* members sleeping per room, house ownership, and whether the household has a bank or post office savings account.

c) *Standard of living index*

List of items used to construct the standard of living index: Housing structure, cooking fuel, drinking water source, separate room for cooking, ownership of house, land, irrigated land, livestock, tractor, car, motorcycle, telephone, refrigerator, TV, bicycle, electric fan, radio, sewing machine, water pump, animal-drawn cart, thresher, mattress, pressure cooker, chairs, cot, table, clock.

Chapter 3

Women's Autonomy, Maternal and Child Healthcare in India: Are the Women and Children from Poorest Households Particularly Disadvantaged?[24]

3.1 Introduction

Besides being an important goal in itself, female autonomy has significant influence on women's health status and that of their children, and this relationship is particularly significant in male-dominated societies that limit women's autonomy (Caldwell 1986). Several studies provide evidence that women's power in a family relative to her husband has considerable implications for maternal healthcare-seeking behavior (Becker 1996, Beegle et al. 2001, and Maitra 2004). The objective of this paper is to test this hypothesis in India, which contributes a staggering 20% of the global burden of maternal deaths, and 25% of global infant mortality rate (World Health Organization 2000).

While India has witnessed massive improvements in maternal and child healthcare in the last decade or more, the power and authority of most women within a household continues to be pitiable (Maitra 2004). Social and cultural norms in strong patriarchal societies hinder women from receiving maternal healthcare even during pregnancy related complications (Berry 2006). Maitra (2004) maintains that in many rural parts of India, deliveries take place in unhygienic condition in the presence of female family members, because social norms prevent women to be administered by outsiders, especially by male doctors. In many developing countries, decisions on maternal care are mostly made by the husband or his family members (WHO 1998). Mason

[24] Rajaram, Ramaprasad, and Balasubramaniam, Divya.

(1996) asserts that improving women's social distribution of power within a household significantly improves reproductive health outcomes.

Several studies have documented a positive relationship between women's autonomy, and maternal and child healthcare in India (Dyson and Moore 1983, Murthi et al. 1995, Dharmalingam and Morgan 1996, Bloom et al. 2001, Maitra 2004). Although we seek to address the same issue, we differ from the existing studies in several important dimensions. While the papers mentioned above control for the economic status of households, they fail to test for the effects of female autonomy on healthcare seeking behavior when households are categorized into different wealth quintiles. From a public health perspective, this segregation is particularly important, because women and children from poor households are likely to face greater challenges in seeking proper maternal and child healthcare, particularly cost-related obstacles.[25] Thus, in this study, we test how female autonomy affects maternal and child healthcare-seeking behavior across the distribution of household's economic status.

While the related literature uses the intra-household bargaining framework to analyze the relationship between female autonomy and maternal healthcare seeking behavior, none of the studies focus on female autonomy and child healthcare seeking behavior. This is the first study to use a bargaining framework to analyze child healthcare seeking behavior in India. In addition, this study factors in two measures of poverty namely, the wealth index and the standard of living index to verify whether different poverty measures yield different results.

The empirical analysis of whether female autonomy affects maternal and child healthcare utilization crucially depends on the way we define "female autonomy". In this paper, we follow

[25] Income or wealth status can have significant implications on the nutritional status of expectant mothers and infants (Warner 1995 and Emerson et al. 2006).For example, poor access to maternal and child healthcare facilities, expenditure related to maternal and child care, access to transportation facilities, economic discrimination from the providers, to name a few, are potentially greater impediments that women and children from poor households face.

Bloom et al. (2001) in defining women's autonomy with respect to freedom of movement, control of finances, and decision making power in large household purchases. Similarly, following Gebramariam (2007) and many others, we measure maternal and child healthcare seeking behavior by a) whether the woman's delivery was attended by an individual with a formal medical training, and b) the last child had received complete immunization medication, as per the World Health Organization standards.[26]

The main results of this paper are a) women with higher autonomy do not have significantly higher odds of seeking proper maternal and child healthcare, and the strength of this relationship does not differ between the wealth and standard of living indexes (see section 3.4 for definition), and b) there is no evidence of any systematic pattern of relationship between female autonomy and healthcare seeking behavior, when households are classified based on wealth or standard of living quintiles. In other words, none of the autonomy variables are related to healthcare seeking behavior exclusively in poor or rich households.

3.2 Female Autonomy and Healthcare

One way to define female autonomy or empowerment is with respect to women's 'ability' to make choices, which was previously denied to them (Kabeer 2005). As Kabeer points out, such empowerment can be transmitted through three interrelated dimensions, namely, agency, resources and achievements. Agency is the process through which choices are made; resources are the means by which agency is implemented, and achievement is the outcome of agency. In India, various customs and traditions have led people to prefer sons over daughters based on social, religious and economic reasons, and consequently women are accorded lower status in India (Arokiasamy and Pradhan 2006, Das Gupta et al. 2003). Strong patriarchal values

[26] More details on measuring the variables is explained in the section on "Data and Methods"

identify the position of a woman in a family mainly for her reproductive role and her domestic duties such as cleaning, cooking, or child-care. Several practices and customs are still prevalent in India that symbolize the subordination of women to men, making gender-bias against women an intrinsic socio-economic issue and impede the empowerment of women.[27]

Several important issues also arise while addressing the relationship between female autonomy, maternal and child healthcare. First, women's autonomy is a subjective term that has many meanings loaded in it, and thus, its definition can change from one setting to another. Second, it is difficult to quantify several aspects of women's autonomy into one measurable index. Third, it is extremely hard to control for various factors that can influence the relationship between female autonomy and her health status. For instance, in India, familial culture and customs widely differ, which is extremely hard to quantify and proxy for.

Mathews et al. (2006) mention the role of women's autonomy in influencing the demand for maternal healthcare. Autonomy with respect to mobility can determine a woman's decision to seek medical care from a hospital that is far off from her house. Similarly, autonomy with respect to control of household finances could affect her decision to undertake costly maternal healthcare procedures. They also claim that women's autonomy is likely to be more significant in their "ability to contact services" in rural India, where medical facilities are sparsely distributed across the region.

Dyson and Moore (1983) document higher rates of fertility and child mortality, and higher ratios of female to male mortality in North India, where female autonomy is generally

[27] Practices such as Sati, Dowry, Purdah, to name a few. Dowry: In India, when a woman marries, she is supposed to live with her husband's family ever after. Thus, at the time of marriage, the bride's family pays huge amount of money in cash and kind (called dowry) as a compensation to the groom's family to take good care of the bride. Sati is a Hindu religious practice in which a widow immolates herself on the husband's funeral pyre. Purdah is predominantly an Islamic practice in which a woman conceals her body from head to toe with a 'Purdah' garment. The purpose of such a practice is to keep women separated from men.

lower than the rest of the country. Since then many studies have analyzed the relationship between female autonomy and fertility issues: smaller family size or desired fertility (Murthi et al. 1995, Morgan et al. 2002). Dharmalingam and Morgan (1996) show that women with independent source of income, freedom of movement and high levels of interaction with other women, have a higher probability of contraceptive use.

Bloom at al. (2001) find that in India, women with greater autonomy in movement are more likely to obtain higher level of antenatal care and use safe delivery care. Bhatia and Cleland (1995) show that households' economic status is a significant determinant of proper maternal healthcare utilization. Maitra (2004) uses a bargaining model to analyze whether female autonomy affects maternal care and that in turn affects child mortality in India. Beegle et al. (2001) show that the distribution of power between couple in the household affects decision to use prenatal and delivery care in Indonesia.

3.3 Conceptual Framework

The relationship of female autonomy on maternal and child healthcare seeking behavior can be analyzed within the intra-household bargaining framework. In the traditional unitary model of household behavior of resource allocation, family members maximize a single utility function (Becker 1981). This model assumes that each member in the household have the same preference or "a single dictator" acts on behalf of the household in the allocation and decision-making process. An alternative to these models is the collective model where household members have differing preferences that can create conflict in decision making process and as a result can lead to allocations different than in the unitary models (Ahmed 2006). The recent

literature focuses on collective bargaining models since it allows for differing preferences among members within the household.

We follow Amponsah and Moses (2009) to analyze the intra-household behavior in resource allocation. Parents maximize a household welfare function *Z*. That is, parents derive utility from market consumption goods (*C*), leisure (*L*), health quality of all household members (*Q*), and characteristics of all the members that may influence tastes and preferences (*TP*). The collective model assumes that parents have different preferences for *C*, *L*, and may also value the consumption and well-being of other household members differently. The household utility function is:

$$U^i = U^i(C, Q, L, TP) \quad \text{----- (1)}$$

where i= m (mother), f (father). The mother's utility is U^m and father's utility is U^f. In this analysis, *Q* includes the well-being of the expectant mother and the child. Each parent chooses *C, L,* and *Q* to maximize the household welfare function, Z. This welfare function aggregates each parent's utility function:

$$Z = Z(U^m(C, L, Q, TP), U^f(C, L, Q, TP)) \quad \text{----- (2)}$$

Now, parents have two constraints:

$$Q = Q(u, P, H, C) \quad \text{----- (3)}$$

where, equation (3) is the constraint imposed by the health production function. That is, parents cannot buy health stock *Q* in the market; therefore, they have to produce it. The health production depends on the healthcare usage (*u*) that measures choice of delivery. *P, H, and C* each represents the parents, household, and community characteristics, respectively that affect the health stock production. The other constraint is the income constraint:

$$p_C C + p_u u = w_m(T_m - L_m) + w_f(T_f - L_f) + A_m + A_f \quad \text{----- (4)}$$

where, $p_C C$ is the value of consumption goods purchased in the market, $p_u u$ expenditure on health inputs (p_u is the price of health inputs). w_i is the wage, T_i is the time endowment for parents, $(T_i - L_i)$ is the amount of time allocated to work, and A_i is the unearned or asset income. We can now estimate the demand for healthcare usage as:

$u = u(P, H, Com, \psi)$ ------ (5)

where the healthcare usage depends on the parental (*P*), and household characteristics (*H*). *Com* contains the community characteristics, and ψ captures a set of variables that include each member's relative authority and power within the household. ψ , is the main parameter that distinguishes the unitary household model from the collective bargaining one. We estimate equation (5) separately for maternal and child healthcare seeking behavior.

3.4 Data, Methods, and Measurement

3.4.1 Data Source

We use the National Family Health Survey (NFHS 2005-06) data for all the variables used in the study. The NFHS is a division of Demographic Health Survey (DHS) that conducts individual and household level survey for over eighty developing countries mainly to provide data in the areas of health, demographics and nutrition.[28] The survey covers 123,485 women between the ages of 15 and 49 across 29 states from a total of 109,041 households in both rural and urban areas. The survey interviewed more than one eligible woman per household. To avoid duplication of the household and community characteristics, we include only one woman per household. This leaves us with a final sample of 51,555 women in the analysis. Although Maitra

[28] NFHS has conducted three surveys in India beginning 1992-93 (NFHS-1), and continued with two more in 1998-99 (NFHS-2) and 2005-06 (NFHS-3). The individual data that we use covers women only between the ages of 15-49.

(2004) has used the 1998-99 survey data to address a similar question, no previous study has used the recent most (2005-06) data to analyze the relationship between female autonomy, and maternal and child health care seeking behavior.

3.4.2 Measuring the Variables

Dependent Variables

To measure safe maternal health, we create a variable which takes the value of one if the woman's last delivery was attended by an individual with a formal medical training; namely, doctor, midwife, or nurse, and not any traditional birth attendants. The above definition conforms to the World Health Organization (WHO) standards of safe delivery care. Similarly, following Gebremariam (2007), we measure child heath by creating a dummy variable that takes the value of one if the child has received one dosage of BCG vaccination (against tuberculosis), at least one out of three doses of DPT (against dipheria, pertussis, and tetanus), at least one out of three doses of polio vaccination, and a measles vaccination.[29]

Independent Variables

(i) Autonomy Variables

A binary variable with a value of one is scored if the (interviewed) woman in the household had a say in the decision to visit her family members, either independently or jointly with her husband or other family members, and zero otherwise. Analogously, we create binary variables for the other two aspects of autonomy – households' financial decision and decision making power in large household purchases.

[29] We account for only one out of three vaccination dosages in polio and DPT because, none of the children in the sample are vaccinated with all three dosages of DPT and polio, and with one dose of measles and BCG.

(ii) Other Household and Community Variables

We use binary variables to indicate whether a) the woman had at least a primary school education, b) she works, and c) the household is in a rural area (which accounts for the number and proximity of medical facilities). We include a continuous variable that measures parity: number of surviving children. Dyson and Moore (1983), among many others, show that the level of female autonomy is much higher in southern than in northern India. Thus, we also include a binary variable to account for whether the household is located in the southern state. These controls are standard in the literature.

We use the wealth index as a measure of economic status. In addition, we use the wealth quintiles to analyze how female autonomy and maternal and child healthcare seeking behavior differ across wealth distribution. NFHS constructs the wealth index using Principle Component Analysis based on data from household's ownership of various assets. The wealth index includes dwelling characteristics such as source of drinking water, electricity supply, materials used in houses, whether the household members have a bank account, to name a few. After each item is assigned a weight through PCA, the scores are standardized in relation to a normal distribution and the wealth index is the sum of these scores. The NFHS also constructs wealth quintiles using the wealth index (the values range from one through five), which denotes the five quintiles of the sample.[30]

NFHS computes the standard of living index (SLI) using a more detailed list of household items including whether the household owns a telephone, pressure cooker, mattress etc. The International Institute of Population Sciences (IIPS) research team in India has developed a specific calculation to assign weights for the items in the standard of living index. The weights are based on the relative importance of the assets in a household rather than a more

[30] One represents the poorest and five represents the wealthiest quintiles.

'formal' analysis. The SLI represents the household scores. The NFHS also categorizes the standard of living index into three levels – "Low standard of living", "medium" and "high". [31]

3.4.3 Model and Methods

To estimate the effects of female autonomy on maternal and child healthcare, we use the following reduced form from equation (5):

$$U_i = \alpha_0 + \alpha_1 FA_i + \alpha_2 I_i + \alpha_3 H_i + \alpha_4 Com_i + \varepsilon_i \text{ ------ (6)}$$

where U_i measures safe maternal and child healthcare seeking behavior separately, FA_i measures female autonomy (which corresponds to ψ in equation (5)), namely, autonomy with respect to movement, financial decisions and large household purchases. I_i measures individual characteristics such as women's education and the number of surviving children for that woman. H_i measures the household characteristic, specifically, whether the woman works, whether the household is rich, and whether the household is located in one of the four southern states. $Com_{i,}$, the community variable specifies whether the women and children live in a rural area. The subscript i denotes the i^{th} individual. We employ the proportional-odds (Logit) model to estimate equation (6), which uses the Maximum Likelihood Estimation technique. Logit model is the most commonly used generalized linear model where the dependent variable is binary.[32] We estimate equation (6) separately for rich and poor households.

The proportional odds model is used to predict the probability of an event where the events are classified into more than two categories (1, 2, ..., J). This multi-category logit model is

[31] The NFHS dataset does not provide the actual SLI scores. Therefore, we use the SLI categories as a measure of economic status as well as to analyze how female autonomy and maternal and child healthcare seeking behavior differ across SLI distribution.

[32] This model is preferred over OLS because, for certain values of the independent variable the probability value of the dependent variable can be greater than one or less than zero, which is not very meaningful. In addition, OLS assumes constant marginal effects on the dependent variable while logit models do not.

based on cumulative probabilities. For a single covariate x, the cumulative probability that the response variable falls into category j or below, is given by

$P(Y< j) = \exp(a + Px) / [1 + \exp(a + Px)]$. Thus, the coefficient estimate corresponds to the log-odds ratio of being above versus below any specific level of the response variable chosen. Thus, in equation (6), if the coefficient α_1 is greater than one, then it implies that compared to women who do not have autonomy, women who have autonomy have higher odds of seeking safe delivery care methods or better child healthcare, and analogously for other coefficients as well.

3.5 Summary Statistics and Regression Results

Table 3.1 shows that only half of the women in the sample seek medically trained personnel for their delivery. Less than two-thirds of the children in the sample are completely vaccinated. Approximately, 60% of the women have autonomy in movement – individually or jointly they had a say in visiting their family members. About 59% of women have autonomy in large household purchases. Only 17% of the women in the sample report having autonomy in financial decision in the household. Roughly, 60% and 30% of the women have a primary education and a job, respectively. Two-thirds of the households live in rural areas. While households based on the wealth index are pretty evenly distributed across the five quintiles, the households are more concentrated among the middle quintile based on the standard of living index quintiles.

Table 3.2A reports the results from estimating equation (6) by proportional odds (logit) method, where the dependent variable is safe maternal healthcare seeking behavior. In this table, we use the wealth index and standard of living index separately, to control for the economic

status of the household.[33] Column (1) includes only the autonomy variables and columns (2) and (3) control for the individual, household, and community characteristics. Column (1) shows that women with autonomy in movement have higher odds (1.32) of seeking better maternal healthcare compared to ones without such autonomy. The magnitude of the odds ratio is not large; however, it is statistically significant at less than 1% level. This ratio is significantly higher than the other two aspects of autonomy, and the magnitudes of the odds ratios are similar to the ones that Bloom at al. (2001) obtain.

Column (2) shows that the odds for seeking proper maternal care are marginally higher for women with autonomy in movement (the odds ratio is slightly greater than 1.00) than the ones without such autonomy, and the value is statistically significant at less than 1% level. Once again, the magnitude of the odds ratio is not very high to warrant any urgent policy measure to empower women within the household to seek proper maternal care. Autonomy in finances has a higher (and positive) effect on maternal healthcare seeking behavior, than the other two aspects of autonomy. The change in the odds ratio from less than one (in column (1)) to greater than one (in Column (2)) suggests that the relationship between women's autonomy in financial decision and maternal healthcare seeking behavior is jointly determined by individual, household, and community characteristics. Women's autonomy in large household purchases does not seem to affect safe maternal healthcare utilization.

Women with at least a primary level education are almost twice more likely than others in seeking proper maternal care, which is very high, and the odds ratio is also statistically significant at well below the 1% level. This result is consistent with a number of studies that emphasize the important role of female education in improving maternal healthcare seeking

[33] Since most of the items used in the construction of both the wealth and the standard of living index overlap, we do not use both the measures in the same regression. However, even if we include both the measures, the results do not change much.

behavior (Maitra 2004). Working women, households living in rural areas, and higher number of surviving children in the household tend to have lower odds than others, in seeking proper maternal healthcare. As one would expect, women in richer households are more likely to seek proper maternal care compared to women in poor households as indicated by the odds ratio of household's economic status. The results are very similar using the alternate measures of poverty (compare columns (2) and (3)). Women in southern states are four times more likely to seek safe maternal healthcare than others. The fully specified model explains about 29% of the variation in maternal healthcare seeking behavior using the wealth index, and 24% of the variation, using standard of living index.

Table 3.2B shows the result of estimating equation (6) with safe child healthcare seeking behavior as the dependent variable. The results are similar to the ones obtained in Table 2A. Column (2) shows that women's autonomy does not significantly affect proper child healthcare seeking behavior, as indicated by the magnitude of the odds ratios. The odds ratios for other variables are similar to the ones obtained in Table 2A and thus, follow similar interpretations. The model explains only 8% of the variation in child health.

Table 3A shows the result of estimating the effects of female autonomy on maternal healthcare after categorizing the households based on their respective wealth index quintiles. The outcome from this estimation would give a sense of whether female autonomy matters differently in rich and poor households. Except for autonomy in finances in the richest quintile, none of the other aspects of autonomy in any quintile significantly affect safe maternal healthcare. This result does not necessarily suggest that autonomy does not matter for seeking safe maternal healthcare – such an effect does not show up in the dataset we use.

Female autonomy in finances matters more than other aspects of autonomy (higher value of odds ratio) in all households except the poorest ones. This result could be because resources are scarce in poor households (by definition), and autonomy in control of such meager resources is less likely to matter much for maternal care utilization. The results also show that there is no systematic relationship between autonomy variables and proper maternal healthcare seeking behavior based on household's economic status. The rest of the control variables are fairly similar across rich and poor households, with the exception of mother's education that matters much more in rich than in poor households.

Table 3.3B is similar to Table 3.3A, except that the dependent variable in Table 3.3B is proper child healthcare seeking behavior. The autonomy variables have varied effects on child healthcare seeking behavior, based on household's wealth quintiles and the magnitude on autonomy variables continue to be very low. The odds ratios on other control variables in 3.3 are fairly similar to Table 3.2, and thus follow similar interpretations.

Tables 4A and 4B use the SLI quintiles with safe maternal and child healthcare seeking behavior as the dependent variables, respectively. Table 4A shows that women's autonomy in finances significantly determines safe maternal healthcare across all the quintiles. Other than that, there is again no systematic relationship across autonomy variables and the standard of living index quintiles.

As in Table 3A, the odds ratio on women's education in Tables 4A and 4B is very large, suggesting that women with a primary education or more are more likely to seek safe maternal and child healthcare than others. The odds ratios for women's education across households in all the quintiles are statistically significant at less than the 1% level. Table 4B uses child healthcare

seeking behavior as the dependent variable and the results are very similar to the ones obtained in Table 4A, and thus follow similar interpretations.

3.6 Conclusion

This is one the first studies to use intra-household bargaining model to test whether female autonomy has significant influence on child healthcare seeking behavior, besides maternal care in India. We also analyze whether this relationship differs across households in wealth and SLI quintiles. The results from this study show that women with autonomy do not have significantly higher odds of seeking proper maternal and child healthcare in India, although the coefficient estimates are statistically significant. The three aspects of autonomy namely, autonomy with respect to movement, finances and household purchases have varying effects on maternal and child healthcare seeking behavior. The relationship does not vary based on the measure used to determine household's economic status. We also find no evidence of any systematic relationship between female autonomy, proper maternal and child healthcare seeking behavior, when households are categorized into different wealth and SLI quintiles.

The results from the study also provide evidence that women's education plays an important role in proper maternal and child healthcare seeking behavior. Regardless of the economic status of the household and the way poverty is measured, the odds of seeking safe maternal and child care is much higher for educated women, compared to others. To that end, policy makers can improve access to education, which can both directly and indirectly have significant effects on safe maternal and child care.

3.7 References

Abel-Smith, B. and Leiserson, A. 1978. "Poverty, Development and Health Policy," Geneva, World Health Organization. http://whqlibdoc.who.int/php/WHO_PHP_69.pdf

Ahmed, M. 2006. "Intra-household Bargaining and Investment in Child Health," working paper Carleton College, Minnesota http://people.carleton.edu/~mahmed/emp.pdf

Amponsah, E.N., and Moses, I. S. 2009. "Expectant Mothers and the Demand for Insitutional Delivery: Do Household Income and Access to Health Information Matter? - Some Insight from Ghana," *European Journal of Social Sciences*, 8(3), 469-482.

Arokiasamy, P., and Pradhan, J. 2006. "Gender Bias Against Female Children in India: Regional Differences and their Implications for MDGs," [Unpublished] Presented at the *2006 Annual Meeting of the Population Association of America, Los Angeles, California*, March 30 – April 1, 2006. 22 p.

Becker, G.S. 1981. A Treatise on the Family. Harvard University Press, Cambridge.

Becker, S. 1996. "Couples and reproductive health: A review of couple studies," *Studies in Family Planning,* 27(6), 291-306.

Beegle, K., Frankenberg, E., Thomas, D. 2001. "Bargaining Power within Couples and Use of Prenatal and Delivery Care in Indonesia," *Studies in Family Planning,* 32(2), 130-146.

Berry, N. S., 2006. "Kaqchikel Midwifes, Home Births, and Emergency Obstetric Referral in Guatemala: Contextualizing the Choice to Stay at Home". *Social Science and Medicine*, 62, 1958-1969.

Bhatia, J. C., and Cleland, J. 1995. "Determinants of Maternal Care in a Region of South India," *Health Transition Review*, 5(2), 127-142.

Bloom, S. S., Wypij, D., and Gupta, M. 2001. "Dimensions of Women's Autonomy and the Influence on Maternal Health Care Utilization in a North Indian City," *Demography,* 38(1), 67-78.

Caldwell, J.C. 1986. "Routes to Low Mortality in Poor Countries," *Population and Development Review*, 12(2), 171-220.

Das Gupta, M., Zhenghua, J., Zhenming, X., Bohua, L., Chung, W., and Ok, B. 2003. "Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea," *Journal of Development Studies,* 40(2), 153-187.

Dharmalingam, A. and Morgan, S.P. 1996. "Women's Work, Autonomy and Birth Control: Evidence From Two South Indian Villages." *Population Studies,* 50(2), 187-201.

Dyson, T. and Moore, M. 1983. "On Kinship Structure, Female Autonomy and Demographic Behavior in India." *Population and Development Review*, 9(1), 35-60.

Emerson, E., Graham, H., and Hatton, C. 2006. "Household Income and Health Status of Children and Adolescents in Britain," *European Journal of Public Health*, 16(4), 354-60.

Gebramariam, W. 2007. "Do Women with Higher Autonomy Seek More Maternal and Child Health-Care? Evidence from Ethiopia and Eritrea," *MPIDR Working Paper,* 35.

Kabeer, N. 2005. "Gender Inequality and Women's Empowerment: a Critical Analysis of the Third Millennium Development Goal", *Gender and Development*, 13(1), 13-24.

Maitra, P. 2004. "Parental Bargaining, Health Inputs and Child Mortality in India," *Journal of Health Economics,* 23(2), 259-291.

Mason, K. O. 1996. "Women's Domestic Economic Power in Five Asian Counties," mimeo. Hawaii: East-West Center.

Mathiyazhagan, M. K. 2003. "Rural Household Characteristics and Health Expenditure in India; An analysis," *Journal of Social and Economic Development*, V(1), 69-89.

Matthew, Z., Ramasubban, R., Rishyasringa, R., and Stones, W. 2006. "Autonomy and Maternal Health-Seeking among Slum population of Mumbai. SSRC Working paper A03/06.

Morgan, S.P., Stash, S., Smith, H.L., and Mason, K.O. 2002. "Muslim and non-Muslim Differences in Female Autonomy and Fertility: Evidence from India, Malaysia, Thailand and the Philippines," *Population and Development Review,* 28, 515-537.

Murthi, M., A.-C. Guio, and Dreze, J. 1995. "Mortality, Fertility, and Gender Bias in India: A District-Level Analysis," *Population and Development Review,* 21(4), 745-782.

Warner, G. L., 1995. "Prenatal Care Demand and Birthweight Production of Black Mothers," *American Economic Review*, 85(2), 132-137.

World Health Organization (WHO). Maternal Mortality in 2000: Estimates Developed by WHO, UNICEF, and UNFPA. http://www.reliefweb.int/library/documents/2003/who-saf-22oct.pdf [PubMed]

WHO, 1998. "*Improved Access to Maternal Health Services,* WHO98.7. Geneva: WHO.

Table 3.1 Variables used in the analysis:

Variables	Number (%ge)
Total number of women interviewed	51555 (100%)
Delivery attended by an individual with formal medical training	27075 (52.5%)
Children who are completely vaccinated	24705 (47.9%)
Autonomy in movement (family visits)	31181 (60.4%)
Autonomy in finances	8719 (17.0%)
Autonomy in family purchases	30272 (58.7%)
Women with primary education and higher	30498 (59.1%)
Women who work	14921 (28.9%)
Households in rural areas	32072 (62.2%)
Households in the poorest wealth index quintile	9200 (17.8%)
Households in the second poorest wealth index quintile	9571 (18.6%)
Households in the middle wealth index quintile	10569 (20.5%)
Households in the rich wealth index quintile	11300 (21.9%)
Households in the richest wealth index quintile	10825 (20.9%)
Households living in the poorest standard of living index quintile	12224 (23.7%)
Households in the middle standard of living index quintile	16326 (40.8%)
Households living in the richest standard of living index quintile	18350 (35.5%)

Table 3.2: Proportional odds regression model: Dependent variable – Safe maternal and child healthcare seeking behavior in India for the year 2005-06

(A) Maternal Healthcare

	(1)	(2)	(3)
Determinants	Model with Autonomy only	Full Model Wealth Idx	Full Model Std Living Idx
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.32 (<0.001)	1.11 (<0.001)	1.15 (<0.001)
Autonomy in finance	0.84 (<0.001)	1.25 (<0.001)	1.31 (<0.001)
Autonomy in large purchases	0.95 (0.038)	1.0 (0.96)	0.97 (0.41)
Education		1.91 (<0.001)	3.2 (<0.001)
Working status		0.86 (<0.001)	0.72 (<0.001)
Rural location		0.62 (<0.001)	0.33 (<0.001)
Parity (surviving children)		0.74 (<0.001)	0.72 (<0.001)
Economic status		1.10 (<0.001)	1.12 (<0.001)
Households in southern states		4.7 (<0.001)	4.4 (<0.001)
Pseudo R-Square	0.003	0.29	0.24
N	51555	51555	46,900*

* Data on standard of living for 4,655 individuals were not available.

(B) Child Healthcare

	(1)	(2)	(3)
Determinants	Model with Autonomy only	Full Model Wealth Idx	Full Model Std Living
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.23 (<0.001)	1.11 (<0.001)	1.13 (<0.001)
Autonomy in Money	0.99 (0.745)	1.11 (<0.001)	1.14 (<0.001)
Autonomy in Purchases	0.99 (0.563)	0.99 (0.62)	0.97 (0.23)
Education		1.77 (<0.001)	2.5 (<0.001)
Working status		1.09 (<0.001)	0.97 (0.24)
Rural location		1.14 (<0.001)	0.73 (<0.001)
Parity (surviving children)		0.96 (<0.001)	0.93 (<0.001)
Economic status		1.05 (<0.001)	1.01 (0.001)
Households in southern states		1.7 (<0.001)	1.6 (<0.001)
Pseudo R-Square	0.002	0.09	0.07
N	51,555	51,555	46,900*

* Data on standard of living for 4,655 individuals were not available.

Table 3.3: Proportional odds regression model: Dependent variable – Safe maternal and child healthcare seeking behavior in India for the year 2005-06, under different wealth index quintiles

(A) Maternal Healthcare

	(1)	(2)	(3)	(4)	(5)
	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.10 (0.44)	1.00 (0.80)	1.00 (0.77)	1.29 (<0.001)	1.18 (0.05)
Autonomy in finance	1.16 (0.07)	1.24 (0.04)	1.34 (<0.001)	1.16 (0.08)	1.56 (0.011)
Autonomy in large purchases	0.89 (0.19)	0.99 (0.79)	0.99 (0.85)	0.94 (0.28)	1.27 (0.003)
Education	1.78 (<0.001)	1.66 (<0.001)	1.91 (<0.001)	2.5 (<0.001)	3.29 (<0.001)
Working status	0.88 (0.04)	0.81 (0.001)	0.80 (0.001)	0.88 (0.06)	1.05 (0.72)
Rural location	0.85 (0.10)	0.58 (<0.001)	0.60 (<0.001)	0.55 (<0.001)	0.55 (<0.001)
Parity (surviving children)	0.75 (<0.001)	0.76 (<0.001)	0.76 (<0.001)	0.70 (<0.001)	0.63 (<0.001)
Households in southern states	4.5 (<0.001)	4.24 (<0.001)	4.24 (<0.001)	5.3 (<0.001)	8.8 (<0.001)
Pseudo R-Square	0.10	0.11	0.12	0.14	0.14
N	9200	9571	10659	11300	10825

(B) Child Healthcare

	(1)	(2)	(3)	(4)	(5)
	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.11 (0.07)	1.09 (0.09)	1.09 (0.07)	1.12 (0.021)	1.13 (0.028)
Autonomy in finance	1.23 (0.001)	1.4 (<0.001)	1.03 (0.58)	0.87 (0.09)	0.96 (0.72)
Autonomy in large purchases	1.01 (0.77)	0.80 (<0.001)	0.99 (0.95)	1.03 (0.36)	1.09 (0.083)
Education	1.72 (<0.001)	1.76 (<0.001)	1.70 (<0.001)	1.89 (<0.001)	2.42 (<0.001)
Working status	1.10 (0.07)	0.94 (0.21)	1.11 (0.03)	1.31 (<0.001)	1.2 (0.076)
Rural location	1.21 (0.05)	1.09 (0.16)	1.19 (<0.001)	1.10 (0.009)	0.93 (0.13)
Parity (surviving children)	0.92 (<0.001)	0.97 (0.01)	0.96 (0.004)	0.97 (0.053)	1.01 (0.54)
Households in southern states	2.57 (<0.001)	2.2 (<0.001)	1.9 (<0.001)	1.4 (<0.001)	1.13 (0.03)
Pseudo R-Square	0.03	0.03	0.03	0.02	0.01
N	9200	9571	10659	11300	10825

Table 3.4: Proportional odds regression model: Dependent variable – Safe maternal and child healthcare seeking behavior in India for the year 2005-06, under different standard of living index quintiles

(A) Maternal Healthcare

	(1)	(2)	(3)
	Quintile 1	Quintile 2	Quintile 3
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.09 (0.13)	1.04 (0.34)	1.32 (<0.001)
Autonomy in Money	1.38 (<0.001)	1.29 (<0.001)	1.55 (<0.001)
Autonomy in Purchases	0.99 (0.95)	1.0 (0.943)	1.01 (0.73)
Education	1.98 (<0.001)	2.17 (<0.001)	3.27 (<0.001)
Working status	0.68 (<0.001)	0.73 (<0.001)	0.79 (<0.001)
Rural location	0.54 (<0.001)	0.39 (<0.001)	0.36 (<0.001)
Parity (surviving children)	0.76 (<0.001)	0.75 (<0.001)	0.67 (<0.001)
Households in southern states	5.3 (<0.001)	4.4 (<0.001)	4.9 (<0.001)
Pseudo R-Square	0.14	0.16	0.18
N	12,224	16,326	18,350

(B) Child Healthcare

	(1)	(2)	(3)
	Quintile 1	Quintile 2	Quintile 3
	Odds Ratio (p-values)	Odds Ratio (p-values)	Odds Ratio (p-values)
Autonomy in Movement	1.13 (0.013)	1.05 (0.277)	1.19 (<0.001)
Autonomy in Money	1.36 (<0.001)	1.22 (<0.001)	1.00 (0.95)
Autonomy in Purchases	0.91 (0.06)	0.99 (0.863)	1.02 (0.51)
Education	1.74 (<0.001)	1.91 (<0.001)	2.51 (<0.001)
Working status	0.89 (0.037)	0.98 (0.63)	1.14 (0.010)
Rural location	1.07 (0.23)	0.90 (0.006)	0.81 (<0.001)
Parity (surviving children)	0.93 (<0.001)	0.95 (<0.001)	0.93 (<0.001)
Households in southern states	2.8 (<0.001)	2.1 (<0.001)	1.3 (<0.001)
Pseudo R-Square	0.05	0.04	0.03
N	12,224	16,326	18,350

Chapter 4

Poverty, Income Inequality and Economic Growth in the U.S. Counties: A Spatial Analysis

4.1 Introduction

The relationship among poverty, inequality and economic growth is an ongoing issue in development economics, and the related evidence has been controversial. Most studies concur on the view that economic growth reduces absolute level of poverty depending on the economy's income distribution (Goudie and Ladd 1999). Many studies also provide evidence that income inequality is harmful for economic growth (Aghion et al. 1999, Alesina and Rodrick 1994, Deininger and Squire 1998, Persson and Tabellini 1994), while a few others document contrary evidence (Li and Zhou 1998, Partridge 1997). Barro (1999), on the other hand, provides evidence for a negative relationship between growth and income inequality in poor countries and a positive relationship in rich countries.

Reducing poverty and income inequality, and increasing economic growth are goals that governments at large pursue in some form or the other. Therefore, understanding the relationship among the three variables is both interesting and important to study. I seek to understand this relationship in the U.S. counties in this paper by investigating a) the effect of initial levels of inequality and poverty on subsequent economic growth, b) the association between economic growth and end of the period levels of poverty and income inequality. I also test whether the relationship above is different across rich and poor counties.

I examine both inequality and poverty for a few reasons. First, studying the overall dispersion of income as well as the lower end of the distribution gives a complete picture as to

how much the poor benefit from economic growth. Second, the theoretical links between poverty and economic growth crucially depend on a given level of income distribution.

Although there are several cross-country studies that analyze the relationship between economic growth, poverty and income-inequality, country-specific analysis has certain advantages over cross-country analysis. First, the method used to gather information on the relevant variables across countries is not as uniform or standardized compared to data collected within a country (Ravallion 2001). Second, laws and policies, which can significantly affect economic growth, poverty and inequality, are more likely vary across countries more than they do within a country. Third, definitions of variables are standardized within a country, while they differ widely across countries. For instance, while the official poverty measure is based on income levels throughout the United States, it is based on consumption expenditure in India.

I use the 1980 and 2000 U.S. decennial Census data to measure the initial and end of the period values, respectively. This twenty-year period serves to capture the consequences of long run growth in the most recent past for the U.S. counties. The advent of information technology and the resultant globalization in the late eighties and early nineties lead to unprecedented economic growth in the U.S. (Rupasingha et al. 2002) making the time frame informative and appropriate for this analysis. I use the change in per capita personal income between 1979 and 1999 to measure economic growth, the rationale for which is explained in section 4.4. I measure income inequality by constructing Gini index for all the counties in the U.S. (explained in detail in section 4.3), and use the percentage of poor people in each county to measure poverty.

Some studies at the U.S. county level have analyzed the determinants of economic growth with inequality amongst one of the several explanatory variables (Rupasingha et al. 2002). Similarly, studies that analyze the causes of poverty at the county level include economic

growth as one of the several explanatory variables (Rupasingha and Goetz 2007, Levernier et al. 2000). Bhatta (2001) studies the relationship among economic growth, poverty and income inequality in the U.S. Metropolitan Statistical Areas (MSA's). However, no study has analyzed the association between initial level of poverty and inequality on subsequent economic growth, and the relationship between economic growth and the end of the period poverty and income inequality at the U.S. county level. In addition, this study also investigates whether such a relationship differs among rich and poor counties, which no study has done before.

I also employ spatial analyses because location parameters can affect economic growth via the externalities associated with access to markets, flow of goods and ideas (Redding and Venables 2002). The results from this study show that in the U.S. counties, low levels of income inequality and poverty is negatively associated with subsequent economic growth. At the same time, high economic growth is negatively associated with end of the period poverty and inequality. Specifically, I find that counties with low levels of poverty and inequality in 1979 experienced higher economic growth between 1979 and 1999 compared to others. Similarly, counties with high economic growth between 1979 and 1999 had lower levels of poverty and inequality in 1999 compared to others. The results do not vary across rich and poor counties. These results suggest that there could be a virtuous cycle of poverty and inequality reduction on the one hand, and higher economic growth on the other, in the U.S. counties.

4.2 Relationship among Economic Growth, Poverty and Inequality

Inequality and Poverty on Economic Growth

The three main theories that relate income distribution and poverty to economic growth are a) savings rate argument b) credit market imperfection argument and c) political economy

argument. The Harrod Domar model, which is based on the savings rate theory, predicts that a higher income inequality leads to higher economic growth. According to this strand of literature, the savings rate in an economy is directly proportional to income level. Thus, a richer person saves on average a larger fraction of his or her income than a poorer person does. Consequently, concentrating income in the hands of a few rich people can maximize the aggregate savings rate in an economy compared to an equitable income distribution among the population. The implicit assumption in these models is that the economy is closed, and thus a higher savings rate automatically translates to higher investment (leading to higher economic growth). Fields (1989) presents evidence that inequality does not necessarily lead to higher economic growth in developing countries.

According to credit-market imperfection theory, inequality curtails the ability of people to accumulate human and physical capital. In general, people's income level and possession of assets largely determine their access to credit markets. Therefore, people in unequal societies typically face borrowing constraints that preclude them from investing in human and physical capital. Thus, stocks of physical and human capital in an unequal society are much lower compared to a more egalitarian society, which leads to lower per capita income and income growth rate in unequal societies. However, concentrating assets and income in the hands of a few people (perhaps rich) would facilitate economic growth if larger investments yield increasing returns than smaller investments (Barro 1999).

The credit-market imperfection theory can also fail to hold in a rich, yet unequal society (Goudie and Ladd 1999). In such an economy, where most of the people are relatively well-off, only a few will be credit constrained and therefore the theory's prediction could fail. Because higher inequality does not necessarily imply a larger fraction of poor people, the credit-market

imperfection argument can be better suited to explain the link between poverty and economic growth.

The political economy argument focuses on the distortionary interventions in an unequal society that leads to slower economic growth. Alesina and Rodrik (1994), Persson and Tabellini (1994) and a few others contend that majority of the voters may vote in favor of redistributive policies if their income is below the mean income. Such policies, primarily in the form of higher capital taxes, serve to reduce the incentive to invest and thus lower economic growth. However, this effect will be minimal in economies where there is a strong lobbying of rich-special interest groups. As Bhatta (2001) argues, egalitarian societies are more likely to implement redistributive policies and thus experience lower economic growth.

Alesina and Perotti (1996), Barro (1999), and a few others present a different version of the political economy argument that focuses on social unrest in unequal economies. Social discontent creates uncertain political and economic environments that reduces investment and consequently lowers economic growth. According to this theory, social unrest can hamper economic growth through two channels. First, in a highly unequal society, the poor may engage in disruptive activities such as crimes and riots that can destroy or damage physical and human capital. Second, people waste their time and effort in such disruptive activities, which they can otherwise use for productive purposes. As Bhatta (2001) notes, social unrest can also have some positive effects on growth of certain industries such as security, surveillance or legal services.

Alesina and Rodrik (1994) develop an endogenous growth model with distributive conflicts between labor and capital, and provide evidence that inequality reduces growth in democracies, while the effect disappears in non-democracies. Persson and Tabellini (1994) also

show that initial level of inequality negatively affects subsequent economic growth only in democracies.

Deininger and Squire (1998) use a similar model and show that asset inequality is negatively related to long-term growth. They use the data set from Deininger and Squire (1996) that many development economists consider as the most reliable, comprehensive and standardized data set on inequality. They present evidence that inequality reduces income growth for the poor but not for the rich. Li and Zhou (1998), employ a panel analysis covering 46 countries with the data averaged over a five-year period. They use a more expanded set of explanatory variables that also include urbanization ratio, population growth rate, and an indicator variable denoting whether a country is a democracy. They show that income inequality increases economic growth, and developed countries have a more equal income distribution compared to developing countries.

Barro (1999) divides his sample into developed and less-developed countries based on real GDP. He employs a panel regression that includes a broad range of countries to show that there is little overall relationship between income inequality and rates of growth and investment. However, he finds that income inequality tends to retard growth in poor countries and foster growth in rich countries.

Economic Growth on Inequality and Poverty

Kuznets (1955) in his seminal paper posits that income inequality follows an inverted U-shape in the process of economic growth. According to Kuznets, income inequality worsens at the early stages of economic development, before improving during the later stages. In the early stages of economic development, people migrate away from the egalitarian rural agricultural sector to the relatively unequal, yet richer industrial sector. These migrating workers experience

an increase in their per capita income, which worsens income inequality initially. Eventually, when sufficient number of rural workers move to the industrial sector, the decreasing size of the agricultural sector drives up the relative wages in that sector. Moreover, early workers who started out at the bottom of the industrial sector move up in relation to the richer workers in this sector. These two processes close the gap in income inequality. Hence, inequality first rises and eventually decreases as the economy becomes more developed, yielding an inverted U-shaped curved.

As Goudie and Ladd (1999) argue, the effect of economic growth on income inequality can go either way depending on country specific characteristics. For instance, the magnitude and effectiveness of transfers will largely determine the effects on inequality. An open economy, which is more likely to experience growth, would also experience improvement in income distribution if the exported goods are labor intensive. At the same time, when the exported goods are capital intensive, it may worsen the income distribution. Similarly, imports can affect income distribution depending on the extent of domestic competition and composition of imported goods. In effect, the policy environment in each country has a significant role in determining the link between economic growth and income inequality.

Early studies on the relationship between growth and poverty believed in the 'big-push" approach, which asserts that benefits of economic growth would automatically trickle down to the poorest section of the population. In recent years, most economists concur on the view that income distribution largely determines how much the poor benefit from economic growth (Goudie and Ladd 1999, Lipton and Ravallion 1995). However, McKay (1996) provides evidence that sustained growth in household income reduces the absolute poverty level (number

people living below a specified income or expenditure level) regardless of the level of initial income inequality.

In sum, holding population and income distribution constant, economic growth tends to increase per capita income and thus lower the absolute level of poverty. In addition, multiplier and accelerator effects (in income and investment) will also complement the increase in per capita income associated with economic growth. Higher tax revenues associated with higher household income contribute to better provision of social capital, which can improve the non-income dimension of poverty as well. On the other hand, the absolute level of poverty will not fall with economic growth, if the poor do not participate in the growth process. The theoretical links among poverty, inequality and economic growth can be complementing or offsetting each other. Thus, an empirical investigation on such a relationship can help understand how these variables interact.

U.S. Specific Studies

Bhatta (2001) explores how initial level of income inequality and poverty are related to subsequent economic growth in the Metropolitan Statistical Areas of the United States. While the initial level of poverty is negatively related to growth, he finds that the initial level of inequality is positively associated with growth. He also presents evidence that Metropolitan Statistical Area's with high growth experience low end of the period poverty and inequality. He measures inequality by constructing the Gini index for the MSA's in the U.S.

Rupasingha et al. (2002) provide evidence that social and institutional factors largely explain the differences in economic growth in U.S. counties. They find that higher level of income inequality is associated with lower growth rates in the US counties. Similarly, Ruapsingha and Goetz (2007), on explaining the structural determinants of poverty in U.S. metro

and non-metro areas, find that initial level of income inequality increases the end of the period poverty rate. The two studies mentioned above use the ratio of mean to median income to measure inequality, which has some limitations as explained in the next section.

Partridge and Rickman (2005) present evidence that economic policies aimed at stimulating job growth and increasing human capital reduce poverty even in high-poverty counties. Levernier et al. (2000) show that the population characteristics, employment growth, educational attainment, job-skill mismatch, migration and industrial restructuring affect poverty both in metropolitan and non-metropolitan counties, although affecting them in varying degrees.

4.3 Measuring Inequality

One of the important contributions of this study, I believe, is the construction of Gini index for all the U.S. counties for 1979 and 1999 to measure income inequality. Income or wealth inequality measures the distribution of income or wealth in an economy. Specifically, it measures whether only a few people hold a given amount of resources. While there are different measures of inequality, one of the most popular and oldest measures is the Gini Coefficient, which is constructed using the Lorenz Curve. A Lorenz curve sorts the observation in increasing order and plots the cumulative percentage of resources against the cumulative percentage of the population. Thus, a Lorenz curve measures the distribution of income in an economy, with the diagonal representing equal distribution (called the line of equality).

The Gini coefficient is two times the area enclosed between the line of equality and the Lorenz curve. It measures the fraction of differences in all possible income groups to total income, and the value lies between zero and one. With perfect equality, the Gini coefficient is zero and with perfect inequality (i.e. one person holding all the resources), the value is one. Gini

index satisfies basic principles of inequality measure such as anonymity, scale independence, population independence, transfer properties, and possesses many desirable properties of an inequality measure such as boundedness and proportionality. Thus, I calculate the Gini coefficient for all the U.S. counties to measure inequality, and only a few studies have constructed Gini index at the U.S. county-level, although for answering different questions (Nielson and Alderson 1997, Ngarambe et al. 1998).

Rupasingha and Goetz (2007), and Rupasingha et al. (2002) use the ratio of mean over median as a measure of inequality, which suffers from some limitations. First, inequality measured by mean over median does not satisfy an important principle of inequality called the transfer principle, which states that inequality should decrease when income is transferred from a rich person to a relatively poor person. Over time, if the income distribution of people above the mean income or below the median income or both changes, this inequality index will not change. Moreover, this measure is more likely to be affected by outliers than the Gini index. However, one apparent drawback of using Gini index is that it does not differentiate whether income is distributed from the rich to the middle class or from middle to the lower class, since it is only an aggregate measure, which is typically the case with many inequality measures.

Constructing the Index

The formula for calculating the Gini Index is:

$$1/2[\sum_{i=1}^{K-1} \sum_{j=i+1}^{K} |(1/K)P_i - (1/K)P_j|]$$

where i and j refer to the share of income the respective individuals possess. K refers to the number of components or income shares, P_i denotes the proportional share of the income that i holds. Since the U.S. decennial Census does not provide information on the upper limit of the

richest class interval of the income distribution, I impute the mean value of this bin by using Hansen's approach.

This value is calculated as follows:

$$h = [\log(A + B) - \log(A)] / [\log(L.L_{open}) - \log(L.L_{penultimate-open})]$$

where A is the number of people in the open ended category, B is the number of people in the category immediately preceding the open ended category, $L.L_{open}$ is the lower limit of the open-ended category and $L.L_{penultimate-open}$ is the lower limit of the category immediately preceding the open-ended category. After calculating h, the mean of the open-ended category can be obtained using the following formula:

$$M_{open} = L.L._{open} (h / h - 1)$$

where M_{open} is the mean income for the highest income group. The mean values for all the counties are higher than the lower limit of the open-ended category confirming that the measure is a reasonable approximation for the actual values.

4.4 Model, Data Source and Data Description

Model

To estimate the effects of inequality and poverty on economic growth, I follow Bhatta (2001), who models economic growth in U.S. MSA's using the augmented Solow model that explicitly accounts for human capital. The growth model is developed as follows:

$$Y_{it} = A_{it} H_{it}^{\alpha} N_{it}^{\beta} \text{ ----- (1)}$$

where Y_i denotes the total output in county *i* at time *t*. A_i is the productivity parameter in each county, H_i is the level of human capital in each county, and N_i is the population in county *i*.

α is the elasticity of output with respect to human capital and β is the elasticity of output with respect to population. Dividing equation (1) by the population, taking natural logarithm, and differentiating with respect to time yields the following per-capita version of equation (1):

$$\hat{y}_{it} = \hat{A}_{it} + \alpha\hat{H}_{it} + (\beta - 1)\hat{N}_{it} \text{ ----- (2)}$$

While various county-specific characteristics determine the productivity term *A*, I include three important factors, namely, initial levels of income inequality, poverty and real per capita income, besides other variables explained below. Thus, I estimate the following reduced form equation:

$$\hat{y}_{it} = \alpha_0 + \alpha_1 EV_i + \alpha_2 PV_i + \alpha_3 GV_i + \alpha_4 \hat{H}_{it} + \alpha_5 \hat{N}_{it} + SF_i + e_i \text{ ----- (3)}$$

where, $\hat{y}_{it}$, the growth rate of real per capita income (which includes money income and transfer payments) in county i over a twenty year period between 1979 and 1999, proxies for economic growth.[34] EV_i, the economic variables, include poverty, income inequality and real per capita income in 1979.[35] I use the percentage of population falling below the poverty line, fixed by the U.S. government to measure poverty. The U.S. Census uses people's pre-tax income to compute poverty status. This income excludes transfer payments, non-cash benefits such as food stamps and Medicaid, and capital gains or losses. Each person or family is assigned one of the 48 possible poverty thresholds based on the size of the family and age of the family members. In 1999, the threshold was fixed at US $ 8,501 and in 1979, it was US $ 3,912 (the figures are adjusted for inflation).[36] Income inequality is measured by constructing the Gini index, as

[34] For more details on the definition of per capita income please visit http://www.census.gov.
I use the BLS database for the CPI values to calculate the real per capita income. The BLS uses 1983 as the base year to measure the CPI changes. As a pert of robustness check, I also use the average growth rate of real per capita income over the twenty year period, and the results are very similar.
[35] Variables without time subscripts indicate that they do not measure the variation over time.
[36] For more details on the poverty-thresholds, please visit http://www.census.gov/hhes/www/poverty/poverty.html.

explained in section 4.3. Since I measure poverty and income inequality (the interest variables) at their initial values, I circumvent the issue of reverse causality.[37] The income level in 1979 captures what is called the "conditional convergence", which states that counties with a lower initial level of income grow faster and catch-up with rich counties over time.

PV_i, the variable accounting for population characteristics, includes percentage of white population in each county and percentage of manufacturing workers (to control for initial level of industrialization) in 1979. GV_i, measures the local government per capita general expenditure in each county in 1979.[38] $\hat{H}_{it}$, measures the rate of change in adult population with a bachelor's degree or higher, between 1979 and 1999, which proxies for the change in human capital. $\hat{N}_{it}$, measures the growth rate of population between 1979 and 1999. SF_i, assigns state dummies that captures the unobserved state-specific characteristics (such as Policies or laws), and e_i is a random error term. I employ spatial regression to estimate equation (3), which is explained in detail under "spatial model".

The model that I use has some limitations. First, following Glaeser et al. 1995 and Bhatta (2001), the model assumes that the economic units (i.e. counties) share a common pool of capital, and thus does not have a separate term for capital. Second, it does not include variables that capture the effect of development policies, which might affect growth, poverty, and inequality separately, or in any combination. However, I believe that including the state fixed effects could reduce this problem considerably. Third, I use income inequality, not asset inequality. While Deininger and Squire (1998) argue that asset inequality is a more robust

[37] Most studies that analyze the effects of income inequality on economic growth use the initial conditions to eliminate the problem of endogeneity (Alesina and Rodrik (1994), Persson and Tabellini (1994) and Barrro (1999), among many others.

[38] The reduced form that Bhatta (2001) estimates does not include the population and government variables. However, Rupasingha et al. (2002) have used these variables as controls to estimate county-level economic growth.

determinant of inequality than income inequality, Aghion et al. (1999) claim that both income and wealth inequality vary together in cross-sectional data. Data limitations preclude me from using asset inequality and compare it with income inequality measures. Finally, growth regressions that use the initial values of per capita income, poverty and income inequality to explain subsequent economic growth do not account for the factors that cause the variation in the initial levels of the respective variables.

Spatial Model

Several studies show that geographical location and location parameters significantly affect productivity, inequality and growth (Quah 1996, Redding and Venables 2002, Rupasingha et al. 2002, Rupasingha and Goetz 2007 among many others). The presence of spatial dependence can thus yield misleading results from employing OLS (LeSage 1999), which assumes that errors from different counties are independent. For instance, growth in a specific county can have spill over effects in the neighboring county, in which case the errors are dependent.[39]

Figure 4.1 shows the spatial pattern in economic growth rate between 1979 and 1999 for the U.S. counties.[40] Each color shade represents a specific range of economic growth. The figure reveals significant spatial dependence in economic growth for the U.S. counties. Similarly, figures 4.2 and 4.3 reveal considerable spatial dependence in poverty and income inequality for U.S. counties both in 1980 and 2000. Hence, I estimate equation (3) by three alternative spatial specification models, namely the Spatial Autoregressive (SAR) model, the Spatial Error Model (SEM) and the General Spatial model (SAC) that account for spatial dependence in various

[39] I interchangeably use 1979 and 1980 because, the U.S. decennial Census of 1980 includes data from both 1979 and 1980 (for certain counties). Following similar reasoning, I interchangeably use 1999 and 2000.
[40] In all the figures, blank spots (white spaces) in the map indicate that data were not available for those counties, and thus not included in the analysis.

forms. These models employ the Maximum Likelihood Estimation method for estimation, and I use Matlab to estimate the three spatial models.

The SAR model accounts for the spatial dependence in the dependent variable, the SEM incorporates spatial dependence in the error term, and the SAC model accounts for spatial dependence both in the dependent variable and the error term. The SAR model takes the following form:

$$y_i = \rho W y_i + X_i \beta + \varepsilon_i$$
$$\varepsilon_i \sim N(0, \sigma^2)$$

y is the dependent variable and X is a vector containing all the independent variables and ε is a normally distributed error term. ρ is called the autoregressive parameter (even though there is no time dimensions in the equation), and W is the weighting matrix that uses the location parameters to assign weights to counties based on how far they are from each other. W is thus a nxn matrix (for the n number of counties), normalized to have row-sums of unity. Thus, if county A is closer to B than C, B will have a higher weight than C under A's row. The main diagonal has zeros, implying that the distance from a county to itself is zero. The Matlab command that I use identifies the counties close to each other based on the latitude and longitude data for each county.[41]

The weighting matrix can also contain first-order contiguity relations (counties only sharing a common border), in which case, the rows in W would contain zeros if the counties are not next to each other, and one otherwise. I used both types of weighting matrices, and the results are very similar.

[41] Matlab uses the 'Delaunay' triangularization process, which identifies neighboring counties based on a set of lines connecting the points nearest to each other. The latitude and longitude values serve as the vertices of the triangles.

Spatial dependence could also arise if a shock to an omitted variable in the model affects the dependent variable, in which case SEM can be used. The SEM takes the following form:

$$y = X\beta + u$$
$$u = \delta Wu + \varepsilon$$
$$\varepsilon \sim N(0, \sigma^2)$$

where δ is the scalar spatial error coefficient. The weighting matrix W is the same for all the three models. If spatial dependence operates via both the dependent variable and the error term, in other words, if both δ and ρ are statistically significant, then one has to use the general spatial model (SAC) (LeSage, 1999).

The SAC, which incorporates spatial dependence in both the dependent variable and shocks to omitted variables in the model, takes the following form:

$$y = \rho Wy + X\beta + u$$
$$u = \delta Wu + \varepsilon$$
$$\varepsilon \sim N(0, \sigma^2)$$

Data Source and Summary statistics

The two primary sources of data in this analysis come from a) The Census of Population and Housing Summary Tape File 1 and 3 - U.S. Bureau of the Census 1980, 1990 and 2000, and b) the U.S. County and City Data Book 1984. I obtain the data for local government general expenditure from the latter source, and the rest from the Census Bureau.

I include all the states and counties in the United States except Alaska because data for most counties in Alaska are not strictly comparable across 1980 and 2000 U.S. Census.[42] Table 4.1 gives the summary statistics, which reveal huge variations in the variables. While some counties experienced a negative growth between 1979 and 1999, some counties experienced

[42] This was mainly because of newly formed counties after 1990.

more than 100% growth rate during the period. The standard deviation for this variable is very high revealing varied pattern of growth rates across the counties. San Miguel County in Colorado experienced the highest growth rate of 234% and Glasscock County in Texas experienced the worst growth of -53% over the twenty years. Income inequality in 1999 varies much more than inequality in 1979. McPherson County in Nebraska had the highest income disparity in 1979 while Holmes County in Mississippi had the highest income disparity in 1999.

The average percentage of population living under poverty decreases from 15.8% in 1979 to 14.1% in 1999 and the maximum value of this variable also decreases from 53% (in 1989) to 52.3% (in 1999). The standard deviation is quite high revealing considerable variation in the fraction of poor people across counties for both years. Tunica County in Mississippi had the highest percentage of poor people in 1979 (52.9%), and in 1999, 33% poor. Shannon County of South Dakota had the highest percentage of poor people living in 1999. All other variables also reveal considerable variation.

4.5 Regression Results

Table 4.2 shows the results from the three spatial regressions with the growth rate in real per capita income between 1979 and 1999 as the dependent variable. Note that in all the columns I include both inequality and poverty, whose correlation is 0.67. Such a high correlation between inequality and poverty could lead to multi-collinearity, which reduces the statistical significance of the variables in the model resulting in lower t-statistics. However, as Drennen and Saltzman 1998, and Johnston 1984 argue, if the coefficient estimates of the collinear variables turn out to

be statistically significant, evaluating the variables for their statistical significance is not a big concern. Therefore, I include both poverty and income inequality in the regressions.[43] Columns (1) through (3) show the results from Spatial Auto Regressive, Spatial Error and General Spatial models respectively. Since the coefficient estimate on both the autoregressive parameter, ρ (from SAR) and spatial error δ (from SEM) are statistically significant, inferring the results from SAC model (Column 3) is preferred over the other two models (LeSage 1999).

Column (3) shows that the coefficient estimate on initial level of per capita income is negative indicating conditional convergence. In other words, counties with a lower initial level of income grow faster and catch-up with rich counties over time. This result is indeed consistent with the theory that poor economies on average grow faster than rich ones, which is supported by many studies (Barro 1991, Sala-I-Martin 1996, Barro 1999). Although some studies criticize the convergence phenomenon in growth regressions based on the grounds of regression to mean effect, others contest the claim.[44]

A one-percent increase in initial level of income is associated with a 0.09 percentage point decrease in economic growth, which is statistically significant at the 1% level. The coefficient estimate on initial level of income inequality is also negative indicating that counties with higher income inequality than others in 1979 experienced slower growth between 1979 and 1999, which is consistent with the theories explained earlier. Column (3) shows that one-percentage point increase in income inequality is associated with 0.13 percentage point decrease in economic growth, which is high. To explain, if the Gini index increases from 37% to 38%, economic growth would fall from 4% to 3.87%. The coefficient estimate is statistically

[43] As a robustness check, I ran the regression with only one of them; the results were still similar to the ones obtained in Table 4.2.
[44] For a detailed discussion refer Quah (1993), and Bliss (1999).

significant at less than the 1% level. Studies on Unites States county-level growth also find a similar result (Rupasingha et al. 2002).

The coefficient estimate on initial level of poverty is also negative suggesting that counties with a higher initial level of poverty experienced slower economic growth between 1979 and 1999. Counties with one percentage point higher level of poverty in 1979 experienced 0.01 percentage points decrease in economic growth, compared to others, which is quite large in magnitude. Once again, the coefficient estimate is statistically significant at less than the 1% level. This result is consistent with most county level studies and Bhatta (2001), who finds that initial level of poverty negatively affects economic growth in the U.S. Metropolitan Statistical Areas. Growth rate of human capital and population (between 1979 and 1999), percentage of white population, percentage of people employed in manufacturing sector and per capita government expenditure in 1979 also positively affect economic growth. All the above coefficient estimates are statistically significant as well.

The coefficient estimate of the spatial autoregressive parameter ρ suggests that ten-percentage point increase in growth in a county, on average, increases economic growth by approximately 2.1 percentage point in the county nearest to it. Rupasingha et al. (2007) get almost the same value for the autoregressive parameter, which is also significant at the 1% level. The spatial error coefficient implies that a random shock in an omitted variable (or variables) in a county affects growth rate in counties close to it. Thus, the results provide evidence that economic growth exhibits spatial dependence in the U.S. counties. The model explains about 65% of variation in economic growth.

The results so far indicate that on average, counties with high levels of poverty and inequality grew at a slower rate than others. To test the effects of economic growth on end of the

period inequality and poverty, I follow Bruno et al. (1999) and Bhatta (2001) in regressing end of the period inequality and poverty on economic growth besides other variables.[45] Thus, I estimate the following equations:

$$Inequal_i = \beta_0 + \beta_1 EV_i + \beta_2 PV_i + \beta_3 GV_i + SF_i + e_i \quad \text{----- (4)}$$

$$Pov_i = \beta_0 + \beta_1 EV_i + \beta_2 PV_i + \beta_3 GV_i + SF_i + e_i \quad \text{----- (5)}$$

In equation (4), $Inequal_i$ measures income inequality in 1999 in county *i* and EV_i measures the economic variables that include the growth rate of income between 1979 and 1999, inequality and poverty in 1979. As in equation (3), PV_i measures the population characteristics, GV_i measures the per capita government expenditure, *SF* capture the unobserved state-specific characteristics and *e* is a random error term. In equation (5), Pov_i measures poverty in 1999 in county *i*, and the other variables are the same as in equation (4). I estimate equations (4) and (5) employing the three spatial models that I used to estimate equation (3).

Table 4.3 has end of the period income inequality and poverty as the dependent variables. While the first column shows the results for income inequality, column (2) shows the results for poverty from the spatial regression. Since both the spatial autoregressive parameter and the spatial error terms are statistically significant, I present the results only for the SAC model (for both inequality and poverty).

Column (1) shows that counties with higher growth rate of real per capita income between 1979 and 1999 experienced low levels of income inequality in 1999 compared to others. Ten-percentage point increase in the real growth rate of income is associated with 0.86 percentage point fall in income inequality and the coefficient estimate is statistically significant

[45] I use the other controls in equations (2) and (3) following Rupasingha and Goetz (2007), Partridge and Rickman (2005),Levernier et al. (2000).

at less than the 1% level. Column (1) also shows that counties with a higher level of income inequality and poverty in 1979 experienced higher income inequality in 1999, and the coefficient estimates are once again statistically significant.

Column (2) in Table 4.3 has percentage of people living in poverty in 1999 as the dependent variable. As with income inequality, counties with higher growth rate between 1979 and 1999 experienced lesser end of the period poverty, than others. Similarly, counties with higher initial levels of inequality and poverty had higher end of the period poverty rates than others. The models explain 78% of the variation in income inequality and 84% of the variation in poverty, respectively, which is very high.

The results indicate that in the US counties, initial levels of income inequality and poverty is negatively associated with subsequent economic growth (Table 4.2), and similarly, economic growth is negatively associated with end of the period income inequality and poverty. However, these results do not imply that counties that grow faster experience faster poverty and inequality reduction: regressing change in poverty on the growth rate of income would help identify this effect. However, such a growth regression will clearly suffer from reverse causality.

Therefore, in Table-4.5, I present some rudimentary, though imprecise, supporting evidence that counties that grew faster performed better than others in reducing end of the period poverty and inequality both in levels and growth rates. Column (1) presents the results for top 20% of counties that have the highest growth rate in per capita real income between 1979 and 1999, Column (2), the bottom 20%, and Column (3), average values for all counties. The results from this table clearly show that counties with highest growth rate in income have lower levels of poverty and income inequality by a large margin, compared to others. In addition, the rate of poverty reduction in these counties is three times higher compared to county average. Similarly,

between 1979 and 1999, while the average growth rate of income inequality across counties is 0.14, it is only 0.07 for the top 20% of the counties. On the other hand, the bottom 20% of the counties did worse than the others in reducing poverty and inequality, both in levels and growth rates. While Table-4.5 does not establish any causality, combining the results from this table with the results from Tables 4.2 to 4.4, indicate that implementing policies aimed at increasing economic growth, which are objectives by themselves, can potentially achieve an additional objective of reducing subsequent poverty and inequality.

Barro (1999) finds that the relationship between inequality and economic growth depends on whether a country is rich. I test this hypothesis for the U.S. counties by classifying rich counties as ones having per capita income of more than $17,500 and poor counties as ones with per capita income of less than $16,300 in 1999.[46] Since the counties are ordered based on their real per capita income, they are not necessarily close to each other, and thus, the spatial models, which employ the distance functions and contiguity matrix, are not appropriate to test this hypothesis. Columns (1) and (2) in Table 4.4 therefore gives the results of OLS regression for poor counties and rich counties, respectively. The standard errors are clustered by state to account for unobserved correlation of errors within a given state.

Results from Table 4.4 show that the coefficient estimate on initial level of real per capita income is negative for rich and poor counties. This result implies that irrespective of whether counties are rich or poor, the poorer ones catch up with the relatively richer ones at a similar rate. In rich and poor counties, initial level of inequality is associated with negative economic growth and the coefficient estimate is statistically significant only in rich counties. Similarly, the coefficient estimates on poverty, which is negatively associated with subsequent economic

[46] The cut-off's are selected to have roughly equal number of observation under each category (1250 in each). I once again use equation (3); however, estimate it separately for rich and poor counties. I also tried using different cut-offs, and the results are similar.

growth is statistically significant only in poor counties. On excluding initial levels of poverty and income inequality from rich and poor counties, respectively, I get the coefficient estimate on the included variable to be statistically significant at the 5% level maintaining the negative sign. The models explain 85% and 69% of variation in growth rates in poor and rich counties respectively, which is high. Thus, the overall results from the analysis confirm that initial level of inequality and poverty is negatively associated with subsequent economic growth. At the same time, economic growth is negatively associated with the end of the period income inequality and poverty, and the results do not differ much across rich and poor counties.[47]

4.6 Conclusion

In this study, I explore the relationship among poverty, income inequality and growth in U.S. counties. The results present evidence that initial levels of poverty and inequality are negatively associated with subsequent economic growth. At the same time, counties that experienced high economic growth had lower subsequent levels of poverty and inequality. An important offshoot of this exercise is the construction of the Gini inequality index for all the U.S. counties for the years 1979 and 1999.

The spatial analysis also confirms that counties exhibit strong spatial dependence and spatial (location) parameters are found to be significant determinants of economic growth, poverty and income inequality in the U.S. counties. The relationship among poverty, inequality and subsequent economic growth does not differ much among counties depending on their income levels, as suggested by some cross-country studies. The instructive result from this study is that policies aimed at promoting economic growth can yield an additional benefit of

[47] As a part of robustness check, I use other measures of inequality such as Atkinson and Theils entropy measure, the results do not change. I also include labor force participation in different sectors, such as agriculture, finance, I.T., and the results do not change much either.

decreasing subsequent levels of poverty and inequality. Thus, policies in pursuit of enhancing economic growth, and reducing inequality and poverty can be viewed as complementing each other.

4.7 References

Aghion, P., Caroli, E., and Garcia-Penasola, C. (1999) "Inequality and Economic Growth: The Perspective of the New Growth Theories", *Journal of Economic Literature*, 37. 1615-1660.

Alesina, A., & Perotti, D. (1996). "Income distribution, political instability, and investment". *European Economic Review*, *40*(6), 1203–1228.

Alesina, A., and Rodrik, D. (1994) "Distributive Politics and Economic Growth", *Quarterly Journal of Economics,* 109(2): 465-90.

Barro, R. J. (1991). "Economic growth in a cross section of countries". *Quarterly Journal of Economics*, *106*, 465–90.

Barro, R. J. (1999). "Inequality, growth and investment", *National Bureau of Economic Research working Paper* 7038.

Bhatta (2001). "Are Inequality and Poverty Harmful for Economic Growth: Evidence from the Metropolitan Areas of the United States", *Journal of Urban Affairs* 23, 335-359.

Bliss, C. (1999). "Galton's Fallacy and Economic Convergence", *Oxford Economic Papers,* 51, 4-14.

Bruno, Ravallion and Squire. 1999. "Equity and Growth in Developing Countries: Old and New Perspectives on the Policy Issues." *Policy Research Working Paper* 1563. World Bank, Washington, DC.

Deininger, K., and Squire, L. (1996) "A New Data Set Measuring Income Inequality", *World Bank Economic Review,* 10: 565-92.

Deininger, K., and Squire, L. (1998) "New Ways of Looking at Old Issues: Inequality and Growth", *Journal of Development Economics,* 10: 565-92.

Drennan, M. & Saltzman, S. (1998). "Regional and spatial econometric analysis". In W. Isard, I. J. Azis, M. P. Drennan, R. E. Miller, S. S. Saltzman, & E. Thorbecke (Eds.), *Methods of interregional and regional analysis*, 41–134. Brookfield: Ashgate.

Fields, G. 1989. "Changes in Poverty and Inequality in Developing Countries", *World Bank Research Observer*, 4, 167-186.

Glaeser, E.L., Scheinkman, J.A., and Shliefer, A. 1995. "Economic growth in a Cross-Section of Cities", *Journal of Monetary Economics*, 36, 117-143.

Goudie, A., and Ladd, G (1999) "Economic Growth, Poverty and Inequality", *Journal of International Development,* 11(2): 177-95.

Johnston, J. (1984). *Econometric Methods* (3rd ed.). New York: McGraw Hill.

Kuznets, S. (1955). "Economic growth and income inequality". *American Economic Review*, *45*, 1–28.

LeSage, J.P., 1999. Spatial Econometrics, available at http://www.rri.wvu.edu/WebBook/LeSage/spatial/spatial.html.

Levernier, W., Partridge, M. D., and Rickman, D, S. (2000). "The Causes of Regional Variation in US Poverty: A Cross-County Analaysis", *Journal of Regional Sciences,* 40(3), 473-497.

Li, H., and Zou, H. (1998). "Income inequality is not harmful for growth: Theory and evidence", *Review of Development Economics*, *2*, 318–334.

Lipton, M., and Ravallion, M. (1995). “Poverty and Policy”, Handbook of Development Economics, 3(41), 2551-2657.

McKay (1996). “Modeling determinants of poverty in Mauritania”, *World Development,* 24(6), 1015-1031.

Neilson, F and Alderson, A, S. (1997). “The Kuznets Curve and the Great U-Turn: Income Inequality in U.S. Counties, 1970 to 1990” *American Sociological Review*, 62(1) 12-33.

Ngarambe, O., Goetz, S, J., and Debertin, D.,L. (1998). “Regional Economic Growth and Income Distribution: County-Level Evidence from the U.S. South”, *Journal of Agricultural and Applied Economics*, 30(2), 325-337.

Partridge, M. D. (1997). “Is inequality harmful for growth?” Comment. *American Economic Review*, *87*(5), 1019–1032.

Partridge, M. D., and Rickman, D, S. (2005). “High-Poverty Nonmetropolitan Counties in America: Can Economic Development Help?”, *International Regional Science Review,* 28, 415-440.

Persson., T., and Tabellini, G. (1994). “Is Inequality Harmful for Growth?”, *American Economic Review,* 84(3): 600-621.

Quah, D. T. (1993). “Galton’s Fallacy and Tests of the Convergence Hypothesis”, *Scandinavian Journal of Economics,* 95(4), 427–443.

Quah, D. T. 1996. “Regional Convergence Clusters Across Europe”, *European Economic Review* 40, 951–958.

Ravallion, M. (2001). “Growth, Inequality and Poverty: Looking Beyond Averages”, *World Development,* 29(11), 1803-1815.

Redding, S. and A.J. Venables. 2000). "Economic Geography and International Inequality", *CEPR Discussion Paper*, 2568.

Rupasingha, A., Goetz, S, J., and Freshwater, D. (2002). "Social and Institutional Factors as Determinants of Economic Growth: Evidence from the United States Counties", *papers in Regional Sciences*. 81(2), 139-155.

Rupasingha, A., and Goetz, S, J. (2007). "Social and Political Forces as Determinants of Poverty: A Spatial Analysis", *The Journal of socio-Economics*. 36, 650-671.

Sala-I-Martin, X. (1996). "The classical approach to convergence analysis". *The Economic Journal*, *106*(437), 1019–1036.

U. S. Bureau of the Census. (1990). The Census of Population and Housing Summary Tape File 3A. Washington DC: U. S. Bureau of the Census.

U. S. Bureau of the Census. (2000). The Census of Population and Housing Summary Tape File 3A. Washington DC: U. S. Bureau of the Census.

U. S. Bureau of the Census. (2000). The County and City Data Book. Washington DC: US. Bureau of the Census.

U. S. Bureau of the Census. (2004). "Income and Poverty Since 1967" Washington DC: US. Bureau of the Census.

Table 4.1 Summary Statistics for 3079 counties*

Variable Name	Mean	Standard Deviation	Minimum	Maximum
Change in real per capita income between 1979-1999 (base year 1999)	0.22	0.24	-0.55	2.34
Real per capita income in 1979 (in $)	14,615	3,334	5,349	39,290
Real per capita income in 1999 (in $)	17,427	3,828	6,286	44,962
Gini coefficient 1979	0.369	0.025	0.265	0.665
Gini coefficient 1999	0.427	0.129	0.138	0.908
Percentage of population living in poverty in 1979	15.81	7.25	3.00	52.9
Percentage of population living in poverty in 1999	14.180	6.506	2.11	52.3
Growth rate of population with a bachelors degree or higher (1979-99)	0.973	1.118	-0.232	32.927
Growth rate of population (1979-99)	0.179	0.425	-0.452	12.036
Percentage of population working in the manufacturing sector in 1979	4.41	10.68	0	98.4
Per capita government expenditure	0.086	0.144	0	0.842
Percentage of white population in 1979	88.44	15.12	6.04	100.000

* Due to data unavailability for one or more variables on certain counties, I could not include all the counties in the U.S.

Table 4.2 Spatial Estimations: *Dependent Variable: Real Growth rate of Per Capita Personal Income between 1979 and 1999*

	(1)	(2)	(3)
Methods	SAR	SEM	SAC
Per capita income in 1979 (Convergence)	-0.01 (0.000)	-0.02 (0.000)	-0.09 (0.000)
Income inequality in 1979 (Gini Index)	-0.1 (0.000)	-0.2 (0.000)	-0.13 (0.000)
Poverty in 1979 (%ge of people living below poverty line)	-0.007 (0.000)	-0.007 (0.000)	-0.01 (0.000)
Constant	0.617 (0.939)	0.2 (0.000)	1.3 (0.001)
State Fixed Effects	Yes	Yes	Yes
Growth rate of people with a college degree or higher between 1979 and 1999	0.05 (0.000)	0.042 (0.000)	0.06 (0.000)
Growth rate of population between 1979 and 1999	0.077 (0.000)	0.08 (0.000)	0.069 (0.000)
Percentage of people employed in manufacturing sector in 1979	0.001 (0.000)	0.001 (0.000)	0.002 (0.000)
Percentage of white population in 1979	0.39 (0.000)	0.5 (0.000)	0.7 (0.000)
Per capita local government expenditure in 1979	0.58 (0.000)	0.5 (0.000)	0.61 (0.000)
Rho (Spatial autoregressive parameter)	0.193 (0.000)	-	0.21 (0.000)
Delta (Spatial Error Coefficient)	-	0.297 (0.000)	-0.011 (0.000)
Number of Observations	3079	3079	3079
R^2	0.63	0.64	0.65

p- values in parenthesis

Table 4.3 Spatial Estimations: *Dependent Variable: Gini Coefficient-1999 in column (1) and Percentage of Poor People in 1999, in column (2)*

	(1)	(2)
	SAC	SAC
	Gini 1999	**Poverty 1999**
Growth rate of real Per Capita Income from 1979 to 1999	-0.086 (0.000)	-0.053 (0.000)
Income inequality in 1979	0.750 (0.000)	0.142 (0.000)
Poverty in 1979 (%ge of people living below poverty line)	0.009 (0.000)	0.006 (0.000)
Constant	-0.073 (0.334)	0.038 (0.000)
State Fixed Effects	Yes	Yes
Percentage of people with a college degree or higher in 1979	-0.137 (0.004)	0.066 (0.001)
Percentage of people employed in manufacturing sector in 1979	0.0002 (0.058)	0.0001 (0.089)
Percentage of white population in 1979	-0.019 (0.397)	-0.163 (0.000)
Per capita local government expenditure in 1979	0.005 (0.821)	-0.151 (0.000)
Rho (Spatial autoregressive parameter)	0.28 (0.000)	0.35 (0.000)
Delta (Spatial Error Coefficient)	0.012 (0.000)	0.025 (0.000)
Number of Observations	3079	3079
R^2	0.78	0.84

p-values in parenthesis

Table 4.4 Performance of counties, based on their growth rate of Real Per Capita Income

	(1)	(2)	(3)
	Top 20% of the counties	Bottom 20% of the counties	County average
Poverty in 2000	12.2%	16.2%	14.2%
Inequality in 2000	0.39	0.45	0.43
Change in Poverty	-23.0%	6.5%	-7.0%
Change in Inequality	0.07	0.19	0.14

Table 4.5 OLS estimations: *Dependent Variable: Real Growth rate of Per Capita Income between 1979 and 1999 (standard errors clustered by state)*

	(1)	(3)
	OLS	OLS
	Rich counties*	Poor counties
Per capita income in 1979	-0.1 (0.000)	-0.1 (0.000)
Income inequality in 1979	-0.18 (0.01)	-0.002 (0.91)
Poverty in 1979 (%ge of people living below poverty line)	0.000 (0.88)	-0.01 (<0.001)
Constant	0.86 (<0.01)	0.9 (0.000)
State Fixed Effects	Yes	Yes
Growth rate of people with a bachelor's degree or higher between 1979 and 1999	0.01 (0.2)	0.04 (0.01)
Growth rate of population between 1979 and 1999	0.16 (<0.001)	0.05 (0.18)
Percentage of people employed in manufacturing sector in 1979	-0.0009 (0.038)	0.0005 (0.48)
Percentage of white population in 1979	0.42 (0.21)	0.51 (<0.001)
Per capita local government expenditure in 1979	0.48 (0.14)	0.55 (<0.001)
Number of Observations	1250	1250
R^2	0.69	0.85

p- values in parenthesis

* Poor counties are the ones with a real per capita personal income of less than $16,300 in 1999, and rich counties are the ones with a real per capita personal income of more than $17,500 in 1999.

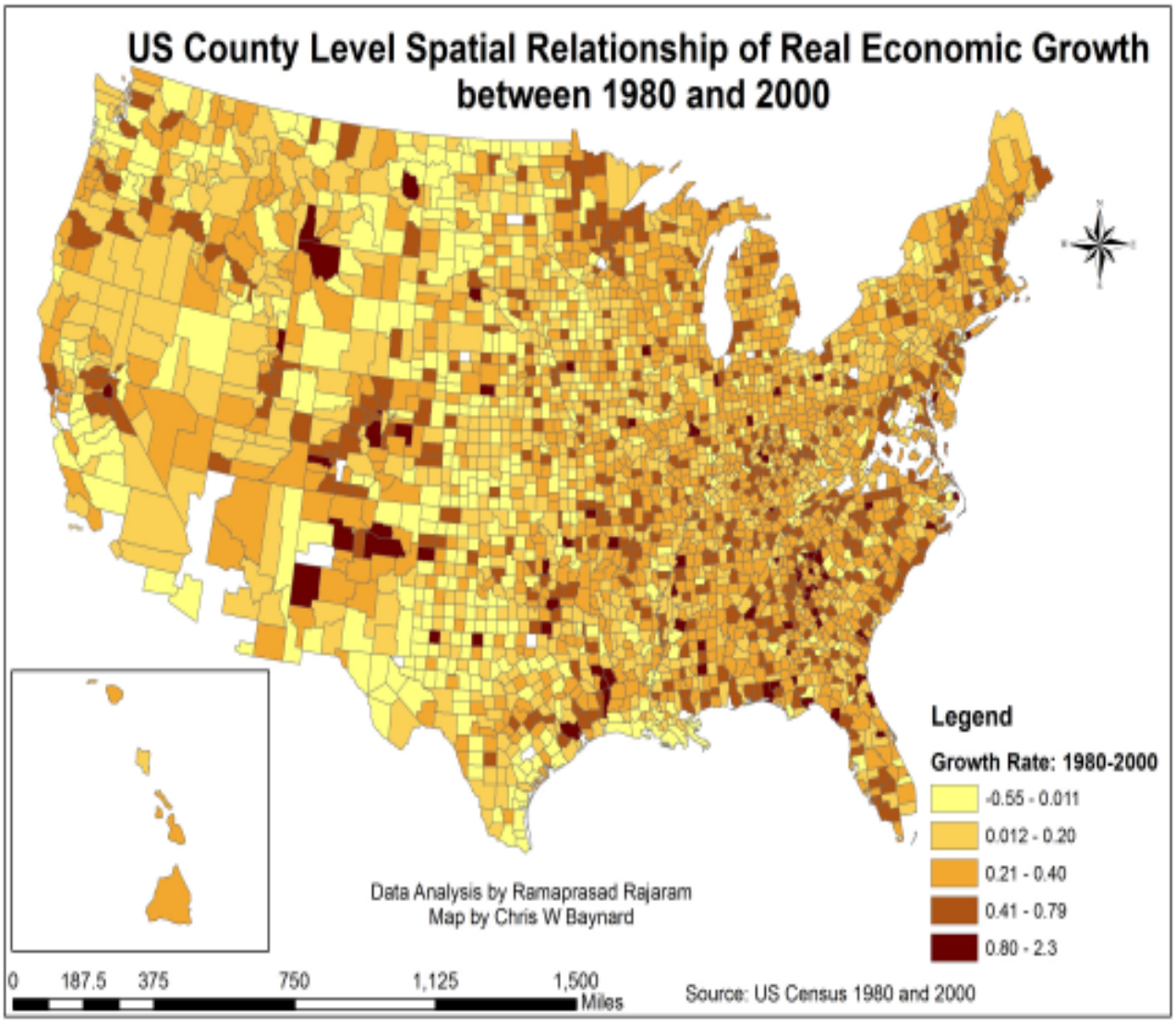
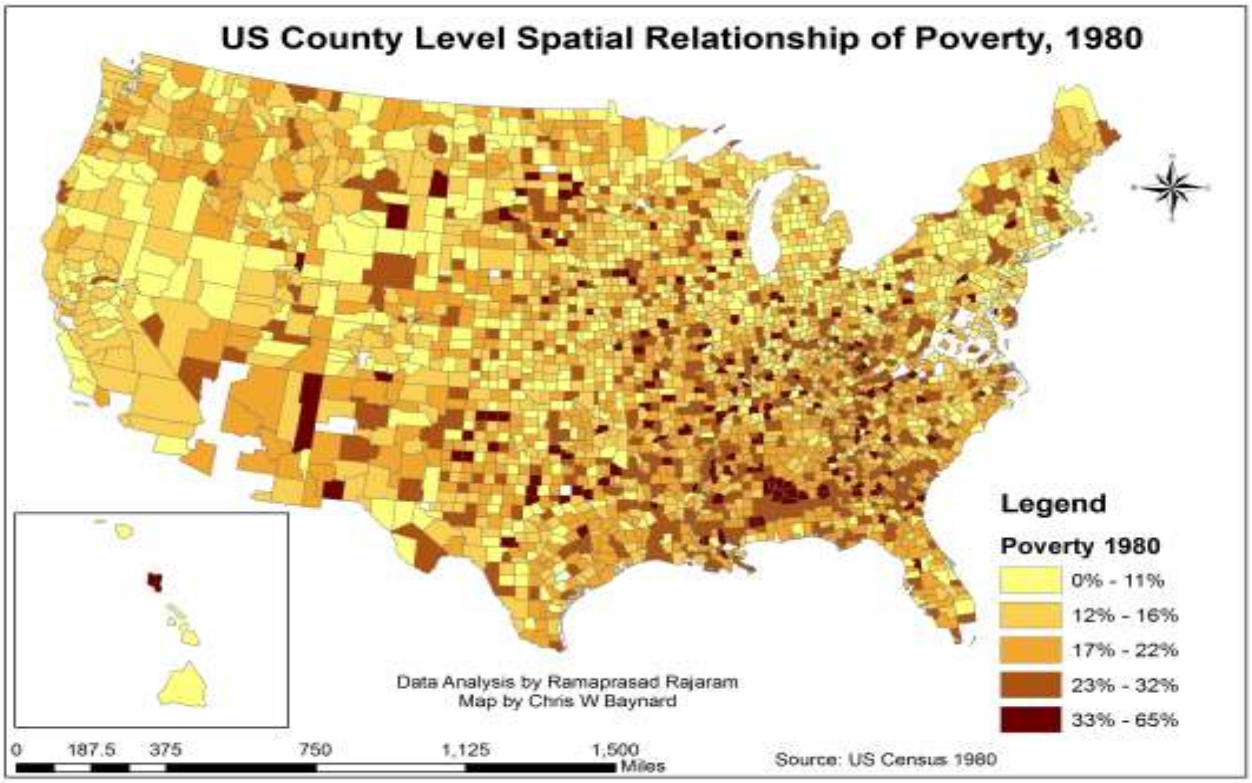


Figure 4.1: County-Level Spatial Relationship of Real Economic Growth between 1980 and 2000



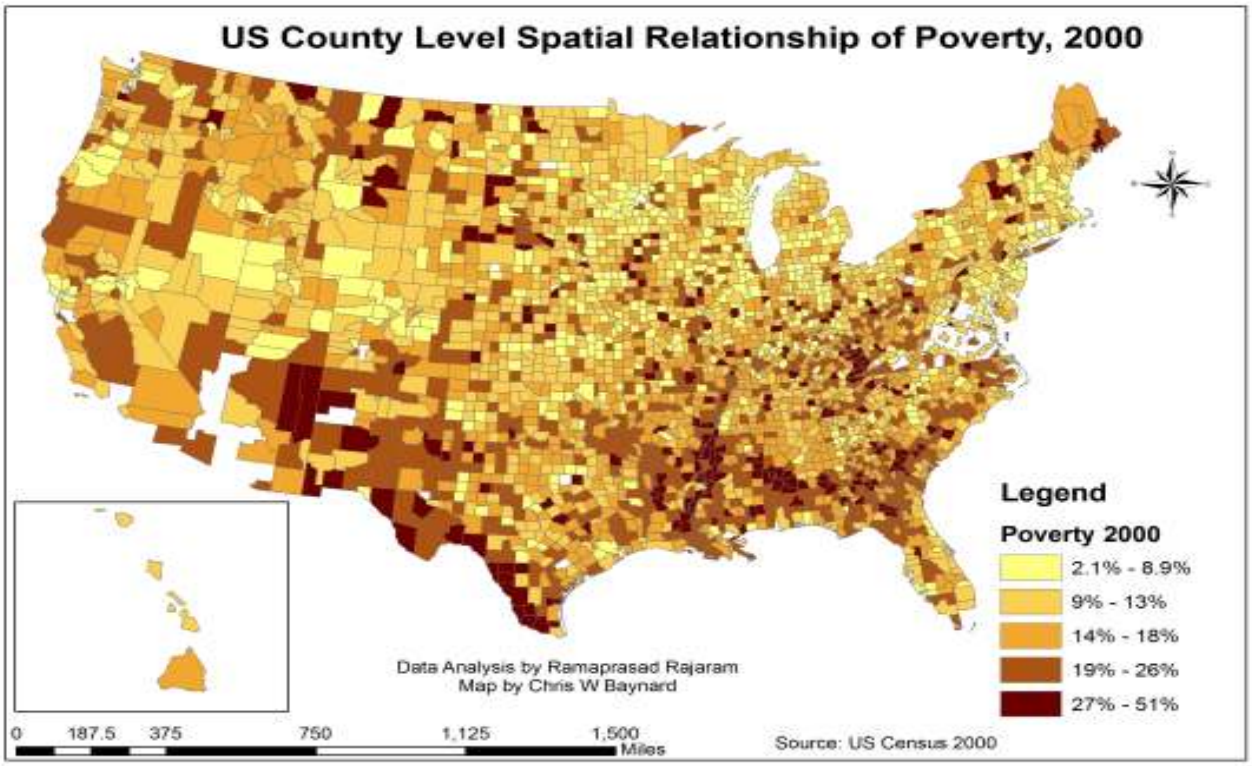
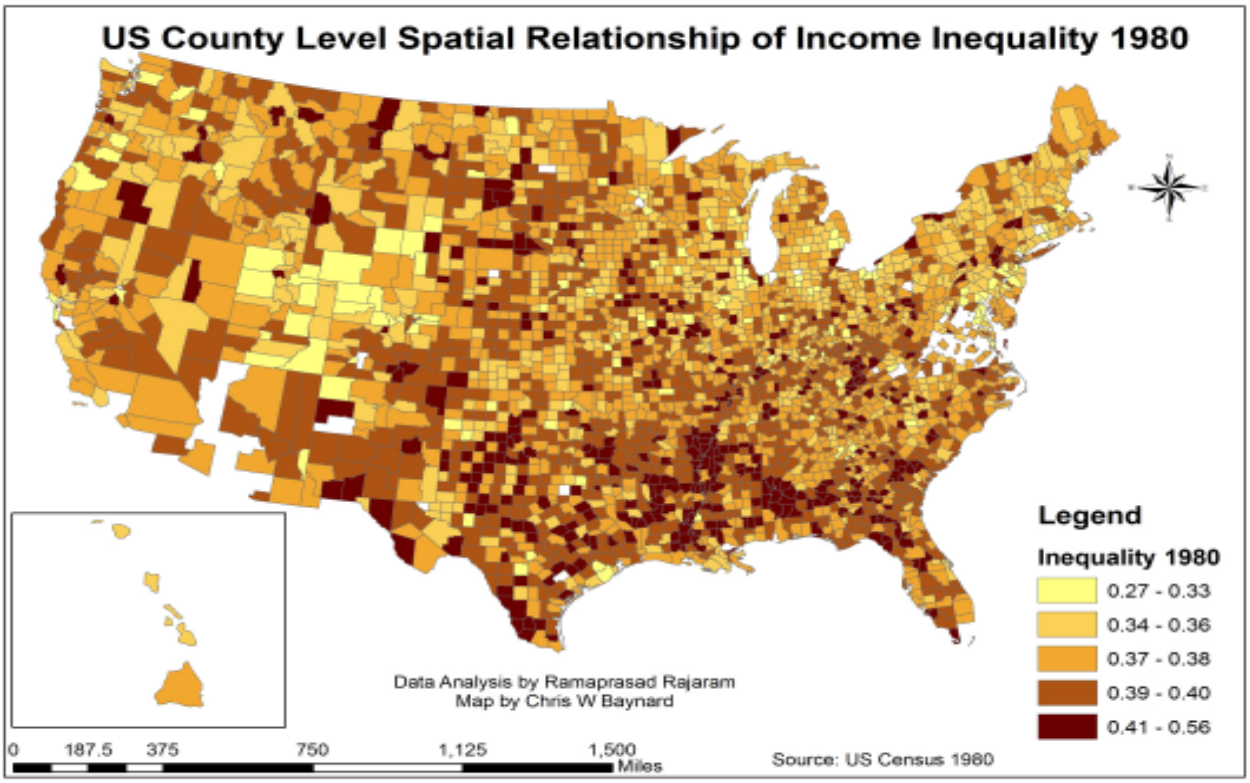


Figure 4.2: County-Level Spatial Dependence of Poverty in 1980 and 2000



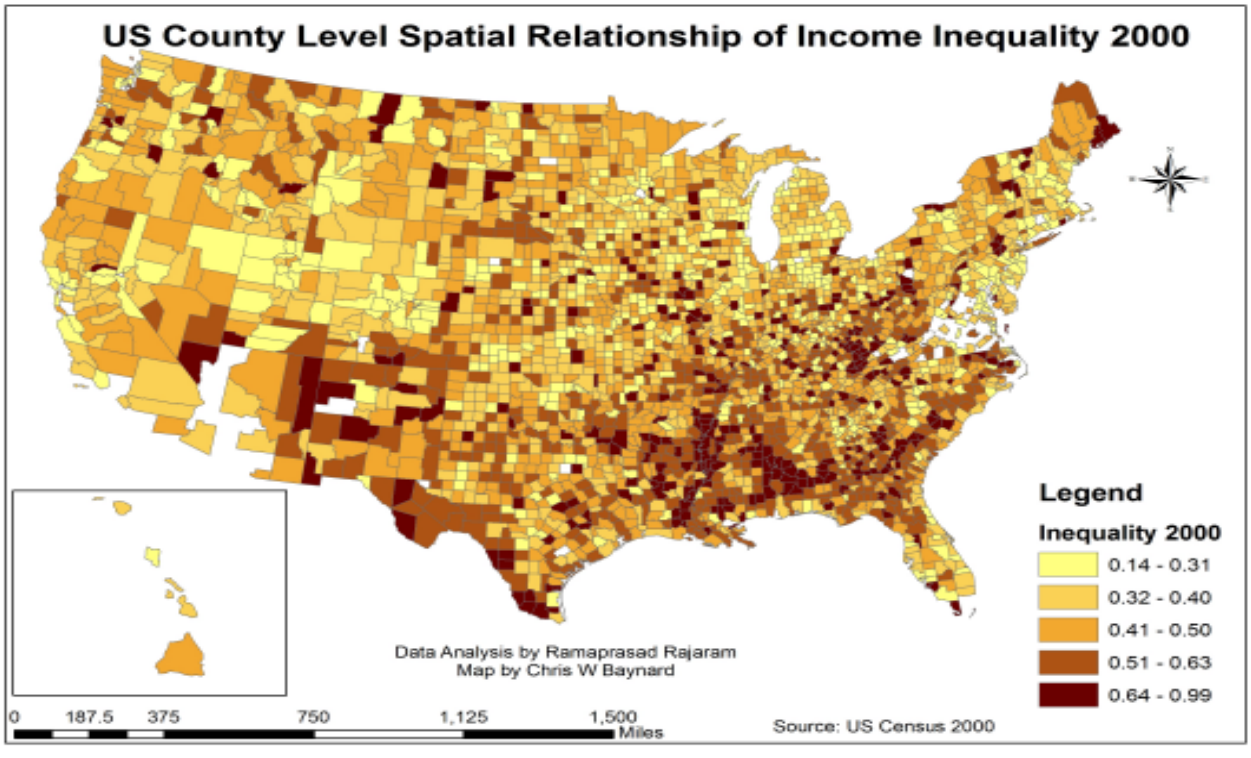


Figure 4.3: County-level Spatial Dependence of Income Inequality in 1980 and 2000

Chapter 5

Conclusion

This dissertation analyzes the relationship between poverty, gender, and healthcare in India, and the association among poverty, income inequality, and economic growth in the U.S. In the first essay, I use data from the National Family Health Survey of India, which no other study has used for any poverty study, and find very little evidence that female-headed households are significantly poorer than the male-headed counterparts. I use asset-based measures of poverty, such as the housing condition, wealth, and standard of living index, and argue why these measures are more appropriate for rural India, than the official measure based on consumption expenditure. While based on the standard of living index, female-headed households are marginally poorer than others, the other two poverty measures provide contrary evidence. Overall, the results do not support the claim that in India, female-headed households are particularly disadvantaged compared to others, and that they require immediate assistance. The second chapter focuses on the relationship between female autonomy, maternal and child healthcare utilization in India. I do not find any strong evidence that women with higher autonomy have higher odds of seeking safe maternal or child healthcare. When the households are categorized into different economic status, there is no systematic pattern of relationship between the different autonomy variables and healthcare seeking behavior. The results also show that female education is a strong determinant of safe maternal and child healthcare seeking behavior.

The third paper estimates the effects of initial (1979) level of poverty and income inequality on subsequent economic growth (between 1979 and 1999) for the U.S. counties using

the U.S. decennial Census data for the years 1980 and 2000. I use the Augmented Solow model of growth, employ spatial regression analysis, and find that counties with lower levels of income inequality and poverty in 1979 experienced higher economic growth between 1979 and 1999 than others. At the same time, counties that experienced higher economic growth between 1979 and 1999 had lower levels of poverty and income inequality in 1999, suggesting the existence of a positive association between poverty and income inequality reduction, and higher economic growth. The results also show that spatial parameters are significant determinants of growth, income inequality and poverty.