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Essays on Growth, Income Distribution and Poverty

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ABSTRACT OF THE DISSERTATION

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The essays compiled for this dissertation are based on the broad theme of economic liberalization and changes in growth, income distribution and poverty levels specifically in the context of India.

The first essay studies the impact of removal of tariffs on wages of agricultural labor. It uses a simple general-equilibrium model with a two-sector, two-factor economy characterized by urban unemployment. In the short run, when capital is sector-specific, it is shown that, contrary to the prediction of the Stolper-Samuelson theorem, free trade leads to a decline in the real agricultural wage rate.

In the second essay, a methodology is developed to rigorously decompose changes in poverty and quantify the relative contribution of growth versus redistribution. The decomposition analysis is carried in the context of the economic liberalization in India. The results indicate that in most of the states in India, a rapid rise in the income levels, especially since the economic reforms, led to a decline in poverty levels. Poverty declined not only as the head count ratio but

also as the poverty gap and squared poverty gap. In the post-reform period, changes in the distribution of income adversely affected the poor. However, growth was the most important factor contributing to a decline in poverty.

A decomposition of the spatial differences in poverty in India is undertaken in the third essay. The analysis reveals that most of the regional variation in poverty across the states is accounted for, largely by the variation in the states' average incomes rather than by differences in the states' distribution of income.

The fourth essay studies convergence in the distribution of income across the states in India over a period of four decades, from 1960s to 1990s. The analysis shows that though inequality declined in the rural sector, the distribution of income diverged across the states. In the urban sector, income distribution across the states converged though overall level of income inequality hardly changed.

These essays are self-contained; however, when combined together they address the several aspects of income inequality, its changes over time and its impact on poverty alleviation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1: INTRODUCTION

Globalization refers to the increasing economic integration and interdependence of countries. Globalization has shaped the progress of the world, through trade, travel, migration, and dissemination of knowledge. Among the many aspects of globalization, economic liberalization is an important feature. Liberalization refers to a process of removing government-imposed restrictions and advocating openness of trade and capital movements between countries.

In a short span of about 20 years, numerous countries throughout Latin America, Eastern Europe, Asia and Africa liberalized their economies. Most of these countries also experienced rapid economic growth during the same period. Between 1990 and 1999, countries in East Asia and the Pacific experienced the fastest growth of GDP per capita—more than 6% per year. Since the late 1970s, per capita income in China grew on an average of almost 8% per annum. In India growth rate more than doubled since the early 1980s—from 1.5% per capita to 3.7%. Most of the countries in Latin America and the Caribbean also experienced an increase of growth between the 1980 and 1995-97. For example, growth in Argentina increased by 8.4 percentage points, in Dominican Republic by 7.7 points and in Mexico 6.5 points. Virtually all countries in Sub-Saharan Africa recorded positive growth. A study by Dollar and Kraay (2004) shows that in the past 20 years growth rates for the non-globalizing developing world slowed down (to 0.8% in the 1980s and only 1.4% in the 1990s); while the growth rate for the post-1980 globalizers accelerated to 3.5% per capita in the 1980s and 5% in the 1990s.[1] Thus, there is a growing consensus that globalization led to overall economic growth in most of the countries.

[1] Dollar and Kraay (pp. F37, 2004) define globalizers as follows: 1. Top one-third developing countries in terms of growth in trade as a share of GDP at constant prices between 1975-79 and 1995-97, 2. Top one-third of tariff cutters between 1985-89 and 1995-97 and 3. Countries, which satisfy both the criteria. The sample for non-globalizers does not include the transition economies of Eastern Europe and the Former Soviet Union.

Economic liberalization promoted free trade among countries across the world. According to the World Development Indicators Report (2005), trade in developing countries grew by 11.3% in 2003; almost double the 6.3% growth in global trade, which is measured as the sum of imports and exports. Trade in East Asia and the Pacific increased from 45% of the GDP in 1990 to 77% in 2003. In 2003, China alone made up 5% of world trade and 20% of developing country trade. Trade also made up a significantly larger part of Latin America and the Caribbean's economy, which increased from 23% GDP in 1990 to 42% in 2003 (World Development Indicators Report 2005). Studies by Lundberg and Squire (1999) and Dollar and Kraay (2004) found a positive correlation between freer trade and faster growth.

Though liberal trade policies led to rapid economic growth among countries, there is a serious debate about the effect of these policies on the distribution of income between and within countries. Economic liberalization was followed by a remarkably rapid rise in income inequality prominently observed in populous countries like the United States, China, Brazil, Russia, and more recently and less pronouncedly, India. The difference between the wage rates of the skilled and unskilled labor, declined when the Asian tigers (Singapore, South Korea, Taiwan and Hong Kong) liberalized in the 1960s and early 1970s (Lindert and Williamson, 2001). Yet wage gaps generally widened when the six Latin American countries (Argentina, Chile, Colombia, Costa Rica, Mexico, and Uruguay) liberalized after the late 1970s (Wood 1994, 1997, 1998; Feenstra and Hanson 1997; Robbins 1997; Robbins and Gindling 1999; Hanson and Harrison 1999). In Bulgaria, the Czech Republic, Poland, Romania and Russia, real wages fell between 18 to 40% in the first year of transition; in some countries including Bulgaria and Poland, unemployment rose from negligible levels to 15% or more (World Development Report 1995). Thus, empirical evidence on the effect of free trade on income distribution in developing countries varies sharply between regions and over time. There is an ongoing debate in the literature concerning the distributive impact of the globalization policy reforms. In the last decade, there has been a revival of interest in studying the link between liberalization and changes in the distribution of income.

Worsening of the distribution of income is an important problem in its own right, as it implies social injustice and in extreme cases, it may lead to political unrest. However rising income inequality is a matter of serious concern, in another context, viz. with reference to poverty. The persistence of mass poverty across countries is a serious concern and the urgency of removing poverty has led to the UN General Assembly's adoption of Millennium Development Goals on poverty reduction. Poverty exists everywhere, but it is most cruel and debilitating in developing countries, where more than one person in five subsists on less than $1 per day. Since 1990, poverty in developing countries has fallen from 28% to 21%. Over the same time population grew 15% to 5 billion people, leaving 1.1 billion people in poverty (World Development Indicators Report, 2005). Thus despite rapid economic growth, many countries still face the problem of extreme poverty.

The essays compiled for this dissertation are based on the broad theme of changes in economic growth, income distribution and poverty levels in the era of economic liberalization. These essays are self-contained; however, when combined together they address the several aspects of income inequality, its changes over time and its impact on poverty alleviation. This introduction aims to elaborate the link between the different issues addressed by the essays.

1.1 Economic Liberalization and its Impact on Income Distribution

In traditional theory, the main rationale of trade liberalization is provided by the Stolper-Samuelson theorem (Stolper and Samuelson, 1941). The theorem shows that, under certain assumptions, free trade will reduce the wage spread in the country exporting labor-intensive goods. It predicts that free trade will increase incomes for the abundant factor and reduce incomes for the scarce factor in the country. Freer trade will be egalitarian for labor abundant countries, since trade will shift unskilled labor toward unskilled-labor-intensive production, raising unskilled wages relative to skilled wages and returns on capital. Thus, in a simple world where labor works the land, and where each country takes world commodity prices as given, any move towards the globalization of commodity markets through trade and commodity price convergence should favor incomes of the laboring poor.

Chapter 2, entitled, **"Effects of Trade Liberalization on Distribution of Factor Income"**, investigates circumstances under which free trade does not always favor the incomes of the poor. In particular, it studies the impact of removal of tariffs on wages of agricultural labor since in many developing countries landless agricultural workers make up a large proportion of the poor population. The chapter uses a simple general-equilibrium model with a two-sector, two-factor economy characterized by urban unemployment. The first model treats capital as a sector specific factor and studies the short run impact of the removal of tariffs on the incomes of the factors of production. The second model considers the long run equilibrium, when capital is perfectly mobile between sectors. The results in the short run are in contrast to the results of the Stolper-Samuelson theorem. Free trade leads to a decline in the agricultural wage rate and thus adversely affects the distribution of income.

1.2 Impact of Growth and Changes in Income Distribution on Poverty

Increase in income inequality may prevent growth in income levels to reach the lower sections of the society. If we define poverty as a lack of income, then economic growth is a potential strategy to reduce poverty. But growth in national income will only help the poor if they share in that growth. Progress on one front (growth) if accompanied by setbacks on the other (inequality) will lead to uncertain implications for the poor. In order to evaluate the success of liberalization policies, we wish to know whether shifts in income distribution helped or hurt the poor during a period of economic expansion. Has the rapid economic growth reached the poorest sections of the society? Or has the distribution of income changed in such a way that growth is accompanied by an increase in the poverty levels?

1.2.1 Changes in Poverty in India Over a Period of Time

These questions become particularly relevant in the case of India. With the world's second largest population -over one billion- India is home to over one third of the world's poor people. Number of poor in India is extremely high; around 250 million people in India are poor. In 1993-94, every third person in India still lived in conditions of absolute poverty (Datt, 1997) and India had 50% more poor people than the whole of Sub-Saharan Africa (World Bank, 2000). But, unlike other countries suffering from extreme poverty, India has recently been one of the fastest growing economies. This impressive growth performance is a recent phenomenon, mostly seen during the last two decades.

For nearly thirty years from 1950 to 1980, the Indian economy grew slowly, with growth of per capita GDP barely 1.5% per year. The economy picked up pace in the 1980s as the per capita growth averaged nearly 3.4% per annum. During the mid-80s a few policy changes were initiated. The exchange rate was made more flexible and controls on industries and investment were lowered. But the new pace of economic growth was unsustainable as it was accompanied by high fiscal and current account deficits. In 1990-91, the country faced a severe macroeconomic crisis. The current account deficit shot up to 3% of the GDP, there was a sharp increase in prices with inflation as high as 13% a year, foreign exchange reserves fell drastically and there was a sudden decline in India's international credit rating. Steps like devaluating the Rupee, borrowing from the IMF and maintaining fiscal austerity were taken to rescue the economy from the payments crisis. Besides implementing stabilizing policies, major structural changes were introduced in the economy. Liberalization policies were introduced. For example, many industries previously reserved for the public sector were opened to the private sector, exports were given a major impetus, tariffs and other restrictions on imports were eased and privatization of the banking and financial sectors was initiated. The reforms were successful in setting the economy on a high growth path. From 1993-94 to 1999-00, the average growth of real GDP was as high as 6.7% per year. However the rapid growth in the 1990s was also accompanied by significant changes in the distribution of income. There was a marked increase in income inequality in the years following the reforms. Thus, in the last decade, the Indian economy experienced major changes in the level and distribution of income.

To what extent did these changes affect the poor in India is an important policy issue. To answer the question it is important to be able to quantify the relative contribution of growth versus redistribution to changes in poverty measures. Chapter 3 entitled, **"Measuring the Impact of Growth and Income Distribution on Poverty"**, provides a methodology to rigorously decompose changes in poverty measures into growth and distributional effects. In order to separate the impact of a rise in the mean income level from the impact of changes in the distribution of income on poverty, a decomposition of poverty measures is undertaken. The decomposition is carried out by estimating two counterfactual poverty levels: i) what would have been the poverty level if only the mean income had changed without any changes in the distribution of income; and ii) what would have been the poverty level if the distribution of income had changed with no change in the mean income level.

The decomposition analysis is conducted to study changes in poverty levels in India over a period of two decades, namely, the pre-reform period from 1983-84 to 1993-94 and the post-reform period from 1993-94 to 1999-2000. It is seen that since the economic reforms, poverty declined not only as the head count ratio but also as the poverty gap and squared poverty gap. The results of the decomposition of the changes in poverty indicate that in most of the states a rapid rise in the income levels, led to the decline in poverty levels.

1.2.2 Spatial Differences in Poverty in India

In a vast country like India, there exist sharp economic disparities across regions. The mean income levels, the distributional patterns of income, and the poverty levels differ widely across states. Even within the states, differences are observed between the rural and urban sectors. Poverty is more prevalent in the rural areas where nearly 80% of Indian poor live. Chapter 4, entitled, **"Decomposing Spatial Differences in Poverty"**, analyses differences in poverty across the states in India. Out of a total of 26 states, poverty levels in 15 major states are studied. These 15 states account for nearly 97% of the total population of the country. Within each state, poverty is analyzed separately in the rural sector and in the urban sector.

This essay is the first attempt in the literature to decompose differences in poverty levels across states, within a country. It provides answers to the counterfactual questions: what would be the poverty level in the states if each state experiences the same national average income level? On the other hand, if the distribution of income also affects poverty, then what would be the poverty level in the states if each state has a similar relative distribution of income, say the national distribution of income? The analysis in chapter 4 concludes that, in India, differences in poverty levels across the states are largely due to differences in their mean income levels. Differences in the distribution of income are far less important in explaining the differences in poverty levels across states.

1.3 Convergence in the Distribution of Income Across India

Economic liberalization in India, led to a rapid rise in income levels as well as substantial decline in poverty levels (Planning Commission of India, 1999, Deaton & Dreze, 2002). However there was also a well-documented rise in income inequality within India (Milanovic, 1999, Cornia and Kiiski, 2001, Wade, 2001, Deaton & Dreze, 2002, Quah, 2002, Sala-i-Martin, 2002). Recent changes in the distribution of income have led to a renewal of interest about what has happened to interregional differences in income levels in India over a longer time horizon. Several studies have tested the hypothesis of convergence in income levels across the different states in India (Cashin and Sahay, 1996, Rao et. al., 1999, Ahluwalia, 2002, Sachs et. al., 2002). There is no consensus whether average income levels across states in India have converged over a period of time.

However, the focus of these studies has been on testing convergence in the per capita state domestic product, i.e. the average income levels of states. It is known that the neoclassical growth model implies convergence in the distribution of income (Barro and Sala-i- Martin, 1992). Per capita income is only the first moment of each country's income distribution. Benabou (1996) pointed out that, once augmented with idiosyncratic shocks most versions of the neoclassical growth models imply convergence in the entire distribution of income, not just in the mean income level. States, regions or countries with similar fundamentals and preferences should converge to the same distribution of income.

Hence chapter 5, entitled, **"Testing Convergence in Income Distribution"**, studies convergence in the entire distribution of income across different states in India. It uses the method of beta convergence, which involves regressing changes in income inequality over time on the initial inequality levels across different states. If it is seen that inequality falls in high initial inequality states and rises in low initial inequality states, then there is evidence for convergence among states towards a common distribution. The chapter analyses changes in income distribution in the rural and urban sectors of different states in India over a period of four decades, from 1960 to 1997. It finds evidence of convergence in income distribution across states in the urban sector but no such evidence in the rural sector.

During the last two decades, many countries adopted liberalization policies. There is a growing consensus that these policies led to rapid growth. However, there is a heated debate about the effect of these policies on income inequality and poverty levels. Against this background, this dissertation attempts to review changes in economic growth, income distribution and poverty alleviation in India.

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Chapter 2: EFFECTS OF TRADE LIBERALIZATION ON THE DISTRIBUTION OF FACTOR INCOME

2.1. Introduction

In the last two decades many countries around the world have opened up their economies to international trade. Promotion of free trade has been an important policy under globalization. International trade is certainly affecting more and more workers all over the world. Back in 1978, about one third of the world's labor force lived in countries weakly linked to international interactions because of protective barriers to trade and investment. But by the year 2000, fewer than 10% of the workers were living in such countries (World Development Report 1995). There is a growing consensus that globalization has led to overall economic growth in most of the countries. David Dollar and Aart Kraay (2004) examined the reforms and trade liberalizations of 16 countries in the 1980s and 1990s, and found positive correlation between freer trade and faster growth. However the impact of globalization on the distribution of income is not so clear. Though liberal trade policies may lead to rapid economic growth among countries, there is an ongoing debate about how these policies affect income inequality within countries.

Empirical evidence on globalization and inequality in developing countries varies significantly between regions and over a period of time. The difference in the wages earned by skilled and unskilled workers declined when the Asian tigers (Singapore, South Korea, Taiwan and Hong Kong) liberalized in the 1960s and early 1970s (Lindert and Williamson, 2001). Yet wage gaps generally widened when the six Latin American countries (Argentina, Chile, Colombia, Costa Rica, Mexico, and Uruguay) liberalized after the late 1970s (Wood 1994, 1997, 1998; Feenstra and Hanson 1997; Robbins 1997; Robbins and Gindling 1999; Hanson and Harrison 1999). In Bulgaria, the Czech Republic, Poland, Romania and Russia, real wages fell between 18 to 40% in the first year of transition; in some countries including Bulgaria and Poland, unemployment rose from negligible levels to 15% or more (World Development Report, 1995). Thus it is not very clear from cross-country studies what has been the impact of free trade on wage income.

The main rationale of trade liberalization is provided in trade theory by the Stolper-Samuelson theorem (Stolper and Samuelson, 1941). The theorem shows that, under certain assumptions, free trade reduces the wage spread in the country exporting labor-intensive goods. It predicts that free trade will increase incomes for the abundant factor and reduce incomes for the scarce factor. Freer trade will be egalitarian for labor abundant countries, since trade will shift unskilled labor towards unskilled-labor-intensive production, raising unskilled wages relative to skilled wages and returns on capital. Thus, in a simple world where labor works the land, and where each country takes world commodity prices as given, any move towards the globalization of commodity markets through trade and commodity price convergence should favor incomes of the laboring poor.

In this chapter we show theoretically that free trade does not always favor the incomes of the poor. We set up a simple general-equilibrium model to analyze the effects of free trade on the distribution of income. In particular, we study the impact of the removal of tariffs on wages of agricultural labor since in many developing countries, landless agricultural workers make up a large proportion of the poor population.

The Stolper-Samuelson theorem is based on certain restrictive assumptions. In particular, it assumes that both capital and labor are costlessly and instantaneously transferable between sectors. It predicts what is going to happen eventually, in the long run, after adequate time has passed for all the factors of production to move freely between sectors as incentives for reallocation arise. Many writers, since Stolper and Samuelson, have purposefully relaxed the traditional "long-run" assumption and analyzed the theorem in the short run (Jones 1971, Mayer 1974, Mussa 1974, Neary 1978). They argue that often, in the short run, capital is temporarily locked in and cannot be adjusted instantaneously. For example, capital in the form of stamping machines and assembly lines of the automobile manufacturers cannot be instantly and costlessly transported from the urban sector to the rural sector and converted into tractors and harvesters needed for production of food. We conduct our analysis in both the time frames, viz. the short run and the long run. In the short run, we assume capital to be a fixed factor. Capital, once installed in a given sector, cannot be transferred immediately to the other sector, even though the rate of return on capital may differ between the sectors. Since capital goods are sector-specific in the short run, any disturbance in the economy leads to a reallocation of the labor force between the sectors. In the long run, however, capital is flexible and moves freely between sectors, leading to a common rate of return earned in both the sectors. Mussa (1974) refers to such a characterization of capital as quasi-fixed capital i.e. when capital is specific to a given sector at a moment of time, but it is free to move between sectors in the long run.

We relax another restrictive assumption made in the Stolper-Samuelson theorem. The theorem assumes full employment of the factors of production. However, in reality, unemployment of the labor force is a common characteristic shared by countries across the world. About one third of the working population in the low-income economies is still not employed (World Development Report 1995). Hence it is important to find out the effect of trade policies on unemployment levels in the economy. We model unemployment by using the simple framework provided by Harris and Todaro (1970). Harris and Todaro presented a simple general equilibrium model in which equilibrium is characterized by persistent unemployment in the urban sector. Labor is assumed to migrate from rural to urban areas until the actual wage in the rural sector equals the expected wage in the urban sector. The urban employment rate measures the perceived probability of an urban job seeker's obtaining a job in industry. The minimum wage in the urban sector is exogenously fixed. The wage rate in the rural sector is perfectly flexible. The Harris-Todaro formulation makes a number of assumptions about the operation of the labor market: all jobs in the urban sector turn over every period; job-seekers are risk-neutral; urban unemployment yields no income and urban dweller and potential migrants have identical tastes (Neary 1981). The original Harris-Todaro model assumes capital to be sector specific. But the model has been extended to permit capital mobility. Corden and Findlay (1975) first introduced the mobile-capital version of the Harris-Todaro model to study the impact of a change in urban minimum wage on output and employment levels. Neary (1981) shows that equilibrium in the Harris-Todaro model together with intersectoral capital mobility becomes unstable if the urban sector is labor abundant relative to the rural sector.

In this chapter, we use the Harris-Todaro framework to study the impact of the removal of tariffs on wages and returns of capital, in the short run as well as in the long run. We also consider what happens to the share of wages in the total output and what happens to the unemployment levels. Our model gives ambiguous results about the impact of trade on the distribution of income. In the short run, when it is not possible for capital to instantly shift from one sector to the other, we find that removal of tariff barriers leads to a decline in the real agricultural wage rate and a decline in the total wage bill. Thus free trade does not necessarily raise the income of the poor. The effect of removal of tariff on the returns to capital varies across the sectors. Trade leads to an increase in the real rate of return on capital employed in the rural sector while it leads to a decrease in the real rate of return on capital employed in the urban sector. In the long run, however, we find that the prediction of the Stolper-Samuelson theorem remains valid, even after we relax the assumption of full employment of labor. A decrease in the relative price leads to a more than proportionate increase in wages and to a decrease in rent on capital. Thus, in the long run, trade proves to be beneficial to the poor. Free trade also helps the poor by lowering the unemployment level in the short run as well as the long run.

The chapter is organized as follows. The model is constructed and solved in Section 2. The case for the short run and the long run appear as subsections under Section 2. Section 3 contains a summary of the main results. The chapter is followed by an Appendix, which contains the details of the short run equilibrium model in the general case when income is measured in terms of a composite price index.

2.2. The Model

Consider a simple, two-commodity, two-factor economy, which is incompletely specialized and where perfect competition prevails. Let the economy produce food in the rural sector and manufactured good in the urban sector. Let production of food be relatively labor intensive while that of the manufactured good be relatively capital intensive. The economy is labor abundant and has a comparative advantage in producing food. The manufacturing sector is protected against imports by imposing tariffs. When the economy opens up for trade, tariff barriers are removed. This leads to a decline in the relative price of the manufactured good. According to the Stolper-Samuelson theorem, under certain assumptions, trade will necessarily raise the real return to labor and will lower the real return to capital.

2.2.1 Short Run Equilibrium:

Let the rural sector produce food F and the urban sector produce manufactured goods M. Both goods are produced using labor L and capital T. The aggregate endowments of the factors of production $\overline{L}$ and $\overline{T}$, are assumed to be fixed. In the short run, capital is considered to be perfectly immobile, so labor is the only variable factor of production. Capital, once installed in one sector, cannot be transferred instantaneously to the other sector, even though capital returns may differ between the sectors. The wage in the rural sector w_F is flexible, but the urban wage has a political or institutional lower bound $w_M \geq \overline{w}$; though we assume throughout that the urban wage is equal to the minimum wage ($w_M = \overline{w}$), otherwise the Harris-Todaro model reduces to the usual full employment model. The minimum wage in the urban sector is such that $\overline{w} \geq w_F$. Labor is assumed to migrate from rural to urban areas until the actual wage in the rural sector equals the expected wage in the urban sector (equation 6). Let P_F denote the price of food and P_M denote the price of the manufactured good. Typically the urban wage will be fixed in terms of the price of food. The following equations summarize above statements:

$$F = F\left(L_F, \overline{T}_F\right) \tag{1}$$

$$M = M\left(L_M, \overline{T}_M\right) \tag{2}$$

$$L_F + L_M = \overline{L} - U \tag{3}$$

$$w_F = F'_{LF}\left(L_F, \overline{T}_F\right) \tag{4}$$

$$\overline{w}_M = \frac{P_M}{P_F}.M'_{LM}\left(L_M, \overline{T}_M\right) \tag{5}$$

$$w_F = \left(\frac{L_M}{\overline{L} - L_F}\right).\overline{w}_M \tag{6}$$

$$r_F = F'_{TF}\left(L_F, \overline{T}_F\right) \tag{7}$$

$$r_M = \frac{P_M}{P_F}.M'_{TM}\left(L_M, \overline{T}_M\right) \tag{8}$$

In the above equations L_F and L_M represent labor, while $T_F = \overline{T}_F$ and $T_M = \overline{T}_M$ represent capital, employed in food and manufacturing sectors respectively. Let U represent unemployed labor, F'_{LF} and M'_{LM} represent the marginal productivity of labor in the food and manufacturing sectors. The usual assumptions about the production function hold, i.e. the first order derivatives are positive i.e. $F'_{LF} > 0, F'_{TF} > 0, M'_{LM} > 0, M'_{TM} > 0$ and the second order own derivatives are negative i.e. $\frac{\partial F'_{LF}}{\partial L_F} < 0$, $\frac{\partial M'_{LM}}{\partial L_M} < 0$, while the cross derivatives are positive, i.e. $\frac{\partial F'_{LF}}{\partial T_F} > 0$, $\frac{\partial F'_{TF}}{\partial L_F} > 0$ $\frac{\partial M'_{LM}}{\partial T_M} > 0$, $\frac{\partial M'_{TM}}{\partial L_M} > 0$. Let food prices serve as the numeraire $P_F = 1$. Following Jones (1965) we use '*' notation to denote the relative or percentage change in a variable or a parameter e.g. $w^*_F = \frac{dw_F}{w_F}$. The proportion of factor i used in industry j is denoted by λ_{ij} e.g. $\lambda_{LF} = \frac{L_F}{\overline{L}}$. Note that, in our model, due to the presence of unemployment $\lambda_{LM} + \lambda_{LF} \neq 1$, instead $\lambda_{LM} + \lambda_{LF} + \lambda_U = 1$. The comparative static equations derived from equations (3) to (8) are as follows:

$$\lambda_{LF}.L^*_F + \lambda_{LM}.L^*_M = -\lambda_U.U^* \quad (9)$$

$$w^*_F = \left(\frac{\partial F'_{LF}}{\partial L_F}.\frac{L_F}{F'_{LF}}\right).L^*_F \quad (10)$$

$$0 = \left(\frac{\partial M'_{LM}}{\partial L_M}.\frac{L_M}{M'_{LM}}\right).L^*_M + .P^*_M \quad (11)$$

$$-L_F.L^*_F + \left(\overline{L} - L_F\right)w^*_F = \left(\overline{L} - L_F\right)L^*_M \quad (12)$$

$$r^*_F = \left(\frac{\partial F'_{TF}}{\partial L_F} \cdot \frac{L_F}{F'_{TF}} \right) . L^*_F \quad (13)$$

$$r^*_M = \left(\frac{\partial M'_{TM}}{\partial L_M} \cdot \frac{L_M}{M'_{TM}} \right) . L^*_M + P^*_M \quad (14)$$

We have six equations and six unknowns ($L^*_F, L^*_M, U^*, w^*_F, r^*_F, r^*_M$). With the removal of tariffs, the price of the manufactured good, which is now imported, declines $P^*_M < 0$. The effect of the decline in price on the rural wage rate can be seen from the following equation:

$$w^*_F = \left[\frac{F''_{LF} . M'_{LM} . \left(\overline{L} - L_F \right)}{M''_{LM} . L_M . \left(w_F - F''_{LF} . \left(\overline{L} - L_F \right) \right)} \right] . P^*_M \quad (15)$$

where $\left(\frac{\partial F'_{LF}}{\partial L_F} = F''_{LF} \right) < 0, \left(\frac{\partial M'_{LM}}{\partial L_M} = M''_{LM} \right) < 0$, and $\left(\overline{L} - L_F \right) > 0$. Since the numerator and the denominator in the bracket of equation (15) are both negative, the rural wage rate declines $w^*_F < 0$ as relative price of the manufactured good declines $P^*_M < 0$. The intuition is that the reduction in price of the manufactured good leads to a decline in the output of the manufacturing sector. Since capital is fixed in the short run, a decline in output, in turn, leads to a shift of labor from the urban sector to the rural sector. The marginal productivity of labor employed in the rural sector decreases and hence there is a decline in the rural wage rate.

The total wage bill is the sum total of the earnings of the rural and urban workers and is given by $W = w_F . L_F + \overline{w}_M . L_M$. Using equation (6) we can show that the percentage change in the total wage bill is exactly equal to the percentage change in the rural wage rate, i.e. $W^* = w^*_F$. Given that, the price of the manufacturing sector declines, $P^*_M < 0$, and the rural wage rate declines, $w^*_F < 0$, the total wage bill too declines, $W^* < 0$. Thus, not only does the rural wage rate decline but the total wage bill declines as well i.e. with the removal of tariffs, the share of labor in the total output declines.

Proposition 1: In the short run, when capital is not mobile and urban unemployment is present, a decrease in the relative price of the manufactured good due to removal of tariffs leads to a decrease in the real wage in the rural sector. It also leads to a decline in the total wage bill.

Solving the comparative static equations (9) to (14), we find that labor employed in the rural sector increases $L^*_F > 0$ and labor employed in the urban sector decreases $L^*_M < 0$. Consequently, with the removal of tariffs, production of food increases $F^* > 0$, while production of manufactured good decreases $M^* < 0$. In the short run, since capital is sector specific, the returns on capital though equal to its marginal product, may not be the same in both the sectors. The change in the rate of return on capital employed in the rural sector is given by equation (13). Since $\frac{\partial F'_{TF}}{\partial L_F} > 0$, $\frac{L_F}{F'_{TF}} > 0$ and $L^*_F > 0$, it is clear that with a decline in the price of the manufacturing sector, $P^*_M < 0$ the return on capital in the rural sector increases, $r^*_F > 0$. Similarly, equation (14) gives the change in the rate of return on capital in the urban sector when price declines. Given that $\frac{\partial M'_{TM}}{\partial L_M} > 0$, $\frac{L_M}{M'_{TM}} > 0$, $L^*_M < 0$, we know that the rate of return on capital in the urban sector decreases i.e. $r^*_M < 0$. The returns on capital in the rural sector increase because the marginal productivity of the fixed capital increases, as labor employed in the rural sector increases. Labor employed in the urban sector decreases, as a result, the marginal productivity of the fixed capital decreases and hence the returns on capital in the urban sector decrease. Removal of tariffs works in the interest of capital owners in the unprotected sector while it acts against the interests of the owners of capital in the protected sector. Thus the model predicts that in the short run, the owners of capital in the export industry welcome liberalization of trade while the owners of capital in the domestic import substituting industry oppose it.

Proposition 2: In the short run, when capital is sector specific and urban unemployment is present, a decrease in the price of the manufactured good due to removal of tariffs leads to an increase in the rate of return on capital employed in the rural sector while it leads to a decrease in the rate of return on capital employed in the urban sector.

In Propositions 1 and 2, we get results in contrast to the Stolper-Samuelson theorem, which predicts that free trade increases income for the abundant factor, and reduces incomes for the scarce factor. The results are consistent with the "neoclassical ambiguity" observed in the specific factor model (Jones 1971). A commodity price change increases the return of the factor specific to the sector whose price has increased relative to all other prices, and reduces the return of the factor specific to the other sector, but the effect on the return of the mobile factor is indeterminate. In our model the inequality $r^*_F > \left(P^*_F = 0\right) > w^*_F > P^*_M > r^*_M$ holds true. The real returns on capital fixed in the rural sector and in the urban sector, change unambiguously irrespective of the price index used to measure real income. However, the effect of a decrease in the price of the manufactured good on the rural wage rate varies, depending on the good in terms of which income is measured. When income is measured in terms of food, the rural wage rate declines. On the other hand, when income is measured in terms of the manufactured good, the rural wage rate increases with a decrease in the price of the manufactured good. In the model, we assume that the income is measured in terms of food because we believe that the poor spend a majority of their income on purchasing food and a negligible amount on purchasing the manufactured good. Hence food is more relevant index to measure the income of the poor in the rural sector. When income is measured in terms of food, Proposition 1 states that a decrease in the relative price of the manufactured good due to removal of tariffs leads to a decrease in the real wage in the rural sector.

However, we derive below a boundary condition for Proposition 1 to hold true even when real wage is measured in terms of a basket of goods. Consider a more general case (details of which are discussed in the Appendix), when income is measured by using a price index comprising both the goods. Let the price index I be denoted by $I = \alpha.P_F + (1-\alpha).P_M$. The price index is a weighted average of the price of food and the price of the manufacturing good. Let α denote the weight attached to the price of food; α lies in the interval $(0 \leq \alpha \leq 1)$. The relative change in the rural wage rate when the price of the manufactured good declines is given by the equation:

$$w^*_F = \left[\frac{F''_{LF}.M'_{LM}.\left(\overline{L}-L_F\right)}{M''_{LM}.L_M.\left(F' - F''_{LF}.\left(\overline{L}-L_F\right)\right)}\right].P^*_M - \left[\frac{F'_{LF}.M''_{LM}.L_M + F''_{LF}.M'_{LM}.\left(\overline{L}-L_F\right)}{M''_{LM}.L_M.\left(F' - F''_{LF}.\left(\overline{L}-L_F\right)\right)}\right].I^* \qquad (16)$$

Equation (16) gives the change in the rural wage rate in the general case, when wages are measured in terms of a price index. Equation (15) gives the change in the rural wage rate when wages are measured in terms of food i.e. when $\alpha = 1$. Thus equation (15) is a special case of equation (16) and can be derived by substituting $\left(I^* = P^*_F = 0\right)$ in equation (16). In the general case, when income is measured in terms of a price index, the effect of a decline in the price of the manufactured good on the rural wage rate is not known since the sign of w^*_F in equation (16) cannot be determined. However, a sufficient condition for the rural wage rate to decline i.e. $w^*_F < 0$ is given by the inequality:

$$0<\left[\frac{F'_{LF}.M''_{LM}.L_M.P_M}{F''_{LF}.M'_{LM}.\left(\bar{L}-L_F\right)+F'_{LF}.M''_{LM}.L_M.P_M}\right]<\alpha\leq 1 \tag{17}$$

Inequality (17) gives the lower bound on the value of α which is the weight attached to the price of food in the price index. When the urban wage is fixed in terms of a price index, the rural wage declines with the removal of tariffs if α lies between the interval. Thus as long as the price index satisfies the inequality (17), a decline in the price of the manufactured good, leads to a decline in the rural wage rate and Proposition 1 holds true even when income is measured in terms of a basket of commodities.

With the change in relative prices, there is a reverse migration of the labor force from the urban sector to the rural sector. It is then not obvious what happens to the number of unemployed in the urban sector. Solving for U^* from the comparative static equations we find that

$$U^* = \frac{L_F}{U}.\left(\frac{w_F - \bar{w}_M}{\bar{w}_M}\right).L^*_F \tag{18}$$

Since $L^*_F > 0$ and $w_F < \bar{w}_M$, we know that $U^* < 0$. Hence, in the short run, free trade leads to a decline in the number of unemployed in the urban sector. Note that although the level of unemployment declines, the rate of urban unemployment rises. This is readily seen from equation (6), which gives the equilibrium condition in the Harris-Todaro model. Since the rural wage is equal to the expected wage in the urban sector and the urban wage rate is fixed, a decline in the rural wage rate implies a decline in the probability of finding a job in the urban sector, i.e. a decline in the urban employment rate and consequently an increase in the urban unemployment rate. However usually for welfare purposes, it is more important to find out what happens to the number of unemployed people than what happens to the rate of unemployment.

Proposition 3: In the short run, free trade leads to a decrease in the number of unemployed in the urban sector.

2.2.2 Long Run Equilibrium:

In the short run, each unit of capital is specific to the sector in which it is employed. Over a period of time, capital can move from one sector to another. Equilibrium is reestablished when enough capital has moved from the low to the high capital return sector such as to equate the value of the marginal product of capital in both the sectors. Hence in the long run, rental rate of capital is equal in the rural and the urban sectors $r_F = r_M = r$. In this section, we consider the effects of removal of tariff barriers on the distribution of income, when the economy is in long run equilibrium. We construct a model similar to the standard model described in Jones (1965). The economy is represented by the following equations:

$$F = F(L_F, T_F) \tag{19}$$

$$M = M(L_M, T_M) \tag{20}$$

$$L_F + L_M = \overline{L} - U \tag{21}$$

$$T_F + T_M = \overline{T} \tag{22}$$

$$w_F = F'_{LF} \tag{23}$$

$$\overline{w}_M = \frac{P_M}{P_F}.M'_{LM} \tag{24}$$

$$w_F = \left(\frac{L_M}{\overline{L} - L_F}\right).\overline{w}_M \tag{25}$$

$$r = F'_{TF} \tag{26}$$

$$r = \frac{P_M}{P_F}.M'_{TM} \tag{27}$$

Given factor endowments $\overline{L}, \overline{T}$, commodity prices P_M and $P_F = 1$ and urban wage rate $\overline{w_M}$, there are nine equations and nine unknowns $(F, M, T_F, T_M, L_F, L_M, U, w_F, r)$. So the system of equations can be solved to find all the unknowns.

Following Jones (1965), assume that technology in each sector exhibits constant returns to scale. Let a_{ij} denote the quantity of factor *i* required to produce a unit of commodity *j*, e.g. $a_{LF} = \frac{L_F}{F}$. With the assumption of constant returns to scale, total factor demand is given by the product of the "*a*" and the output level. Under perfect competition, with both goods being produced, the unit costs must reflect market prices. Hence, in equilibrium, we get the following output and price equations:

$$a_{LM}.M + a_{LF}.F = \overline{L} - U \tag{28}$$

$$a_{TM}.M + a_{TF}.F = T \tag{29}$$

$$a_{LM}.\overline{w_M} + a_{TM}.r = P_M \tag{30}$$

$$a_{LF}.w_F + a_{TF}.r = 1 \tag{31}$$

Let θ_{ij} be the *i*th factor's share in the *j*th industry, e.g. $\theta_{TM} = \frac{a_{TM}.r}{P_M}$. Then by definition, $\theta_{LM} + \theta_{TM} = 1$ and $\theta_{LF} + \theta_{TF} = 1$. Let σ_j be the elasticity of factor substitution in industry *j*. Let the elasticity of substitution in the rural sector be greater than the elasticity of substitution in the urban sector $(\sigma_F > \sigma_M)$. Following statements are true by definition:

$$\sigma_M = \frac{a^*_{TM} - a^*_{LM}}{-r^*} \tag{32}$$

$$\sigma_F = \frac{a^*_{TF} - a^*_{LF}}{w^*_F - r^*} \tag{33}$$

The comparative static equations of the equilibrium equations from (28) to (31) are given below:

$$\lambda_{LM}.M^* + \lambda_{LF}.F^* = -\lambda_U.U^* - \lambda_{LM}.a^*_{LM} - \lambda_{LF}.a^*_{LF} \tag{34}$$

$$\lambda_{TM}.M^* + \lambda_{TF}.F^* = -\lambda_{TM}.a^*_{TM} - \lambda_{TF}.a^*_{TF} \tag{35}$$

$$\theta_{TM}.r^* = P^* \tag{36}$$

$$\theta_{LF}.w^*_F + \theta_{TF}.r^* = 0 \tag{37}$$

Solving equations (36) and (37) we find that

$$w^*_F = -\left(\frac{\theta_{TF}}{\theta_{LF}.\theta_{TM}}\right).P^*_M \tag{38}$$

$$r^* = \left(\frac{1}{\theta_{TM}}\right).P^*_M \tag{39}$$

As barriers to trade are removed, price of the importable good declines $P^*_M < 0$. As seen from equation (38), the wage rate in the rural sector increases. The total wage bill also increases. Thus, contrary to the short run, trade not only leads to an increase in the agricultural wage rate but it also leads to an increase in the combined share of total output received by labor in the rural and the urban sector.

Proposition 4: In the long run, when capital is assumed to be perfectly mobile and urban unemployment exits, a decline in the price of the manufactured good due to the removal of tariff leads to an increase in the real wage in the rural sector. It also leads to an increase in the total wage bill of the rural and urban workers.

From equation (39) it is seen that a decline in the price of the manufactured good $P^*_M < 0$, leads to a decline in the returns to capital in both the sectors.

Proposition 5: In the long run, when capital is assumed to be perfectly mobile and urban unemployment exits, removal of tariff leads to a decline in the real return on capital.

It is interesting to know that even when we relax the assumption of full employment of labor, the prediction of the Stolper-Samuelson theorem that free trade increases incomes for the abundant factor and reduces incomes for the scarce factor, remains valid as long as capital is mobile. The magnification effect proved by Jones (1965) continues to hold true i.e. $w^*_F > \left(P^*_F = 0\right) > P^*_M > r^*$. A relative rise in the price of the manufactured good causes the rural wage rate to rise by more than either commodity price and the return to capital to decline by more than either commodity price. Thus, in the long run, the real returns to the factors change unambiguously irrespective of the commodity in terms of which income is measured.

To know what happens to the level of urban unemployment in the long run, we need to first find out what happens to the output levels. Solving equations (34) and (35) we find that under the sufficient condition $(\lambda_{LF} - \lambda_{TF}) > 0$ i.e. per unit requirement of labor is greater than per unit requirement of capital in the agricultural sector, trade leads to a rise in the agricultural output $F^* > 0$ and a decline in the manufactured output $M^* < 0$. In the traditional model this condition is automatically satisfied by the assumption that agricultural sector employs labor more intensely than the manufacturing sector. However, with the introduction of unemployment in our model, the assumption about factor intensity gives the condition $(\lambda_{LF} - \lambda_{TF}.(1-\lambda_U)) > 0$. Hence we need to impose $(\lambda_{LF} - \lambda_{TF}) > 0$ as a sufficient condition. Since $\left(a^*_{LM} = \theta_{TM}.\sigma_M.r^*\right) < 0$, labor employed in the manufacturing sector declines $\left(L^*_M = M^* + a^*_{LM}\right) < 0$. We can derive the expression giving the percentage change in the level of urban unemployment as follows:

$$U^* = -w^*_F.\left(\frac{L_M + U}{U}\right) + L^*_M \tag{40}$$

Since $w^*_F > 0, L^*_M < 0$ we know that the level of unemployment decreases $U^* < 0$. Note that the rate of urban unemployment also decreases in the long run. Since the urban wage rate is fixed, an increase in the rural wage rate implies an increase in the probability of finding a job in the urban sector, i.e. an increase in the rate of urban employment and a decline in the rate of urban unemployment. Thus, in the long run, the level as well as the rate of unemployment in the urban sector declines.

***Proposition 6*:** In the long run, international trade will lead to a decrease in the number of urban unemployed.

2.3. Conclusion

We conclude that free trade can have differential impact on the distribution of income. In particular, we show that the impact of the removal of tariffs on the wages of agricultural workers, which make up a large proportion of the poor population, varies over the short run and the long run.

Removal of protection to the manufacturing sector in the form of tariffs leads to a decrease in the price of the manufactured good and an increase in the price of food. As a result production of manufactured good declines and that of agricultural good increases. Labor moves from the urban sector to the rural sector. In the short run, capital is temporarily locked in and cannot be adjusted instantaneously. With fixed capital and more labor, the marginal productivity of labor in the agricultural sector declines and hence rural wages decline. Total wage bill declines as well. Thus free trade adversely affects the income of the poor. Our results stand in contrast to those found in the Stolper-Samuelson theorem. The theorem predicts that free trade will increase incomes for the abundant factor, labor, and reduce incomes for the scarce factor, capital. We show that in the short run, free trade may in fact reduce the income earned by the agricultural workers. The effect of removal of tariff on the return to capital varies across the sectors. Free trade leads to an increase in the real rate of return on capital employed in the rural sector while it leads to a decline in the rate of return on capital employed in the urban sector.

In the long run, however, when capital is able to freely shift from one sector to the other sector, we find that the prediction of the Stolper-Samuelson theorem remains valid, even after relaxing the assumption of full employment of labor. A decrease in the relative price leads to a more than proportionate increase in wages and to a decrease in rent on capital. Thus in the long run, trade helps reduce income inequality among factors of production.

Though liberalizing trade has varying impact on the distribution of income, we show that free trade proves to be beneficial to the poor in an important respect. It leads to a decline in the unemployment levels in the short run as well as the long run.

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APPENDIX TO CHAPTER 2

In the short run, when capital is sector specific, the effect of a change in the commodity price on the rural wage rate is ambiguous. A decline in the price of the manufactured good, leads to a decline in the rural wage if wage is measured in terms of food and leads to an increase in the rural wage, if wage is measured in terms of the manufactured good. In the appendix, we consider the general case, when the real income is measured in terms of a basket of goods, comprising of both food and the manufactured good.

Let the urban wage rate be measured by using a price index I. This price index is a weighted average of the price of food and the price of the manufacturing good. In the short run, capital is considered to be perfectly immobile, so labor is the only variable factor of production. In this general setting the factor income equations in the equilibrium are given as follows:

$$I = \alpha.P_F + (1-\alpha).P_M \qquad \text{(A1)}$$

$$w_F = \frac{P_F}{I}.F'_{LF}\left(L_F, \overline{T}_F\right) \qquad \text{(A2)}$$

$$\overline{w}_M = \frac{P_M}{I}.M'_{LM}\left(L_M, \overline{T}_M\right) \qquad \text{(A3)}$$

$$w_F = \left(\frac{L_M}{\overline{L} - L_F}\right).\overline{w}_M \qquad \text{(A4)}$$

$$r_F = \frac{P_F}{I}F'_{TF}.\left(L_F, \overline{T}_F\right) \qquad \text{(A5)}$$

$$r_M = \frac{P_M}{I}.M'_{TM}\left(L_M, \overline{T}_M\right) \qquad \text{(A6)}$$

Equation (A1) gives the price index, where α is the weight attached to the price of food and lies in the interval $(0 \leq \alpha \leq 1)$. For simplicity, let food prices serve as the numeraire i.e. $P_F = 1$, $P^*_F = 0$. The comparative static equations derived from the above equations are as follows:

$$I^* = (1-\alpha).\frac{P_M}{I}.P^*_M \tag{A7}$$

$$w^*_F + I^* = \left(\frac{\partial F'_{LF}}{\partial L_F}.\frac{L_F}{F'_{LF}}\right).L^*_F \tag{A8}$$

$$I^* = \left(\frac{\partial M'_{LM}}{\partial L_M}.\frac{L_M}{M'_{LM}}\right).L^*_M + P^*_M \tag{A9}$$

$$-L_F.L^*_F + (\overline{L} - L_F)w^*_F = (\overline{L} - L_F)L^*_M \tag{A10}$$

$$r^*_F + I^* = \left(\frac{\partial F'_{TF}}{\partial L_F}.\frac{L_F}{F'_{TF}}\right).L^*_F \tag{A11}$$

$$r^*_M + I^* = \left(\frac{\partial M'_{TM}}{\partial L_M}.\frac{L_M}{M'_{TM}}\right).L^*_M + P^*_M \tag{A12}$$

From the above equations, we can solve for the relative change in the rural wage rate by using equations (A8, A9, A10). The effect of a decline in the relative price of the manufactured good on the rural wage rate is given by the following equation:

$$w^*_F = \left[\frac{F''_{LF}.M'_{LM}.(\overline{L} - L_F)}{M''_{LM}.L_M.(F' - F''_{LF}.(\overline{L} - L_F))}\right].P^*_M - \left[\frac{F'_{LF}.M''_{LM}.L_M + F''_{LF}.M'_{LM}.(\overline{L} - L_F)}{M''_{LM}.L_M.(F' - F''_{LF}.(\overline{L} - L_F))}\right].I^*$$

(A13)

Since the sign of w^*_F in equation (A13) cannot be determined, the effect of a decline in the price of the manufactured good on the rural wage rate is not known. However, a sufficient condition for the rural wage rate to decline $w^*_F < 0$ is given by the inequality:

$$0<\left[\frac{F'_{LF}.M''_{LM}.L_M.P_M}{F''_{LF}.M'_{LM}.\left(\overline{L}-L_F\right)+F'_{LF}.M''_{LM}.L_M.P_M}\right]<\alpha\leq 1 \qquad \text{(A16)}$$

Inequality (A16) gives the lower bound on the value of α which is the weight attached to the price of food in the price index. When the urban wage is fixed in terms of a basket of commodities, the rural wage declines with the removal of tariffs if α lies between the interval. Thus as long as the price index satisfies the inequality (A16), a decline in the price of the manufactured good, leads to a decline in the rural wage rate and Proposition 1 in the paper holds true. Now consider the two extreme cases, which are special cases of the formulation above.

A.1. Urban wage is fixed in terms of the price of the manufacturing good:

When $\alpha = 0$ then $I = P_M$ and the urban wage is fixed in terms of the price of the manufactured good. Substitute $I^* = P^*_M$ in equation (A13). Then the percentage change in the rural wage rate is given by:

$$w^*_F=\left[\frac{-F'_{LF}}{F'_{LF}-F''_{LF}.\left(\overline{L}-L_F\right)}\right].P^*_M \qquad \text{(A14)}$$

In equation (A14), the sign of the term in the bracket is negative, and $P^*_M < 0$, implying $w^*_F > 0$. Thus, when the urban wage is fixed in terms of the price of the manufactured good, a decrease in the relative price of the manufactured good due to removal of tariffs leads to an increase in the real wage in the rural sector.

A.2. Urban wage is fixed in terms of the price of food:

If $\alpha = 1$ then $I = P_F = 1$, and we get the case studied in the paper, when the urban wage is fixed in terms of the price of food. In this case, the effect of a decline in the price of the manufactured good on the rural wage rate can be derived from (A13) by substituting $\left(I^{*}=P^{*}{}_{F}=0\right)$. The percentage change in the rural wage rate is given by:

$$w^{*}{}_{F}=\left[\frac{F''{}_{LF}.M'{}_{LM}.\left(\bar{L}-L_{F}\right)}{M''{}_{LM}.L_{M}.\left(F'{}_{LF}-F''{}_{LF}.\left(\bar{L}-L_{F}\right)\right)}\right].P^{*}{}_{M} \tag{A15}$$

Equation (A15) is exactly the same as equation (15) derived in the paper. The expression in the bracket is positive and $P^{*}{}_{M}<0$. In the paper we assume that the income is measured in terms of food because we believe that the poor spend a majority of their income on purchasing food and a negligible amount on purchasing the manufactured good. Hence food is more relevant index to measure the income of the poor in the rural sector. When income is measured in terms of food, Proposition 1 states that a decrease in the relative price of the manufactured good due to removal of tariffs leads to a decrease in the real wage in the rural sector.

Chapter 3: MEASURING THE IMPACT OF GROWTH AND INCOME DISTRIBUTION ON POVERTY

3.1 Introduction

India has the largest concentration of poor people in the world, with nearly 300 million people living in absolute poverty. In 1993-94, every third person in India still lived in conditions of absolute poverty (Datt, 1997), and India had 50% more poor people than the whole of Sub-Saharan Africa (World Bank, 2000). But, unlike other countries suffering from extreme poverty, India has recently been one of the fastest growing economies. In the 1990s, when countries across the world experienced economic slowdown, per capita GDP in India grew at a high rate of 4% per year. This impressive growth performance is a recent phenomenon, mostly seen during the last two decades. In 1990-91, the country faced a severe macroeconomic crisis, as a response to which the Government undertook several economic reforms. Besides stabilizing the economy, the reforms also brought about structural changes. The economy was liberalized from bureaucratic regulations and free markets were introduced in many fields. The reform policies succeeded in placing the economy on a higher growth path. However the rapid growth in the 1990s was also accompanied by significant changes in the distribution of income. Some recent studies indicate there was a marked increase in income inequality in the years following the reforms (Deaton & Dreze, 2002). Thus, in the last decade, the Indian economy experienced major changes in the level and distribution of income.

How did these changes affect the poor in India? Did a rise in the income level reduce poverty? Or did the changes in the distribution of income adversely affect poverty? Which of the two factors affected the poverty levels to a greater extent? This chapter attempts to answer these important questions.

In order to separate the impact of a rise in the mean income level from the impact of changes in the distribution of income on poverty, we undertake a decomposition of poverty measures. The decomposition is carried out by estimating two counterfactual poverty levels: i) what would have been the poverty level if only the mean income had changed without any changes in the distribution of income; and ii) what would have been the poverty level if the distribution of income had changed with no change in the mean income level. The chapter includes a brief discussion of the various methods of decomposition of poverty changes that one finds in the literature.

At the risk of emphasizing the obvious, we would like to clarify one point here. The decomposition analysis does not imply that a change in the distribution of income will never lead to a change in the mean income or vice versa. Without denying the possibility of such interdependence between the mean income and the distribution of income, what the decomposition exercise does is this. It gathers together the changes in the mean income arising from all possible sources including changes in the distribution of income and answers the counterfactual question as to what would have been the reduction in poverty given the change in the mean income level and no change in the distribution of income. Similarly, the decomposition exercise gathers together the changes in the distribution of income arising from all possible sources including change in the mean income and answers the counterfactual question as to what would have been the reduction in poverty given the change in the distribution and no change in the mean income level.

A distinct feature of this chapter is that the decomposition of the changes in poverty is carried out at the state level. In a vast country like India, there exist sharp economic disparities across regions. The mean income levels, the distributional patterns of income, and the poverty levels differ widely across states. Even within the states, differences are observed between the rural and urban sectors. Poverty is more prevalent in the rural areas where nearly 80% of the poor in India live. The paper considers separately the rural and urban poverty levels across the different states in India. Out of a total of 26 states, it includes 15 major states (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal)[2], which account for nearly 97% of the total population of the country.

The analysis of the changes in poverty is carried in the context of the economic reforms. The impact of growth and changes in the distribution of income on poverty is studied over a period of two decades, namely, the pre-reform period from 1983-84 to 1993-94 and the post-reform period from 1993-94 to 1999-2000.[3] Our modest aim in choosing this time frame is to examine whether given the new set of policies, a rise in the mean income level or changes in the distribution of income affected poverty to a greater extent. We do not intend to evaluate the reform policies vis-à-vis alternate competing growth policies nor do our results provide causal explanations. Rather, the intention of the analysis is to evaluate how growth and changes in the distribution of income brought about by the reforms, contributed in changing the poverty levels.

The results of the decomposition of the changes in poverty indicate that in most of the states a rapid rise in the income levels, especially since the economic reforms, led to a decline in poverty levels. Poverty declined not only as the head count ratio but also as the poverty gap and squared poverty gap. In the pre-reform period, the changes in the distribution of income in many states contributed to lowering the poverty levels. In the post-reform period, however, changes in the distribution of income in most states adversely affected the poor. During both the periods,

[2] The states of Bihar, Madhya Pradesh and Uttar Pradesh refer to the ones before the formation of the new states of Jharkhand, Chattisgarh and Uttaranchal in late 2000.

[3] The post-reform period covered is shorter than the pre-reform period, as 1999-2000 is the latest year for which data is available.

growth in income levels was the most important factor contributing to a decline in poverty in India.

The chapter is presented as follows. Section 2 briefly discusses the various methods for decomposing the changes in poverty and issues regarding these decompositions. Section 3 contains description of the data and the procedure adopted for estimating various poverty measures, details of which are given in the Appendix. The main results of the decomposition of poverty levels appear in Section 4. Section 5 concludes.

3.2 Decomposition of the Changes in Poverty Over Time

Income poverty as conventionally defined,[4] can be fully expressed in terms of the level of income relative to a benchmark poverty line and the distribution of income. The poverty level can be written as $P = P(z, m, l)$ where z is the poverty line; m is the mean level of income; and l is the Lorenz curve.[5] When poverty line z is kept fixed and there is no ambiguity about it, we shall write the poverty level as simply $P = P(m, l)$. Thus given the poverty line z, poverty at time $t = 0$ will be denoted by $P_{00} = P(m_0, l_0)$ where m_0 denotes the mean income level at time $t = 0$ and l_0 denotes the Lorenz curve at time $t = 0$. Similarly, poverty at time $t = 1$, will be denoted by $P_{11} = P(m_1, l_1)$ and so on. Poverty at time $t = 1$ will be different from poverty at time $t = 0$ most likely because both the mean income level and the distribution of income have changed over time. However, one can think of hypothetical situations. If only the mean income had changed from m_0 to m_1 and the distribution of income was fixed at l_0, then poverty would

[4] The concept of income poverty defines the poor as all those people whose income is less than or equal to a certain benchmark income level, called the poverty line.

[5] The Lorenz curve is a standard tool used to characterise the distribution of income and is defined as the relationship between the cumulative proportion of population and the cumulative proportion of income received when the population is arranged in an ascending order of income.

have been $P_{10} = P(m_1, l_0)$. On the other hand, if only the distribution of income had changed from l_0 to l_1, and the mean income was fixed at m_0, then poverty would have been $P_{01} = P(m_0, l_1)$.

When the mean income changes from m_0 to m_1 and the Lorenz curve changes simultaneously from l_0 to l_1, the total change in poverty is given by:

$$P_{11} - P_{00} = P(m_1, l_1) - P(m_0, l_0) \tag{1}$$

What part of this total change is due to the change in the mean income level and what part is due to the shift in the Lorenz curve? This is an issue of considerable interest. The question can be answered by decomposing the total change in poverty with the help of the hypothetical poverty levels, P_{10} and P_{01}. Kakwani and Subbarao (1990) carry out the decomposition in the following way:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{11} - P_{10}) \tag{2}$$

Jain and Tendulkar (1990) propose an alternative way:

$$P_{11} - P_{00} = (P_{11} - P_{01}) + (P_{01} - P_{00}) \tag{3}$$

The first term on the right hand side of each of the equations (2) and (3) denotes the growth component, which gives the change in poverty purely due to the change in the mean income. The growth component in (2) is measured by holding the distribution of income fixed at l_0 while letting the mean income change from m_0 to m_1. The growth component in (3) is measured by holding fixed the income distribution at l_1 and letting the mean income change from m_0 to m_1. Similarly, the second term in each of the equations is the distribution component, which gives the change in poverty purely due to the change in the distribution of income. In equation (2), the distribution component is measured by holding the mean income level fixed at m_1 and changing the distribution of income from l_0 to l_1. In equation (3), the distribution component is measured by holding the mean income level fixed at m_0 and changing the distribution of income from l_0 to l_1. In general, the growth component and the distribution component as measured in (2) will differ from the growth and distribution components, respectively, as measured in (3). As there is no theoretical reason to prefer the base year to the final year as the benchmark or vice versa, there is no reason to prefer either of the two decompositions to the other.

Datt and Ravallion (1992) criticize the above approach to decomposition on the grounds that the decomposition is not path independent. The reduction in poverty due to a change in the mean income (distribution of income) depends on whether the distribution (mean income) is held fixed at time $t = 0$ or $t = 1$. To make each component path independent they suggest the following type of decomposition:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{01} - P_{00}) + R \qquad (4)$$

where R is the residual. In this case each parameter is changed holding the other parameter fixed at time $t = 0$, in general at a common reference period, thus, making the sequence in which the changes are calculated irrelevant. Unfortunately, this path independence property is obtained at a cost. The decomposition in (4) is partial in the sense that the two components do not add to the total change and contains a residual term. The residual is the difference between the growth (distribution) components evaluated at the final and initial distribution of income (mean income level). It is important to note that this residual can be either positive or negative, thus representing at times an unexplained part of the decomposition and at other times an over explained part of the decomposition. Intuitively, if the total change in poverty can be expressed completely in terms of the change in the mean income level and in terms of the change in the distribution of income, then there is no reason why the decomposition should have any residual. The residual term does not arise out of a conceptual necessity, rather, it arises due to the particular procedure adopted to carry out the decomposition. The decompositions in equation (2) and (3) are complete but not path independent; whereas the one in (4) is path independent but has a residual.

Of course, the choice of the method of decomposition depends on the properties one wishes the decomposition to satisfy. In this chapter, we choose a decomposition, which has both the properties of path independence and completeness. From equations (2) and (3) the total change in poverty can be rewritten as:

$$P_{11} - P_{00} = \left(\frac{(P_{10} - P_{00}) + (P_{11} - P_{01})}{2} \right) + \left(\frac{(P_{11} - P_{10}) + (P_{01} - P_{00})}{2} \right) \qquad (5)$$

In the above decomposition we take the average of the two growth components; one of these gives the change in poverty due to a change in the mean income when distribution is held fixed at time $t = 0$ and the second gives the change in poverty when distribution is held fixed at time $t = 1$. Similarly, we take an average of the two distribution components; one of them gives the change in poverty due to a change in distribution when the mean income is held fixed at time $t = 0$ and the other gives the change in poverty when the mean income is held fixed at time $t = 0$. Taking averages is a standard practice to make the decomposition path independent[6] (Kakwani, 1997, McCulloch et al., 2000, Shorrocks & Kolenikov, 2001). Shorrocks (1999) shows that this method of decomposition is formally equivalent to the Shapley value solution in cooperative game theory. He points out that this is the only method of decomposition which satisfies the following requirements: i) the decomposition should be path independent; ii) the

[6] Datt & Ravallion (1992) mention it as a possible way to make the residual vanish, in a footnote in their paper.

decomposition should be complete; iii) and the components of the decomposition should be given by the marginal effect of changing one factor, holding constant all the other factors.

Table 3.1 contains an example highlighting the differences in the contribution of growth and distribution of income in reducing poverty, when decomposition is carried out in the several different ways discussed above. From 1983-84 to 1993-94, head count ratio of poverty in rural West Bengal declined by 44.22%. The method of averages shows that out of the total change in poverty, 40.76% change was due to the rise in the mean income level, while 3.46% change was due to the change in the distribution of income. The decomposition method followed by Datt and Ravallion (1992) shows that only 35.35% of the total change in poverty was due to growth and 1.95% due to the change in the distribution of income. The remaining 10.83% is unaccounted for, as the residual. This means that nearly 25% of the total change in poverty is left unexplained. The example also highlights path dependence of the decomposition methods given in equations (2) and (3) respectively. Using equation (2), it is seen that poverty would have declined by 8.88% if the distribution of income had changed from 1983-84 to 1993-94, keeping the mean income level fixed at 1993-94. On the other hand, using equation (3), it is seen that poverty would have increased by 1.95% if the distribution of income had changed from 1983-84 to 1993-94, keeping the mean income level fixed at 1983-84. Thus, not only does the magnitude of the effect of the change in the distribution on the change in poverty differ according to the path followed but also the direction of the change in poverty; in one case, the change in the distribution of income leads to a decline in poverty while in the other it leads to an increase in poverty.

3.3 Data and Estimation Procedure

In order to decompose the total change in poverty levels, we need to estimate actual poverty levels P_{00} and P_{11} as well as hypothetical poverty levels P_{10} and P_{01}. The primary source of data used to calculate the poverty levels in the different states of India is the quinquennial consumer expenditure surveys conducted by the National Sample Survey Organisation (NSS). The NSS is a unified agency under the Department of Statistics, Government of India, and is one of the chief agencies providing reliable data since 1972. We use data from the 38th round, 50th round and 55th round of the NSS to estimate poverty levels for the years 1983-84, 1993-94 and 1999-00 respectively.[7]

There is a growing concern about the comparability of data collected in the 55th round with data collected in the earlier rounds. The 55th round differs from the earlier quinquennial rounds in two respects. In the earlier rounds, data on food expenditure was collected using a recall period of 30 days while in the 55th round data on food expenditure was collected using a recall period of 30 days and 7 days. Data on the non-food expenditure in the previous rounds was published from 30 days recall schedule while that for the 55th round was published from 365 days recall schedule. We estimate poverty levels in 1999-00 by using the 30 days recall schedule of the 55th round for food expenditure and the 365 days recall schedule of the 55th round for the non-food expenditure. The Planning Commission of India (1999) also uses the same schedules of the 55th round to estimate poverty levels in 1999-00.

However it has been argued that the change in the recall schedule may have led to an overestimation of expenditure levels reported in the 55th round and consequently an underestimation of poverty levels in 1999-00. Hence we check the robustness of our decomposition results by lowering the expenditure levels of the 55th round and re-estimating poverty levels for 1999-00. Even after discounting for a possible overestimation in the expenditure levels, we find that poverty levels in 1999-00 were lower than those in 1993-94.

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[7] Grouped data of the NSS rounds for 1983-84 and 1993-94 was used from the World Bank Data Set collected for the project "Poverty and Growth in India" by Ozler, Datt & Ravallion (1996). For 1999-00, raw data from the NSS was made available by UNU/WIDER, Helsinki.

Several alternate methods have been used to make data from the 55th round comparable with data from earlier rounds. Though none of these methods are fool proof, all of them arrive at the same conclusion that there was a non-negligible decline in the poverty rate in India during the 1990s (Datt & Ravallion, 2002, Deaton & Derez, 2002, Planning Commission of India, 1999, Sundaram & Tendulkar, 2003, World Bank, 2000). As long as poverty levels in 1999-00 are lower than those in 1993-94, there are no changes in the qualitative results of the decomposition analysis. All the conclusions in the paper based on the decomposition of the change in poverty remain valid.

The NSS collects data at the household level and converts the household level data to per capita expenditure level by dividing it by the number of members in a household. Data appears in grouped form with 12 to 14 classes of the average per capita per month consumption expenditure and the percentage of people falling in those expenditure classes. Hence we have to first estimate a Lorenz curve and then use an indirect method to estimate poverty levels. A parametric Lorenz curve is specified from the General Quadratic model suggested by Villasenor and Arnold (1989). The general quadratic form has been widely used to fit Lorenz curves (Datt & Ravallion, 1992) and it is especially useful since the head count poverty ratio can be expressed explicitly in terms of the Lorenz curve parameters. The Lorenz curve parameters are estimated by ordinary least squares regression.[8]

The estimates of the Lorenz curve parameters are used to calculate three standard measures of poverty, namely, the head count ratio, which gives the proportion of population having per capita income below the poverty line and denotes the incidence of poverty; the poverty gap, which gives the average income shortfall of the poor as a proportion of the poverty line, capturing the depth of poverty; and the squared poverty gap, which is the sum of the squared

[8] The estimated GQ Lorenz curve fits the data closely with R-squared value around 0.99. The poverty estimates do not vary significantly even with alternative Beta Lorenz curve specification.

shortfall of the poor people's income as a proportion of the poverty line and is used to measure the severity of poverty.

To estimate poverty at different time periods, the per capita consumption expenditure for all the three years is converted into real terms and the values are expressed at all India rural/urban prices in 1973-74.[9] Poverty levels in different periods are measured by keeping the poverty line fixed in real terms. The poverty lines used are the ones defined by the Planning Commission of India in 1979, (Planning Commission of India, 1997). The Planning Commission followed the "food-energy method" by which the poverty lines correspond to the levels of per capita total expenditure (including food and non-food expenditure) required to attain some basic nutritional norm. For the rural sector, this norm was set at a per capita per day intake of 2400 calories and the corresponding per capita monthly expenditure levels were set at Rs.49 at 1973-74 all India prices. The respective figures for the urban sector were an intake of 2100 calories and a per capita monthly expenditure level of Rs.57. Note that although in the discussion throughout the chapter income levels are used, the NSS data is available instead on consumer expenditure levels. In the application, hence, income is replaced by consumption expenditure.

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[9] For the years of 1983-84 and 1993-94, the expenditure levels were converted to the base year values of 1973-74 by using Consumer Price Index for Agricultural Labor (CPIAL) for the rural sector and Consumer Price Index for Industrial Workers (CPIIW) for the urban sector with adjustments made to take into account interstate price differentials (see World Bank data set 1996, for further details). For the year 1999-2000, the expenditure levels were first converted to 1993-94 values by using the Poverty Line Price Index and then further converted to 1973-74 values by using the respective Consumer Price Indices. Since poverty lines in India are updated for price changes overtime, keeping the interstate price differentials fixed, the Poverty Line Price Index very closely resembles the official CPIAL for the rural sector and CPIIW for the urban sector (Deaton & Tarozzi, 2000, Deaton, 2001).

3.4 Results of the Decomposition

3.4.1 Decline in Poverty

The modest growth in the 1980s was accompanied by a decline in poverty in most of the states. In the early 1990s, immediately after the crisis, when reforms were being introduced, there was a slight increase in poverty levels in the rural parts of some states[10] but this rise in poverty was a temporary phenomenon. By 1993-94, growth in the mean income level resumed pace and in fact accelerated in the following years. As a result, the post-reforms period witnessed a significant decline in poverty. Table 3.2 shows that on an average the head count ratio in this period declined by nearly 30% in the rural sector and by nearly 25% in the urban sector. Other studies using different poverty lines too conclude that poverty declined significantly in the 1990s (Planning Commission of India, 1999, Deaton & Dreze, 2002). Compared to the pre-reforms period, the decline in poverty in the post-reforms period was significantly greater in the rural sector. In the urban sector the decline in poverty in both the periods was about the same.

It is even more important to note that in the post-reform period, in most of the states, not only did the head count ratio decline but the poverty gap and the squared poverty gap also declined (Figure 3.1). In fact, the percentage decline in the poverty gap (40% in the rural sector and 36% in the urban sector) and the squared poverty gap (47% in the rural sector and 45% in the urban sector) was larger than the percentage decline in poverty as the head count ratio (30% in the rural sector and 25% in the urban sector). This indicates that growth promoted by the reforms did reach the poorest of the poor. A rise in the mean income level pulled the poor closer to the benchmark poverty line income level. The reduction in the poverty gap and the squared poverty gap refutes the claim by some analysts (Dreze & Sen, 2002) that post-reform reduction in poverty was largely seen because in 1993-94 poor households were heavily concentrated near the poverty

[10] The headcount ratio in the rural areas of Assam, Haryana and Punjab showed a slight increase mainly because 1991-92 was a bad year for agriculture due to poor monsoon rains (Joshi & Little, 1996).

line and a rise in the per capita income helped them to cross the poverty benchmark. This would have been true only if the headcount ratio of poverty had declined but not the poverty gap and the squared poverty gap. The World Bank Country Study (2000) on India supports our finding that the depth and severity of poverty fell at a faster rate than the headcount ratio.

3.4.2 Importance of Growth in Reducing Poverty

The decomposition of the total change in poverty enables us to go beyond the basic question of whether poverty levels increased or declined. Table 3.2 shows that not only did poverty over the two decades decline but also that a large part of the decline in poverty was brought about by a rise in the mean income levels. The contribution of growth in reducing poverty was much greater than the contribution of the changes in distribution of income. For example, as seen in Figure 3.2, in the pre-reform period, in the rural sector, changes in the mean income levels on an average led to an 11% decline in the head count ratio while changes in the distribution of income led to a 3% decline in the head count ratio. Thus rising mean income levels brought about a significant decline in poverty.

3.4.3 The Role of Distributional Changes in Reducing Poverty

In the pre-reform period, a rise in the mean income level along with changes in the distribution of income led to a decline in poverty levels. Hence in most of the states, the total decline in poverty during this period was more than proportional to the decline in poverty due to growth. However, in the post-reform period, though the mean income accelerated, the changes in the distribution of income worked against the poor people. The distribution changes tended to increase the poverty levels. As a result, growth's potential in reducing poverty could not be fully realized and, in most states, the total decline in poverty was less than proportional to the decline in poverty due to growth. For example, in the post reform period, in the urban sector, growth in income led to a decline in the head count ratio of poverty by 33%. But changes in the distribution of income led to a rise in the head count ratio of poverty by only 8%. As a result the total decline in poverty was only 25% (Table 3.2, Figure 3.2).

In the post-reforms period, changes in the distribution of income adversely affected the poor in both urban and rural areas of most of the states. The adverse impact was particularly more pronounced in the urban than in the rural sector. In the absence of a rise in the mean income level in the 1990s, changes in the distribution of income would have led to a rise in the head count poverty ratio on an average by 2% in the rural sector and by more than 8% in the urban sector (Table 3.2). Thus the unequal distribution pattern constrained the rising mean income levels from reducing poverty to a much greater extent in the urban sector as compared to the rural sector. In the post-reform period, in the absence of a rise in the mean income level, the rise in the income inequality in the urban areas would have led to an increase in the poverty in terms of the head count ratio or the poverty gap or the squared poverty gap.

3.4.4 Results at the State Level

The changes in the mean income level, the distribution of income and the resulting changes in the poverty levels differ widely across the different states of India. Tables 3.3, 3.4, 3.5 document the decomposition of poverty when measured in terms of the head count ratio, the poverty gap and the squared poverty gap for the rural and urban sectors, across the different states, over the two time periods.

In both the decades, Punjab and Haryana were the richest states in terms of the mean income levels. In these two states, not only was the level of poverty one of the lowest but the rate of decline was also one of the fastest. For example, Table 3.3 shows that in the post reform period, the head count ratio in rural Haryana declined by nearly 60% and that in Punjab by nearly 46%. In contrast, Bihar and Orissa continued to be the poorer states with very high levels of poverty. Though poverty levels remained high, the head count ratio in rural Bihar declined by nearly 26% in the 1990s. But, in Orissa, the decline in the head count ratio in the 1990s was dismally low as compared to the previous decade. In rural Orissa, in the 1990s head count ratio declined by only 13% as compared to 30% in the 1980s, while in the urban sectors it declined merely by 8% as compared to 25% in the pre-reform period.

Among the middle income states, consider the states of Andhra Pradesh, Tamil Nadu and Uttar Pradesh. In these states, the total decline in poverty was more than proportional to the decline in poverty purely due to a rise in the mean income levels. In other words, the changes in the distribution of income led to a decline in the poverty levels in the pre as well as post-reform period. In the post-reform period, states like Gujarat, Karnataka, Maharashtra and West Bengal were among the fastest growing states, with real per capita State Domestic Product growing nearly 5% per year. Consequently, during this period, poverty levels in these states declined significantly. The head count ratio of poverty, in both the urban and rural sectors of these states declined by more than 30%, except for urban Maharashtra where it declined by about 13% (Table 3.3). The figures in tables indicate that rural poverty measured either as the head count ratio, the poverty gap or the squared poverty gap, in all four states, would have declined to a greater extent in the 1990s had there been no change in the distribution of income in these states.

Kerala stands out as a state exhibiting a rapid decline in the poverty gap and the squared poverty gap (Tables 3.4, 3.5). In the post-reform period, especially in the rural parts of this state, the income of the poor was pulled closer to the poverty line benchmark income level. Again, growth may have been more effective in reducing poverty in Kerala as compared to other states.

This is mainly because Kerala has attained remarkably high levels of life expectancy, literacy and has considerably reduced mal-nutrition, infant mortality (Deaton &Dreze, 2002).

An important result true for all states, for both the sectors and during both the time periods, is that poverty when measured in terms of the head count ratio never increased with a rise in the mean income level. This means that a positive growth in the mean income level was never accompanied by a simultaneous rise in the proportion of poor people. However, during the post-reform period, in Assam, there was a rise in the mean income level and a rise in the poverty level in terms of the poverty gap (in the urban areas) and the squared poverty gap (in rural and urban areas). This indicates that during this period, changes in the distribution of income in Assam were such that despite a rise in the mean income levels, the poor were pushed further below the poverty line and income inequality within the poor increased.

3.5 Conclusions

In the last decade, India adopted a new set of economic policies. The success of these policies is widely debated, especially in the context of the extent to which the policies have affected the poor in the country. In this chapter we provide quantitative information on the contribution of the rise in income levels and the changes in the distribution of income on poverty levels in India.

Our results indicate that, in most of the states, rapid economic growth led to decline in poverty levels. Poverty declined not only in terms of the headcount ratio but also as the poverty gap and the squared poverty gap. The decomposition of the total decline in poverty further reveals that growth was the single most important factor contributing to the decline in poverty.

However this does not mean that changes in the distribution of income were unimportant in determining the poverty levels. In the pre-reform period, the distribution changes in many states contributed to lowering the poverty levels. In the post-reform period, though, the changes in the distribution of income in most states adversely affected the poor. The distribution component put an upward pressure on the poverty levels, especially in the urban sector. As a result, the potential of growth in reducing poverty was not fully realized.

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Figure 3.1 Over Time Decline in All-India Poverty

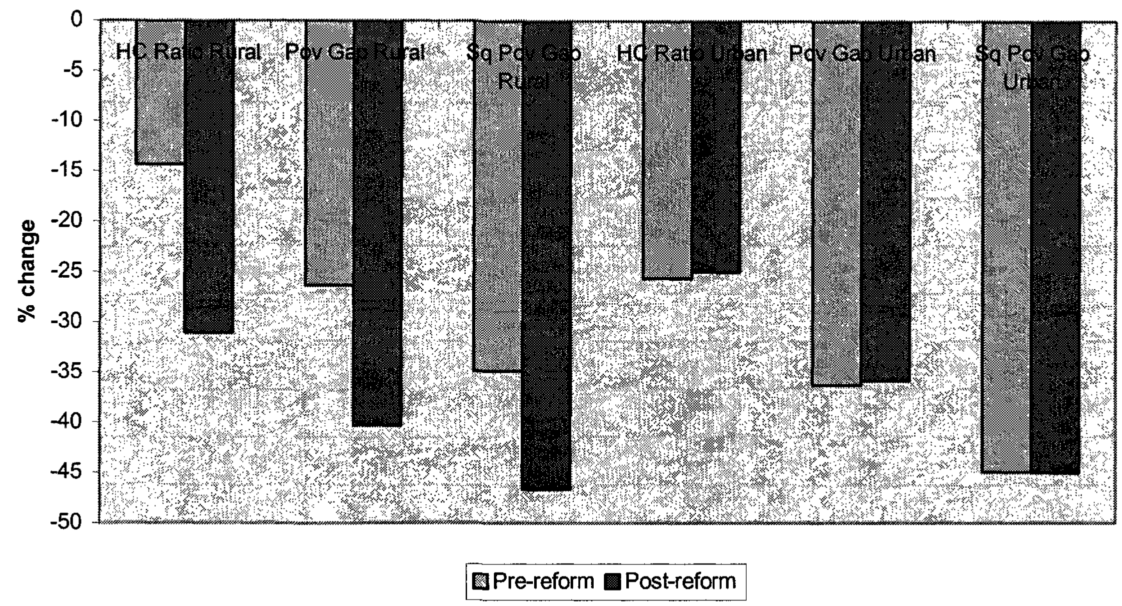

Figure 3.2 Decomposition of the Changes in the All-India Head Count Ratio

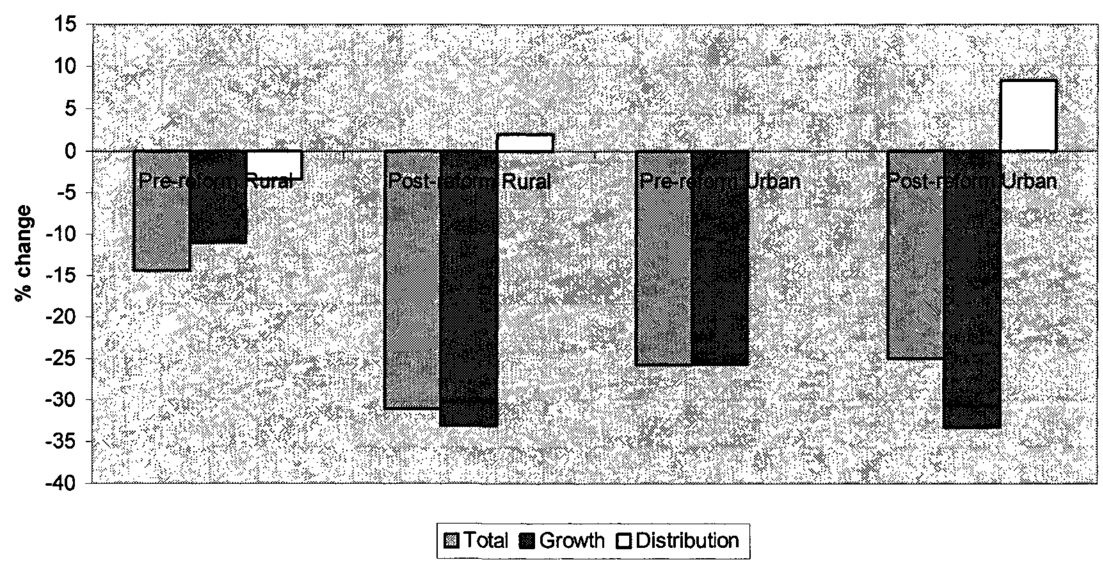

Table 3.1 Illustration of the Use of Different Methods for Decomposing Change in Head-Count Ratio

Different Methods of Decomposition	Total Change in Poverty	Contribution of Growth	Contribution of Distribution	Residual
Kakwani & Subbarao	-44.22	-35.35	-8.88	
Jain & Tendulkar	-44.22	-46.17	1.95	
Datt & Ravallion	-44.22	-35.35	1.95	-10.83
Method of Averages	-44.22	-40.76	-3.46	

*Decomposition of the head count ratio for rural West Bengal during 1983-84 to 1993-94.
*All changes in % terms.

Table 3.2 Decomposing Changes Over Time in All-India Poverty Levels

Sector	Poverty Measure	1983-84 to 1993-94			1993-94 to 1999-00		
		Total Change in Poverty	Contribution of Growth	Contribution of Distribution	Total Change in Poverty	Contribution of Growth	Contribution of Distribution
Rural	Head count.	-14.39	-10.98	-3.42	-31.09	-33.08	1.99
	Poverty Gap	-26.33	-13.91	-12.43	-40.29	-44.45	4.17
	Sq. Pov. Gap	-34.87	-15.60	-19.26	-46.67	-54.66	7.98
Urban	Head count.	-25.64	-25.60	-0.04	-24.99	-33.29	8.30
	Poverty Gap	-36.25	-34.70	-1.55	-35.85	-47.62	11.78
	Sq. Pov. Gap	-44.94	-42.08	-2.58	-44.97	-59.90	14.93

*Averages across the states are taken by using sample size as population weights.
*All changes in % terms.

Table 3.3 Decomposing Changes Over Time in State Level Head Count Ratio

Rural Sector				Urban Sector			
Pre-Reform (1983-84 to 1993-94)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-23.15	-19.74	-3.41	Andhra P	-15.18	-19.37	4.20
Assam	5.92	11.49	-5.58	Assam	-53.28	-73.64	20.36
Bihar	-8.20	-8.12	-0.08	Bihar	-21.06	-22.41	1.35
Gujarat	-12.32	-3.43	-8.88	Gujarat	-27.08	-29.56	2.48
Haryana	31.65	11.83	19.82	Haryana	-45.01	-19.35	-25.66
Karnataka	-9.55	-2.08	-7.47	Karnataka	-21.68	-13.15	-8.53
Kerala	-28.35	-14.83	-13.51	Kerala	-46.40	-31.41	-14.99
Madhya P	-14.95	-12.10	-2.85	Madhya P	-17.99	-23.34	5.35
Maharash	-13.14	-15.45	2.31	Maharash	-6.26	-19.81	13.55
Orissa	-30.18	-30.81	0.63	Orissa	-25.67	-25.15	-0.52
Punjab	2.79	13.46	-10.67	Punjab	-61.81	-34.65	-27.16
Rajasthan	-4.60	11.41	-16.01	Rajasthan	-19.99	-16.69	-3.30
Tamil Nadu	-33.75	-32.15	-1.60	Tamil Nadu	-28.82	-24.73	-4.09
Uttar P	-7.63	-5.70	-1.93	Uttar P	-31.47	-30.14	-1.33
W Bengal	-44.22	-40.76	-3.46	W Bengal	-30.83	-32.86	2.03
Post-Reform (1993-94 to 1999-00)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-22.31	-10.98	-11.33	Andhra P	-27.78	-39.06	11.28
Assam	-14.92	-26.30	11.38	Assam	-2.57	-67.68	65.11
Bihar	-26.94	-30.28	3.34	Bihar	-10.06	-26.48	16.42
Gujarat	-35.97	-43.96	7.99	Gujarat	-33.94	-44.08	10.14
Haryana	-59.91	-38.27	-21.64	Haryana	-53.65	-62.89	9.24
Karnataka	-38.48	-42.95	4.46	Karnataka	-32.73	-41.00	8.27
Kerala	-57.20	-60.90	3.69	Kerala	-17.16	-30.88	13.72
Madhya P	-14.98	-15.67	0.68	Madhya P	-22.11	-26.56	4.45
Maharash	-33.79	-27.19	-6.61	Maharash	-13.34	-15.78	2.44
Orissa	-13.56	-25.77	12.21	Orissa	-8.02	-16.71	8.69
Punjab	-45.78	-51.69	5.91	Punjab	-64.09	-79.77	15.69
Rajasthan	-29.84	-23.66	-6.18	Rajasthan	-25.95	-31.88	5.93
Tamil Nadu	-45.70	-44.09	-1.62	Tamil Nadu	-40.32	-43.00	2.68
Uttar P	-33.97	-28.60	-5.37	Uttar P	-8.98	-19.09	10.11
W Bengal	-36.01	-64.45	28.44	W Bengal	-43.26	-34.54	-8.72

*All changes in % terms

Table 3.4 Decomposing Changes Over Time in State Level Poverty Gap

Rural Sector				Urban Sector			
Pre-Reform (1983-84 to 1993-94)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-38.89	-25.46	-13.43	Andhra P	-27.94	-27.18	-0.76
Assam	4.18	16.27	-12.09	Assam	-81.27	-84.86	3.59
Bihar	-23.15	-13.06	-10.09	Bihar	-33.46	-32.37	-1.09
Gujarat	-14.83	-4.59	-10.24	Gujarat	-29.93	-42.56	12.64
Haryana	55.12	18.84	36.28	Haryana	-59.39	-26.49	-32.90
Karnataka	-25.03	-2.63	-22.40	Karnataka	-32.52	-17.81	-14.71
Kerala	-38.38	-19.41	-18.97	Kerala	-63.39	-39.02	-24.37
Madhya P	-25.88	-16.81	-9.06	Madhya P	-22.32	-34.90	12.59
Maharash	-16.81	-22.82	6.01	Maharash	-10.25	-25.08	14.83
Orissa	-48.97	-36.98	-11.99	Orissa	-32.39	-36.70	4.30
Punjab	-16.68	18.00	-34.68	Punjab	-80.33	-41.97	-38.37
Rajasthan	-24.55	14.33	-38.89	Rajasthan	-32.33	-22.08	-10.25
Tamil Nadu	-51.36	-40.75	-10.61	Tamil Nadu	-43.81	-32.75	-11.06
Uttar P	-15.70	-7.92	-7.79	Uttar P	-41.77	-42.65	0.89
W Bengal	-67.56	-43.98	-23.59	W Bengal	-46.57	-45.41	-1.15
Post-Reform (1993-94 to 1999-00)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-33.58	-14.89	-18.69	Andhra P	-38.50	-58.40	19.90
Assam	-1.05	-38.68	37.63	Assam	19.39	-129.85	149.24
Bihar	-38.62	-43.78	5.16	Bihar	-16.03	-41.85	25.82
Gujarat	-42.50	-55.40	12.90	Gujarat	-46.31	-60.54	14.23
Haryana	-73.85	-46.36	-27.48	Haryana	-63.82	-88.47	24.64
Karnataka	-53.02	-54.79	1.77	Karnataka	-47.20	-55.10	7.90
Kerala	-75.02	-74.34	-0.67	Kerala	-19.20	-46.30	27.10
Madhya P	-21.11	-21.72	0.60	Madhya P	-29.40	-38.64	9.23
Maharash	-47.28	-34.32	-12.96	Maharash	-22.40	-21.74	-0.66
Orissa	-9.85	-36.72	26.87	Orissa	-12.48	-24.94	12.46
Punjab	-52.69	-74.46	21.77	Punjab	-85.93	-102.28	16.36
Rajasthan	-43.85	-29.21	-14.64	Rajasthan	-44.79	-43.49	-1.29
Tamil Nadu	-59.24	-57.10	-2.14	Tamil Nadu	-52.99	-59.43	6.44
Uttar P	-47.95	-37.24	-10.72	Uttar P	-22.65	-28.13	5.48
W Bengal	-39.80	-94.46	54.65	W Bengal	-61.58	-48.48	-13.09

*All changes in % terms

Table 3.5 Decomposing Changes Over Time in State Level Squared Poverty Gap

Rural Sector				Urban Sector			
Pre-Reform (1983-84 to 1993-94)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-50.98	-29.80	-21.18	Andhra P	-39.56	-36.23	-3.33
Assam	0.94	20.01	-19.06	Assam	-92.98	-62.87	-30.11
Bihar	-34.44	-15.63	-18.81	Bihar	-43.31	-41.03	-2.28
Gujarat	-15.44	-5.72	-9.72	Gujarat	-31.53	-46.40	14.87
Haryana	80.92	26.89	54.03	Haryana	-69.68	-50.51	-19.17
Karnataka	-36.72	-3.03	-33.68	Karnataka	-41.11	-23.82	-17.29
Kerala	-45.17	-23.40	-21.77	Kerala	-74.29	-45.11	-29.18
Madhya P	-33.77	-20.29	-13.48	Madhya P	-25.50	-42.35	16.84
Maharash	-17.96	-28.92	10.96	Maharash	-19.87	-21.50	1.63
Orissa	-62.65	-39.21	-23.44	Orissa	-37.86	-44.21	6.35
Punjab	-32.99	21.74	-54.73	Punjab	-89.88	-74.55	-15.33
Rajasthan	-38.16	16.36	-54.52	Rajasthan	-42.99	-33.72	-9.27
Tamil Nadu	-63.16	-45.86	-17.30	Tamil Nadu	-54.91	-40.52	-14.39
Uttar P	-23.20	-9.67	-13.52	Uttar P	-49.14	-51.27	2.13
W Bengal	-81.07	-43.99	-37.08	W Bengal	-59.14	-56.60	-2.54
Post-Reform (1993-94 to 1999-00)							
states	total change	contribut. growth	contribut. distri	states	total change	contribut. growth	contribut. distri
Andhra P	-43.04	-18.31	-24.73	Andhra P	-47.86	-74.72	26.86
Assam	16.91	-51.90	68.81	Assam	46.10	-232.49	278.59
Bihar	-46.67	-52.76	6.09	Bihar	-23.07	-55.04	31.97
Gujarat	-48.88	-65.97	17.09	Gujarat	-57.10	-73.71	16.61
Haryana	-82.65	-52.09	-30.55	Haryana	-71.80	-111.94	40.14
Karnataka	-64.53	-63.10	-1.44	Karnataka	-58.58	-65.99	7.42
Kerala	-85.87	-81.13	-4.74	Kerala	-22.19	-61.37	39.18
Madhya P	-26.68	-26.74	0.05	Madhya P	-36.42	-48.90	12.49
Maharash	-57.34	-39.48	-17.86	Maharash	-30.61	-26.67	-3.95
Orissa	-7.42	-47.45	40.03	Orissa	-17.19	-32.07	14.88
Punjab	-58.75	-96.38	37.63	Punjab	-94.54	-112.31	17.76
Rajasthan	-53.97	-33.33	-20.64	Rajasthan	-59.41	-51.47	-7.94
Tamil Nadu	-69.62	-66.62	-3.01	Tamil Nadu	-63.27	-72.15	8.88
Uttar P	-58.45	-43.82	-14.63	Uttar P	-35.81	-34.91	-0.90
W Bengal	-44.86	-125.97	81.11	W Bengal	-73.89	-57.75	-16.14

*All changes in % terms

APPENDIX TO CHAPTER 3

A.1 On Estimating Poverty Levels from Lorenz Curve

A Lorenz curve is often used to characterize the distribution of income and is defined as the relationship between the cumulative proportion of the population and the cumulative proportion of income received when the population is arranged in an ascending order of income.

Empirically, a Lorenz curve can be fitted on grouped data set, in several different ways. Villasenor and Arnold (1989) suggested the General Quadratic model:

$$y(1-y)=a(x^2-y)+by(x-1)+d(x-y) \qquad \text{(A1)}$$

where x denotes the cumulative proportion of the population and y denotes the cumulative proportion of income received. For fitting income distributions, the appropriate solution for the above equation is:

$$y=\frac{1}{2}\left(-(bx+e)-(\gamma x^2+\delta x+e^2)^{\frac{1}{2}}\right) \qquad \text{(A2)}$$

where $\gamma=b^2-4a$ and $\delta=2be-4d$. The parameters of the Lorenz curve can be estimated by ordinary least squares method. With the estimates of the Lorenz curve parameters and the data on the mean income level, the head count poverty ratio (h) is obtained by using the relation $l'(h)=z/m$ i.e. the slope of the Lorenz curve evaluated at the head count ratio is equal to the ratio of the poverty line to the mean income level. By inverting the above first order derivative, one can solve for the head count ratio as follows:

$$h=-\frac{1}{2\gamma}\left[\delta+r\left(b+2\left(\frac{z}{m}\right)\right)\left\{\left(b+2\left(\frac{z}{m}\right)\right)^2-\gamma\right\}^{-\frac{1}{2}}\right] \qquad \text{(A3)}$$

where $r = (\delta^2 - 4\gamma e^2)^{\frac{1}{2}}$. The poverty gap measure can be written as $pg = h - (m/z)y_h$ where $y_h = y$ is evaluated at $x = h$. The squared poverty gap measure is given as:

$$spg = 2pg - h - \left(\frac{m}{z}\right)^2 \left[ah + by_h - \left(\frac{r}{16}\right) \ln \left\{ \frac{\left(1 - \frac{h}{s_1}\right)}{\left(1 - \frac{h}{s_2}\right)} \right\} \right] \quad \text{(A4)}$$

where $s_1 = \dfrac{r-\delta}{2\gamma}$ and $s_2 = -\dfrac{(r+\delta)}{2\gamma}$.

A.2 On the 55th Round of the NSS Data:

The 55th round differs from the earlier quinquennial rounds in two respects. In the earlier rounds, data on food expenditure (includes expenditure on food, paan, tobacco and intoxicants) was collected using a recall period of 30 days while in the 55th round data on food expenditure was collected using a recall period of 30 days and 7 days. In order to maintain consistency with the earlier rounds, we use the 30 days recall schedule of the 55th round.[11] Data on non-food expenditure (includes expenditure on clothing, footwear, durables, education, and health care) in the previous rounds was published from 30 days recall schedule while that for the 55th round was published from 365 days recall schedule. However expenditure on non-food items accounts for merely 1/5 of the total expenditure (Datt & Ravallion, 2002). It is unlikely that overall expenditure on non-food items was overestimated by more than 10%. Thus, even by generous

[11] It has been argued that since the 30 days and 7 days recall columns appeared on the same pages of a single questionnaire, respondents may have tried to reconcile the values in both the schedules. As a result, expenditure levels in the 30 days recall schedule may have been overestimated. However, Sundaram & Tendulkar (2003) use data from the Employment-Unemployment Surveys and argue that the 30 day recall numbers on food expenditure from the 1999-00-expenditure survey are comparable with previous rounds.

measures, total expenditure levels in the 55th round would have been overestimated by about 2% to 3%.

The change in the recall period may also have led to an underestimation of inequality in expenditure levels (Sundaram & Tendulkar, 2003). If this is true, it further reinforces our conclusion that a rise in inequality in 1999-00 adversely affected the poverty levels. However, since there is no accurate information as to what extent did the overestimation of expenditure levels vary across different fractiles of the population, we assume that overestimation of expenditure levels was uniform across different expenditure intervals.

We recalculate the poverty estimates for 1999-00 and the components of decomposition of the total change in poverty, by lowering the mean expenditure levels by 2% and 4%. As seen from tables below, the values of the change in the head count ratio of poverty certainly vary as the mean expenditure levels are lowered. But poverty levels for all states in both the sectors continue to be lower in 1999-00 as compared to 1993-94. As long as poverty levels in 1999-00 are lower than those in 1993-94, there are no changes in the qualitative results of the decomposition exercise. All the conclusions in the paper based on the decomposition of the change in poverty remain valid.

Table 3.6 Decomposition Results without any Changes to the Mean Expenditure in the 55th round of the NSS

Head count Ratio in Rural Sector				Head Count Ratio in the Urban Sector			
states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-22.31	-10.98	-11.33	Andhra P	-27.78	-39.06	11.28
Assam	-14.92	-26.30	11.38	Assam	-2.57	-67.68	65.11
Bihar	-26.94	-30.28	3.34	Bihar	-10.06	-26.48	16.42
Gujarat	-35.97	-43.96	7.99	Gujarat	-33.94	-44.08	10.14
Haryana	-59.91	-38.27	-21.64	Haryana	-53.65	-62.89	9.24
Karnataka	-38.48	-42.95	4.46	Karnataka	-32.73	-41.00	8.27
Kerala	-57.20	-60.90	3.69	Kerala	-17.16	-30.88	13.72
Madhya P	-14.98	-15.67	0.68	Madhya P	-22.11	-26.56	4.45
Maharash	-33.79	-27.19	-6.61	Maharash	-13.34	-15.78	2.44
Orissa	-13.56	-25.77	12.21	Orissa	-8.02	-16.71	8.69
Punjab	-45.78	-51.69	5.91	Punjab	-64.09	-79.77	15.69
Rajasthan	-29.84	-23.66	-6.18	Rajasthan	-25.95	-31.88	5.93
Tamil Nadu	-45.70	-44.09	-1.62	Tamil Nadu	-40.32	-43.00	2.68
Uttar P	-33.97	-28.60	-5.37	Uttar P	-8.98	-19.09	10.11
W Bengal	-36.01	-64.45	28.44	W Bengal	-43.26	-34.54	-8.72

* All changes in % terms

Table 3.7 Decomposition Results if Mean Expenditure in the 55th round of NSS is lowered by 2%

Head count Ratio in Rural Sector				Head Count Ratio in the Urban Sector			
states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-17.06	-5.69	-11.37	Andhra P	-23.94	-35.22	11.28
Assam	-10.40	-21.44	11.04	Assam	6.87	-57.82	64.69
Bihar	-23.49	-26.82	3.33	Bihar	-6.44	-22.84	16.40
Gujarat	-31.89	-39.96	8.07	Gujarat	-29.97	-40.21	10.23
Haryana	-56.81	-34.90	-21.90	Haryana	-49.31	-58.22	8.91
Karnataka	-34.71	-39.30	4.60	Karnataka	-29.10	-37.54	8.44
Kerala	-53.78	-57.71	3.93	Kerala	-12.84	-26.52	13.68
Madhya P	-11.04	-11.71	0.67	Madhya P	-18.67	-23.04	4.37
Maharash	-30.36	-23.80	-6.56	Maharash	-10.12	-12.63	2.51
Orissa	-9.30	-21.36	12.07	Orissa	-4.64	-13.35	8.70
Punjab	-41.13	-46.69	5.56	Punjab	-55.91	-72.26	16.36
Rajasthan	-25.59	-19.57	-6.02	Rajasthan	-21.32	-27.52	6.20
Tamil Nadu	-42.31	-40.66	-1.65	Tamil Nadu	-37.05	-39.67	2.62
Uttar P	-30.08	-24.76	-5.32	Uttar P	-4.86	-15.11	10.24
W Bengal	-31.70	-60.33	28.63	W Bengal	-38.85	-30.08	-8.77

Table 3.8 Decomposition Results if Mean Expenditure in the 55th round of NSS is lowered by 4%

Head count Ratio in Rural Sector				Head Count Ratio in the Urban Sector			
states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-11.51	-0.12	-11.39	Andhra P	-19.97	-31.23	11.26
Assam	-5.72	-16.36	10.65	Assam	16.70	-47.53	64.23
Bihar	-19.97	-23.28	3.31	Bihar	-2.74	-19.09	16.35
Gujarat	-27.53	-35.68	8.14	Gujarat	-25.82	-36.14	10.32
Haryana	-53.49	-31.33	-22.16	Haryana	-44.72	-53.27	8.56
Karnataka	-30.74	-35.47	4.73	Karnataka	-25.31	-33.91	8.60
Kerala	-50.17	-54.34	4.16	Kerala	-8.34	-21.95	13.61
Madhya P	-6.95	-7.61	0.65	Madhya P	-15.10	-19.39	4.29
Maharash	-26.77	-20.26	-6.51	Maharash	-6.80	-9.37	2.58
Orissa	-4.86	-16.75	11.89	Orissa	-1.17	-9.88	8.71
Punjab	-36.19	-41.37	5.18	Punjab	-47.32	-64.36	17.04
Rajasthan	-21.13	-15.29	-5.84	Rajasthan	-16.50	-22.97	6.47
Tamil Nadu	-38.74	-37.05	-1.69	Tamil Nadu	-33.64	-36.20	2.56
Uttar P	-26.00	-20.75	-5.26	Uttar P	-0.63	-10.99	10.36
W Bengal	-27.17	-55.96	28.79	W Bengal	-34.25	-25.43	-8.82

*All change in % terms

Chapter 4: DECOMPOSING SPATIAL DIFFERENCES IN POVERTY

4.1 Introduction

In a vast country like India, poverty at the national level does not reflect significantly different poverty levels across different regions. For example, in 1999-00, the all-India head count ratio of poverty was about 25%. But in rural Orissa, the head count ratio was as high as 41%, whereas in rural Punjab it was as low as 8%. Given the vast differences in poverty levels across the country, it is important to understand the reasons underlying these differences. Do poverty levels across states differ because states have different mean income levels? If so, what would have been the poverty levels in the states if each state had experienced the same all-India mean income level? On the other hand, if the distribution of income also matters in determining poverty, then what would have been the poverty levels in the states if each state had a similar relative distribution of income, say the all-India distribution? In other words, what explains the difference in poverty levels across states, the difference in the mean level of income or the difference in the distribution of income? This chapter tries to answer these important questions.

In order to analyze the differences in poverty levels across the country we decompose the differences in poverty levels. There have been some attempts in the past to decompose the total change in poverty over a period of time (Kakwani & Subbarao (1990), Datt & Ravallion (1992), Dhongde (2005)). However in this paper, we decompose for the first time differences in poverty levels across states, within a country.[12] At a given point in time, for the year 1999-00, we decompose the total difference between state and national poverty levels and measure how much of this difference is due to the difference between state and national mean income levels and how much of it is due to the difference between state and national distributions of income. The

[12]A recent paper by Kolenikov & Shorrocks (2003) is based on a similar decomposition of poverty across the regions in Russia.

decomposition of poverty contributes important information, relevant to the ongoing debate about the impact of the rise in the mean income levels and changes in the distribution of income on poverty levels. It enables us to quantify the relative significance of the differences in state and national mean income levels as compared to the differences in state and national distributions of income, in explaining the differences in state and national poverty levels.

Our analysis concludes that, in India, differences in poverty levels across the states were largely due to differences in their mean income levels. Differences in the distribution of income were much less important. The results imply that states with poverty levels higher than the all-India level could have reduced poverty significantly by raising the state mean income level to the all-India mean income. On the other hand, if the poorer states were to redistribute their income such that the distribution of income resembled all-India income distribution, without changing their mean income levels, poverty in these states would have increased further. On the whole, spatial differences in poverty were chiefly explained by spatial differences in the mean income levels rather than by differences in the distributions of income.

Another novel feature of the analysis is the use of non-parametric kernel density to estimate poverty levels. The non-parametric method estimates income distribution directly, without assuming any particular functional form for the true distribution. The chapter contains a brief discussion of the use of this new technique in estimating poverty.

The chapter is organized as follows. Section 2 contains an explanation of the concepts involved in the decomposition of poverty. Section 3 contains a brief discussion of the non-parametric technique used to estimate poverty levels. The details of the data used in the study are given in Section 4. The results of the analysis are discussed in Section 5. Section 6 contains a summary of the conclusions.

4.2 Decomposition of Differences in Poverty Across States

The conventional notion of income poverty defines the poor as those people who earn income less than or equal to some benchmark level of income called the poverty line. Income poverty can be written as a function, $P(z, m, l)$, where z is the poverty line benchmark, m is the mean income level and l is the relative distribution of income, represented by the Lorenz curve.[13] Assuming a fixed poverty line, the poverty level in any state is given by $P(m_0, l_0)$ where m_0 is the mean income level of the state and l_0 is the Lorenz curve representing the relative distribution of income in the state.[14] Similarly, the poverty level of the nation as a whole is given by $P(m_1, l_1)$ where m_1 is the mean income level of the nation,[15] and l_1 is the Lorenz curve representing the income distribution of the nation. Note that any poverty measure thus defined is independent of the number of people since the scale of the population affects neither the mean income level nor the distribution of income, i.e. the Lorenz curve. The difference between poverty at the national and state levels is simply,

$$\Delta P = P(m_1, l_1) - P(m_0, l_0) \qquad (1)$$

The total difference in poverty at the two levels occurs because of a difference between the national and state mean income levels and/or a difference between the national and state distributions of income.

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[13] A Lorenz curve gives the relationship between the cumulative proportions of population to the cumulative proportion of income received when the population is arranged in an ascending order of income.

[14] Henceforth, for the sake of convenience, we will drop the word "relative" and simply use the term distribution of income. However, the reader is urged to note that a change or no change in the distribution of income is to be understood as a change or no change in the Lorenz curve representing the relative distribution of income.

[15] The national mean income level is equal to the population-weighted average of the state mean income levels.

The decomposition analysis helps us understand how much of the total difference in national and state poverty levels can be attributed to a difference between the two mean income levels and how much of it can be attributed to a difference between the two distributions of income. In order to conduct the decomposition, we need to construct "hypothetical" poverty levels. $P(m_1, l_0)$ tells us what would have been a state's poverty level if the state's mean had been the national mean, without any change in its distribution of income. On the other hand, $P(m_0, l_1)$ tells us what would have been a state's poverty level if there had been no change in the state's mean income level but its distribution of income had been the income distribution at the national level. Using these hypothetical poverty levels, the total difference between the state and national poverty can be decomposed in different ways. One way is to first change the state's mean income level and then change its distribution of income:

$$P(m_0, l_0) \rightarrow P(m_1, l_0) \rightarrow P(m_1, l_1) \qquad (2)$$

Another way is to first change the state's distribution of income and then change its mean income level:

$$P(m_0, l_0) \rightarrow P(m_0, l_1) \rightarrow P(m_1, l_1) \qquad (3)$$

The components of the decomposition obtained by following the first sequence will differ from those obtained by following the second sequence. Since there is no compelling reason to prefer one sequence to the other, we can take an average of their components.

Thus, the difference between the national and state poverty levels arising purely from a difference between their mean income levels is given by:

$$\Delta P(m) = \frac{P(m_1, l_0) - P(m_0, l_0)}{2} + \frac{P(m_1, l_1) - P(m_0, l_1)}{2} \qquad (4)$$

where an average is taken of two components; the first component gives the difference in poverty due to changes in the mean income, when distribution of income is held fixed at the state level and the second component gives the difference in poverty due to changes in the mean income, when distribution is held fixed at the national level. Similarly, the difference between the national and state poverty levels arising purely from a difference between their distributions of income is given by:

$$\Delta P(l) = \frac{P(m_1, l_1) - P(m_1, l_0)}{2} + \frac{P(m_0, l_1) - P(m_0, l_0)}{2} \qquad (5)$$

where an average is taken of two components; the first component gives the difference in poverty due to changes in the distribution of income, when mean income is held fixed at the national level and the second component gives the difference in poverty due to changes in the distribution of income, when mean income is held fixed at the state level.

By taking averages of the two components, the decomposition no longer depends on the sequence in which the mean income level and the distribution of income are changed, i.e., the decomposition becomes path independent. Also, the changes in the mean income level and the changes in the distribution of income fully explain the total change in the poverty level, i.e., the decomposition is exact and has no residual.[16] Thus, the total difference in poverty can be decomposed into a mean component and a distribution component:

$$\Delta P = \Delta P(m) + \Delta P(l) \qquad (6)$$

The following example illustrates the decomposition procedure explained above. In 1999-00, in the rural sector of Bihar the head count ratio of poverty $P(m_0, l_0)$ was 40.62% while all-India head count ratio $P(m_1, l_1)$ was 25.19%. If Bihar had raised its mean income levels to the all-India income level, keeping fixed the state distribution of income, the head count ratio in

[16] Shorrocks (1999) shows the links between this method of decomposition to the Shapley value solution in cooperative game theory. Footnote 3 in his paper asserts that this is the only method of decomposition which satisfies the following requirements: the decomposition to be path independent; the decomposition to be complete; and the components of the decomposition to be given by the marginal effect of changing one factor, holding constant all the other factors.

Bihar $P(m_1,l_0)$ would have declined to nearly 17.19 %. On the other hand, if Bihar had adopted the all-India distribution of income, keeping its mean level constant, the head count ratio $P(m_0,l_1)$ would have increased to 47.62%. Thus the total difference between national head count ratio and Bihar's head count ratio was $\Delta P = 25.19\% - 40.62\% = -15.43\%$. Out of this total difference, the average contribution of the mean component was:

$$\Delta P(m) = \frac{17.19\% - 40.62\%}{2} + \frac{25.19\% - 47.62\%}{2} = -22.93\%$$

The average contribution of the distribution component was:

$$\Delta P(l) = \frac{25.19\% - 17.19\%}{2} + \frac{47.62\% - 40.62\%}{2} = 7.50\%$$

4.3 Non-Parametric Estimation of Poverty

In this chapter, we decompose the head count ratio of poverty.[17] The head count ratio is the most common and easy to interpret measure of poverty. It gives the proportion of the population earning income less than or equal to the poverty line income level. The head count ratio can be obtained as a cumulative sum of the density of population earning income below the poverty line. Thus to calculate the head count ratio of poverty one needs to estimate the distribution of income. We estimate the distribution of income by using the Non Parametric technique.

Given data on individual income levels in each state, one can estimate the income distribution by specifying a parametric functional form, typically a lognormal distribution. A disadvantage of the parametric method is the need to assume that the actual income density is indeed lognormal or some such function. This may not always be true. For example, most of the

[17] Although our analysis focuses on the head count ratio of poverty, it can be easily extended to include other poverty measures such as the poverty gap or the squared poverty gap.

studies on India have employed a two parameter lognormal distribution to fit income distribution (Minhas et al. (1987)). But the lognormal distribution tends to overcorrect the positive skewness of the income distribution and thus fits poorly to the actual data (Kakwani & Subbarao (1990)). The non-parametric approach instead estimates distribution directly from the given data, without assuming any particular form.

Let x_i $(i = 1,2,....n)$ be a continuous random variable representing income. The density at any income level x given by $f(x)$, is estimated by the probability that x_i lies in an interval around x, say, $x - \frac{h}{2} \leq x_i \leq x + \frac{h}{2}$ where h is the width of the interval. Let $\phi_i = \frac{x_i - x}{h}$, then the interval can be rewritten as $-\frac{1}{2} \leq \phi_i \leq \frac{1}{2}$. A simple way to measure the head count ratio of poverty is by plotting the histogram. The histogram is a naïve estimate of income distribution and is given by $\hat{f}_1(x) = \frac{1}{nh}\sum_{i=1}^{n} I\left(-\frac{1}{2} \leq \phi_i \leq \frac{1}{2}\right)$ where I is an indicator function. I takes the value one if ϕ_i lies in the above interval and takes the value zero otherwise. However, the histogram contains jumps at each income interval and so gives a discontinuous estimate of income distribution. In order to obtain a continuous estimate of the distribution in a non-parametric way, a kernel is often used. The Rosenblatt-Parzen kernel estimate of the distribution is given by

$\hat{f}_2(x) = \frac{1}{nh}\sum_{i=1}^{n} K(\phi_i)$ where K is a real positive kernel function satisfying the property $\int_{-\infty}^{\infty} K(\phi)d\phi = 1$ and $K(\phi)$ is small for large values of $|\phi_i|$. Since the properties that a kernel function is required to satisfy are similar to those satisfied by a density function, kernels are often chosen to be well known density functions. In this chapter, we choose the standard normal density function as the kernel $K(\phi)=\frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}\phi^2\right)$. Optimal h is chosen such that $\hat{f}(x)$ is as close as possible to the true density, $f(x)$. The most common criterion is to minimize the integrated mean squared error given by $E\left[\int_{-\infty}^{\infty}\left(\hat{f}(x)-f(x)\right)^2\right]$. Using the criterion of minimizing the integrated mean square error to choose the optimal window width h we approximate h as $h \cong 1.06\sigma n^{-\frac{1}{5}}$ where σ denotes the standard deviation of income and n denotes the sample size[18]. Thus, we estimate income density by using the non-parametric kernel method. The head count ratio of poverty is obtained as the sum of the estimated densities, till the poverty line income level is reached. Table 4.4 and 4.5 show the estimated headcount ratios for each state in the rural and the urban sectors respectively.

4.4 Data

The difference between national and state headcount ratio is decomposed for a given point in time, namely, for the year 1999-00. We chose this year, because it is the latest year for which the National Sample Survey (NSS) data is available. The National Sample Survey Organization is a unified agency under the Department of Statistics, Government of India, and is one of the chief agencies providing reliable data since 1972.

Although in the discussion in this chapter income levels are used, the NSS data is available in fact on consumer expenditure levels. Hence, when estimating poverty, income is replaced by consumption expenditure. The expenditure series is not only more stable than the

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[18] Software packages which implement non parametric density estimation (SAS,Shazam,STATA) use $h \cong 1.06\sigma n^{-\frac{1}{5}}$ as the default window width. For a detailed discussion on the choice of optimal kernel and window width, see Pagan & Ullah, (1999).

income series but also the difference between the income and expenditure series narrows down considerably for the poor. We use the per capita consumption expenditure data from the 30-day recall schedule of the 55th round of the NSS, which is available separately for the rural and urban sectors of each state[19]. Out of a total of 26 states, our analysis includes 15 major states (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal),[20] which account for nearly 97% of the total population of the country.

The data records per capita expenditure in each state at the nominal value. However, at any given point in time, prices differ significantly across states,[21] and, hence, nominal expenditure levels cannot be compared directly. In order to make meaningful comparisons across the states we adjust nominal expenditure levels by using the poverty line price deflator, i.e. the nominal expenditure levels in each state are scaled by the ratio of the state poverty line to the all-India poverty line. Table 4.1 gives the price deflators used to convert nominal expenditure levels to real expenditure levels for each state in each sector. Since expenditure levels across states are made comparable at the national level, all-India poverty line is used to measure the head count ratio in each state. All-India rural poverty line of Rs.327 per capita per month is used to measure poverty in the rural sector of every state and all-India urban poverty line of Rs.454 per capita per month is used to measure poverty in the urban sector of every state. These poverty lines have been prescribed by the Planning Commission of India.

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[19] The raw data of the 55th NSS round for the year 1999-00 was made available by UNU/WIDER, Helsinki.

[20] The states of Bihar, Madhya Pradesh and Uttar Pradesh refer to the ones before the formation of the new states of Jharkhand, Chattisgarh, and Uttaranchal in late 2000.

[21] Prices, especially those of foodgrains may differ widely across states as free trade of agricultural products across state boundaries can be restricted by the State Governments by enforcing the Essential Commodities Act.

Table 4.2 shows the ranking of the states in terms of the real mean expenditure levels. In both the rural and the urban sectors, Punjab, Haryana and Tamil Nadu were among the rich states while Bihar, Orissa and Uttar Pradesh were the poorer states. Compared to the urban sector, the rural sector had more number of states with mean income levels higher than the all-India average.

Table 4.3 shows the ranking of the states in terms of the Gini coefficient of the distribution of expenditure. The Gini coefficients are estimated from the raw data since no price adjustment is required for calculating the Gini coefficients. In Assam, Gujarat, Haryana and Rajasthan distribution of income was fairly equal in both the sectors, while Kerala, Maharashtra, Tamil Nadu and Karnataka had a relatively unequal distribution of income as measured by the Gini coefficient. It is rather surprising that in Kerala, especially in the rural sector, the Gini coefficient (0.32) was highest among all the states though Kerala also had high mean income levels and low poverty levels. [22] Although Kerala has often been cited for its commendable achievements in the fields of education and health care, it is rather surprising, why there has been no mention in the literature of the high income inequality levels prevalent in the state. Overall, in the rural sector, the mean income levels were positively correlated with the Gini coefficients (+0.5), indicating that poorer states had a more equal distribution of income compared to the richer states. In the urban sector, the correlation was weak. It was only slightly negative (-0.2) suggesting that richer states also had lower income inequality.

[22] The high Gini coefficient in rural Kerala is not a peculiarity of the data collected for 1999-00, but it is persistently seen over the last few years. The Gini coefficient in rural Kerala was one of the highest in 1993-94 and was recorded as 0.3 in Dreze & Sen, (2002). In 1983, too, rural Kerala's Gini coefficient was as high as 0.37, see Mishra & Parikh (1997). However, note that all the estimates of the Gini coefficient quoted above are based on the per capita consumption expenditure data of the NSS. Hence the relatively widespread provision of public goods in Kerala as compared to the other states is not accounted for and so the Gini estimates of inequality are likely to be biased upwards.

4.5 Results of the Decomposition

Table 4.4 shows the decomposition of the head count ratio across the states in the rural sector and Table 4.5 shows the decomposition of the head count ratio across the states in the urban sector.

4.5.1 Worse Performing States in the Rural Sector

In the rural sector, 6 out of 15 states experienced poverty levels higher than the all-India poverty level. These included the states of Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal.

The decomposition of the difference between the state and national poverty levels shows that the main reason underlying the high levels of poverty in these states was the low level of mean income compared to the all-India mean income. If these states had raised their mean income levels to the all-India level without changing the distribution of income, poverty in these states would have declined below the all-India poverty level. On the other hand, if these states had changed the distribution of income to the all-India distribution, without raising the mean income levels, poverty in these states would have risen above their actual poverty levels.

For example, consider the state of Bihar (Table 4.4). The rural head count ratio in Bihar was 40.62 % as compared to the all-India ratio of 25.19 %. If Bihar had raised its mean income levels to the all-India income level, keeping fixed the state distribution of income, the head count ratio in Bihar would have declined from 40.62% to nearly 17.19 %, which is lower than the all-India head count ratio. On the other hand, if Bihar had adopted the all-India distribution of income, keeping its mean level constant, the head count ratio would have increased to 47.62%, which is above the actual head count ratio in Bihar. Thus, in this sense, Bihar had a better distribution of income than all-India and high levels of poverty in the state were mainly due to low levels of income. In fact like Bihar, all the other poorer, worse performing states had a better distribution of income than all-India and the high poverty levels in these states were chiefly due to low mean income levels.

4.5.2 Worse Performing States in the Urban Sector

In the urban sector, 7 out of 15 states experienced poverty levels higher than the all-India poverty level. These included the states of Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Orissa and Uttar Pradesh.

All these states had mean income levels lower than the all-India level. Poverty in these states would have declined significantly had these states achieved all-India mean income level. However, instead of raising income to the all-India levels, had these states changed their distribution of income so that it resembled all-India distribution of income, poverty in the states would have increased. Thus, though the states had low income levels, distribution wise, most of the states were "better off" than all-India.

Note that lower value of the Gini coefficient does not imply lower value of the head count ratio of poverty. For example, Orissa had a lower Gini coefficient than all-India Gini coefficient. Given this fact, one would be tempted to think that if Orissa had adopted all-India distribution of income, poverty in Orissa would have increased. On the contrary, the decomposition analysis reveals that poverty in Orissa would have declined if it had adopted all-India distribution of income without changing the mean income level. This is because the Gini coefficient is a summary measure of inequality and it depends on the shape of the entire Lorenz curve, while the headcount ratio of poverty is calculated using only one segment of the Lorenz curve. In order to answer the counterfactual question of what would have been the poverty levels for different distributions of income, we need to calculate hypothetical poverty levels.

On the whole, in both the rural and the urban sector, it is seen that a rise in the poorer states' mean income level to the all-India level would have reduced the gap between the state and national poverty levels. However, if instead, the poorer states had adopted the all-India distribution of income without changing their mean income levels, the gap between the state poverty levels and the national poverty level would have, in most cases, increased further.

4.5.3 Better Performing States in the Rural Sector

In the rural sector, 9 out of 15 states had poverty levels lower than all-India poverty level. The better performing states included the states of Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan and Tamil Nadu.

All of these states had mean income levels higher than the all-India mean income. In most of the states, the high mean income levels experienced by these states explained more than 50% of the total difference between the state and national poverty levels. Most of these states also had a more equal distribution of income than all-India, in the sense that keeping the mean income constant, if the states' distributions of income had changed to the all-India distribution, poverty in these states would have increased.

Important exceptions were the states of Kerala, and Tamil Nadu. Had these rich states changed their distribution of income to all-India distribution, without changing their mean income levels, poverty in these states would have declined. Thus, despite being richer than all-India, these states would have reduced their poverty levels further by adopting the all-India distribution of income.

4.5.4 Better Performing States in the Urban Sector

In the urban sector, 8 out of 15 states had poverty levels lower than the all-India poverty levels. These included the states of Assam, Gujarat, Haryana, Kerala, Punjab, Rajasthan, Tamil Nadu and West Bengal.

All of these states, except for Rajasthan, had mean income levels higher than the all-India mean income. But in richer states like Punjab, Haryana and Gujarat the high level of mean income was not the only reason for the low level of poverty. The distribution component of the decomposition was equally important. In other words, a substantial part of the difference between the state and national poverty levels was accounted for by the difference between the state and national distributions of income. Thus as noted earlier, the rich states also had a better distribution of income compared to the all-India distribution.

Another example where the distribution of income played an important role was in the state of Rajasthan. The mean income level in urban Rajasthan was lower than the all-India mean income. Yet poverty in this state was also lower than all-India poverty, due to a fairly equal distribution of income.

Thus, in both the rural and the urban sectors, better performance of the states in terms of poverty levels was explained mainly because these states had higher than average mean income levels. In the urban sector, the lower poverty levels were also partly explained by a better distribution of income compared to the all-India distribution.

4.6 Conclusions

The performance of the states in terms of the mean income level, the distribution of income and the poverty levels varies significantly across India. In this chapter we conduct, for the first time, a spatial decomposition of poverty, to measure how much of the total difference in state and all-India poverty levels is due to a difference between their mean income levels and how much of it is due to a difference between their distributions of income.

We find that the difference between the state and national levels of poverty is largely explained by a difference in the state and national mean income levels. In all cases, except urban Rajasthan, higher than average mean income levels implied lower than average poverty levels and vice versa. On the whole, differences in the state and all-India distribution of income were less important in explaining differences in poverty levels. However, there were a few important exceptions. Especially, in the urban areas of Punjab, Haryana and Gujarat, low levels of poverty were results of not only higher income levels, but also of a "better" distribution of income.

The analysis has interesting implications. In 1999-00, many states in India had a higher incidence of poverty compared to the all-India ratio. The number of poor in these states would have declined significantly had these states raised their mean income levels to the all-India level without altering the distribution of income. In contrast, had these states adopted the all-India distribution of income, without changing the mean income levels, poverty in most of the states would have increased. Of course, the question whether in each state the required changes in the mean income level and the distribution of income were politically feasible, remains open. Nevertheless, the decomposition analysis provides important information by revealing the fact that in India, differences in the state and national mean income levels were relatively more significant compared to differences in the distributions of income, in explaining the differences in state and national poverty levels.

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Table 4.1 Poverty Line Price Deflator for Interstate Price Comparisons in 1999-00

States	Rural		Urban	
	Pov. Line	Deflator	Pov. Line	Deflator
Andhra Pradesh	262.94	0.80	457.40	1.01
Assam	365.43	1.12	343.99	0.76
Bihar	333.07	1.02	379.78	0.84
Gujarat	318.94	0.97	474.41	1.04
Haryana	362.81	1.11	420.20	0.93
Karnataka	309.59	0.95	511.44	1.13
Kerala	374.79	1.14	477.06	1.05
Madhya Pradesh	311.34	0.95	481.65	1.06
Maharashtra	318.63	0.97	539.71	1.19
Orissa	323.92	0.99	473.12	1.04
Punjab	362.68	1.11	388.15	0.85
Rajasthan	344.03	1.05	465.92	1.03
Tamil Nadu	307.64	0.94	475.60	1.05
Uttar Pradesh	336.88	1.03	416.29	0.92
West Bengal	350.17	1.07	409.22	0.90
All India	**327.56**	**1.00**	**454.11**	**1.00**

*Deflator is the ratio of state poverty line to all-India poverty line. All the poverty lines used have been prescribed by the Planning Commission of India

Table 4.2 Mean Per Capita Expenditure Levels Across the States in 1999-00

States	Rural Mean (Rs)	States	Urban Mean (Rs)
Punjab	725	Assam	1117
Kerala	712	Punjab	1105
Haryana	657	Haryana	1044
Tamil Nadu	613	West Bengal	1008
Andhra Pradesh	604	Tamil Nadu	952
Gujarat	592	Kerala	913
Karnataka	583	Gujarat	850
Rajasthan	547		
Maharashtra	534		
All India	**515**	**All India**	**841**
Uttar Pradesh	485	Andhra Pradesh	808
West Bengal	471	Maharashtra	808
Madhya Pradesh	463	Rajasthan	789
Orissa	415	Karnataka	786
Assam	405	Bihar	776
Bihar	404	Uttar Pradesh	751
		Orissa	676
		Madhya Pradesh	676

* Real mean levels after adjusting for interstate price differences

Table 4.3 Gini Coefficient of Expenditure Levels Across the States in 1999-00

States	Rural Gini	States	Urban Gini
Kerala	0.32	Tamil Nadu	0.40
Tamil Nadu	0.31	West Bengal	0.36
		Maharashtra	0.35
All India	**0.28**	**All India**	**0.34**
Karnataka	0.28	Bihar	0.34
Maharashtra	0.27	Kerala	0.34
Madhya Pradesh	0.27	Karnataka	0.34
Punjab	0.27	Andhra Pradesh	0.33
Orissa	0.26	Orissa	0.33
Uttar Pradesh	0.26	Uttar Pradesh	0.33
Andhra Pradesh	0.26	Madhya Pradesh	0.33
West Bengal	0.26	Assam	0.31
Gujarat	0.24	Gujarat	0.30
Haryana	0.24	Rajasthan	0.30
Bihar	0.23	Punjab	0.29
Rajasthan	0.23	Haryana	0.28
Assam	0.22		

*Gini Coefficients calculated using NSS data.

Table 4.4 Decomposing Spatial Differences in Head Count Ratio in the Rural Sector

States	Head ct Ratio (%)	Total Difference	Mean Compon	Distrib Compon
Orissa	40.96	-15.77	-18.95	3.18
Bihar	40.62	-15.43	-22.93	7.50
Assam	37.46	-12.27	-21.38	9.11
Madhya Pradesh	32.96	-7.77	-9.54	1.77
West Bengal	28.35	-3.16	-4.87	1.71
Uttar Pradesh	27.43	-2.24	-5.54	3.30
All India	**25.19**	**0.00**	**0.00**	**0.00**
Maharashtra	21.96	3.23	1.79	1.44
Tamil Nadu	18.98	6.21	10.23	-4.03
Karnataka	16.38	8.81	7.58	1.23
Rajasthan	12.98	12.21	3.33	8.88
Kerala	12.88	12.31	17.41	-5.11
Gujarat	12.40	12.79	7.79	5.00
Andhra Pradesh	11.76	13.43	9.43	4.00
Haryana	8.40	16.79	12.90	3.90
Punjab	7.91	17.28	16.71	0.57

* Total difference is difference between the all-India and the state head count ratios.

Table 4.5 Decomposing Spatial Differences in Head Count Ratio in the Urban Sector

States	Head ct Ratio (%)	Total Difference	Mean Compon	Distrib Compon
Orissa	36.71	-11.73	-11.00	-0.72
Madhya Pradesh	36.47	-11.49	-13.23	1.74
Uttar Pradesh	29.88	-4.90	-5.98	1.08
Bihar	29.42	-4.43	-4.15	-0.29
Maharashtra	28.68	-3.69	-1.83	-1.86
Karnataka	27.20	-2.22	-3.15	0.93
Andhra Pradesh	26.35	-1.37	-1.95	0.58
All India	**24.98**	**0.00**	**0.00**	**0.00**
Tamil Nadu	23.81	1.17	2.92	-1.75
Rajasthan	21.39	3.59	-3.09	6.68
Kerala	20.25	4.74	3.73	1.00
Gujarat	17.82	7.16	0.54	6.63
West Bengal	16.49	8.49	8.45	0.04
Assam	9.54	15.44	10.38	5.06
Haryana	8.61	16.38	7.31	9.06
Punjab	6.90	18.08	9.90	8.18

* Total difference is difference between the all-India and the state head count ratios

Chapter 5: TESTING CONVERGENCE IN INCOME DISTRIBUTION

5.1 Introduction

The seminal paper on convergence in per capita income level was written by Barro and Sala-i- Martin (1992). This paper was followed by numerous other papers, all of which were focused on analyzing the convergence in income levels across different countries. However it is known that the neoclassical growth model (Ramsey (1928), Solow (1956), Cass (1965) and Koopmans (1965)) implies convergence in the distribution of income. Per capita income is only the first moment of each country's income distribution. Benabou (1996) pointed out that, once augmented with idiosyncratic shocks most versions of the neoclassical growth model imply convergence in the entire distribution of income, not just in the mean income level. States, regions or countries with similar fundamentals and preferences should converge to the same distribution of income. Benabou noted (pp.59) "the issue of convergence in distribution is an important and essentially unexplored topic for empirical research."

In the past few years, there has been some work done to test convergence in income distribution. Benabou (1996) tested for beta convergence of Gini coefficients. He used Deininger and Squire (1995) and Luxembourg Income Study (LIS) dataset on Gini coefficients of different countries. He found evidence of unconditional convergence in income inequality levels across countries from 1970 to 80, but found no such evidence from 1980 to 90 and 1970 to 90. Panizza (2002) tested convergence in income distribution across 48 states in the US for the period from 1940 to 1980. He used the Ordinary Least Squares Method (OLS) and the Generalized Method of Moments (GMM) and found strong support for convergence in income distribution across the American states. Bleanney et al (2003) extended Benabou's data set by using the WIID (2000) data on Gini coefficients across countries. They found that the speed of convergence was different for advanced and developing countries and that convergence was much faster in advanced countries.

Ravallion (2003) explored the possibility that the speed of convergence can be biased due to measurement error in the initial inequality measure. Under (over) estimating the initial level of inequality would lead to over (under) estimation of the subsequent trend. He tested convergence across countries by correcting the measurement error in the initial Gini coefficients. He found that the correction had little effect on the speed of convergence of Gini coefficients across countries.

In this chapter, we build upon Ravallion's model to correct measurement error. Ravallion tested the hypothesis that the trend in inequality depends on its initial level. He assumed a linear relationship between the trend and initial inequality. Convergence is seen if the trend in inequality is inversely related with the initial inequality levels. However, the assumption of linearity in trend is restrictive and implies that the rate of change in trend is independent of the initial level of inequality. But this may not necessarily be true since Gini coefficients differ significantly across countries. In this paper we work with a more general setting. We assume a non-linear (quadratic) relationship between the trend and initial inequality. Thus we allow the rate of change in the trend and consequently the speed of convergence to vary across countries or states.

We study convergence in the distribution of income across the states in India over a period of four decades, from the 1960s to the 1990s. Cross-country data on Gini coefficients is plagued by several problems and inconsistencies. In some countries, Gini coefficients are measured using data on income levels while in other countries they are measured by using data on expenditure levels. Often, the years for which the Gini values are calculated vary from one country to another. Usually, researchers have to interpolate the missing data. Also, though data on Gini coefficients is available for several countries, there are at the most two to three years for which all the countries have consistent observations. This puts restrictions on estimation methods using panel data. Furthermore, convergence in income distribution occurs for countries with similar fundamentals. However cross-country data sets include several different countries, which hardly share any common features. The hypothesis of convergence makes more sense when it is tested for states or regions within a country rather than across countries. The states in India differ in their economic performance but they share several common economic features owing to the federal structure of the country. We test for convergence in Gini coefficients across the states in India. The data set taken from Jha (2000) contains information on Gini coefficients across 14 major states in India, consistently collected over nearly four decades, from 1959 to 1997. It covers the rural and the urban sectors of the states of Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal, which combined together consist of more than 80% of the population of the country. Values of the Gini coefficients for all states are calculated using the same data source i.e. per capita expenditure levels collected by the National Sample Survey Organization of India (NSS).

In the past, a lot of research has been done to study convergence in income levels across the different states in India. However, the focus of these studies has been on testing convergence in the per capita state domestic product, i.e. the average income levels of states. There is no consensus whether average income levels across states have converged over a period of time.[23] In this chapter, instead of average income levels we study convergence in the entire distribution of income for different states in India.

We test the convergence hypothesis by using three different methods: the conventional method, which does not take into account the possibility of measurement error, Ravallion's method, which corrects for measurement error by assuming a linear trend in income inequality

[23] Singh et al (2000) provides a good survey of literature on the convergence in income levels across the states in India.

and our method, which corrects for measurement error by assuming a quadratic trend in income inequality. All three tests give results that are qualitatively similar. In India, in the rural sector, we find no evidence of convergence across states. This result is in contrast to the results obtained for other countries. Most of the studies mentioned earlier have found evidence of convergence among Gini coefficients across countries and also among Gini coefficients across different states in the US. In India, we find that though inequality has declined in the rural sector, the distribution of income seems to have diverged across the states. In the urban sector, contrary to the rural sector, we find that income distribution across the states has converged though the overall level of income inequality has not changed significantly.

The chapter is organized as follows. In Section 2, different methods used to test convergence are discussed and corresponding equations are outlined. Section 3 provides information on the data used. The results of the chapter are discussed in Section 4. Section 5 concludes.

5.2 Convergence Tests

We use three different methods to test convergence across the states in India. All the methods are based on the concept of beta convergence. Testing for beta convergence involves regressing changes in income inequality over time on the initial inequality levels across different states. If we see that inequality falls in high initial inequality countries and rises in low initial inequality countries, then we find evidence for convergence among countries towards a common distribution.

5.2.1 Conventional Approach

Benabou (1996) proposed a simple method to test for convergence in income distribution. Let G_{it} denote observed Gini coefficient. Let $i = 1,2,......,N$ denote number of states and $t = 0,1,.....,T$ denote number of years. For any state i, G_{iT} is the Gini coefficient observed at time $t = T$ e.g. G_{i0} is the Gini coefficient for state i observed at time $t = 0$. To test for convergence we estimate the following regression:

$$(G_{iT} - G_{i0}) = \alpha + \beta G_{i0} + u_i \quad (1)$$

where u_i is a zero mean error term. Income distribution is said to converge if the slope coefficient is negative $(\beta < 0)$ and is said to diverge if the slope coefficient is positive $(\beta > 0)$. Note that to test for beta convergence by this conventional method one does not require panel type of data. Equation (1) is estimated by using only the initial and final values of the Gini coefficients for each state.

5.2.2 Assuming Linear Trend in Income Inequality

Ravallion (2003) pointed out that possible measurement error in the initial inequality would bias the test in the direction of suggesting convergence. Under (over) estimating the initial level of inequality would lead to over (under) estimation of the subsequent trend. To correct the measurement error he suggested the following model. Let G^* be the true value of the Gini index. Each state is assumed to have an underlying trend, T_i, in inequality, so that:

$$(G^*_{it} - G^*_{i1}) = T_i(t-1) + v_{it} \quad (3)$$

where v_{it} is a zero-mean innovation error term. The observed Gini coefficient is given by:

$$G_{it} = G^*_{it} + \varepsilon_{it} \quad (4)$$

where ε_{it} is a zero-mean and serially independent measurement error. Assume that the trend follows a linear relationship of the form:

$$T_i = \alpha + \beta G^*_{i1} + \mu_i \tag{5}$$

where μ_i is zero-mean innovation error term. Combining equations (3), (4) and (5) we get the following equation:[24]

$$(G_{it} - G_{i1}) = (\alpha + \beta G_{i1})(t-1) + e_{it} \tag{6}$$

$$i = 1,\ldots\ldots., N; t = 2,\ldots\ldots., D$$

where the error term e_{it} is heteroskedastic and is given by

$$e_{it} = v_{it} + (\varepsilon_{it} - \varepsilon_{i1}) + (t-1)(\mu_i - \beta\varepsilon_{i1}) \tag{7}$$

Note that since ε_{i1} jointly influences G_{i1} and e_{it}, $\text{cov}(G_{i1}, e_{it}) \neq 0$, hence OLS estimate of β in equation (6) is inconsistent. Hence Ravallion estimates equation (6) by using G_{i0} as the instrumental variable under the assumption that the errors in measuring inequality are serially independent.

The hypothesis to be tested is that the trend in inequality depends on its initial level. From equation (5), we get:

$$\frac{dT_i}{dG^*_{i1}} = \beta \tag{8}$$

If the initial level of inequality is inversely related with the trend $(\beta < 0)$ i.e. for initially high levels of inequality, the trend in inequality declines, and for initially low levels of inequality the

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[24] We also test a more general form of equation (6) with a lag dependent variable given in Ravallion (2003).

$$(G_{it} - G_{i1}) = \phi(G_{it-1} - G_{i0}) + \alpha(1-\phi)(t-1) + \beta(t-1)G_{i1} + \beta\phi(1-t)G_{i0} + u_{it}$$

But as is the case in Ravallion's paper, we too fail to reject the null hypothesis that $\phi = 0$ and hence use the simpler version.

trend increases, then countries will tend to converge towards a common distribution and if $(\beta \geq 0)$ then countries will diverge. Since Ravallion assumes the trend to be a linear function of initial inequality, the rate of change in trend T_i is constant and is equal to (β) for all levels of initial inequality G^*_{i1}.

$$\frac{d^2 T_i}{dG^{*}_{i1}{}^2} = 0 \tag{9}$$

However this may not be true. The change in the trend may differ across countries depending on the initial level of inequality.

5.2.3 Assuming Quadratic Trend in Income Inequality

We relax the assumption of a linear trend made by Ravallion. We assume instead a quadratic trend and substitute equation (5) by equation (5'):

$$T_i = \alpha + \beta G^*_{i1} + \gamma G^*_{i1}{}^2 + \mu_i \tag{5'}$$

where μ_i is zero-mean innovation error term. Combining equations (3), (4) and (5') we get the following equation:

$$\left(G_{it} - G_{i1}\right) = \left(\alpha + \beta G_{i1} + \gamma G_{i1}{}^2\right)(t-1) + u_{it} \tag{6'}$$

$$i = 1, \ldots\ldots, N; t = 2, \ldots\ldots, T$$

where the error term u_{it} is heteroskedastic and is given by

$$u_{it} = v_{it} + \left(\varepsilon_{it} - \varepsilon_{i1}\right) + \left(t-1\right)\left(\mu_i - \beta\varepsilon_{i1} + \gamma\varepsilon_{i1}{}^2 - 2\gamma G_{i1}\varepsilon_{i1}\right) \tag{7'}$$

Here again we see that ε_{i1} jointly influences G_{i1} and u_{it}, hence OLS estimate of β and γ will be inconsistent. We estimate equation (6') by using G_{i0} and G_{i0}^{2} as instrumental variables. From equation (5'), we see that the rate of change in trend now depends on the initial inequality level:

$$\frac{dT_i}{dG^{*}_{i1}} = \left(\beta + 2\gamma G^{*}_{i1}\right) \qquad (8')$$

Since G^{*}_{i1} is the unobserved true value of the initial Gini coefficient we take the expectation of the above equation:

$$E\left(\frac{dT_i}{dG^{*}_{i1}}\right) = \left(\beta + 2\gamma E\left(G^{*}_{i1}\right)\right) = \beta + 2\gamma G_{i1} \qquad (8'')$$

Thus the rate of change in trend T_i is no longer a constant but depends on the level of initial inequality G_{i1}.

$$E\left(\frac{d^2 T_i}{dG^{*}_{i1}{}^{2}}\right) = 2\gamma \qquad (9')$$

The trend will change (fall or rise) at an increasing rate if $(\gamma > 0)$ or at a diminishing rate if $(\gamma < 0)$ and so the speed of convergence will vary depending on the initial level of inequality. Thus assuming a non-linear trend provides us with additional information on convergence.

If we average over the different initial levels of inequality across states in equation (8''), we get:

$$\frac{1}{N}\sum_{i=1}^{N} E\left(\frac{dT_i}{dG^{*}_{i1}}\right) = \frac{1}{N}\sum_{i=1}^{N}\left(\beta + 2\gamma G_{i1}\right) = \beta + 2\gamma \overline{G}_{\_1} \qquad (8''')$$

where $\overline{G}_{\_1}$ is the average Gini coefficient across all different states at time $t = 1$. Now we can test the hypothesis whether the change in trend in inequality depends on the average initial level. If for an initially high level of inequality, the trend in inequality declines, and for an initially low level of inequality the trend increases, i.e. $\left(\beta + 2\gamma \overline{G}_{\_1}\right) < 0$ then states will converge towards a common distribution and if $\left(\beta + 2\gamma \overline{G}_{\_1}\right) \geq 0$ then income distribution across the states will diverge.

5.3 Data

As discussed in the introduction, data on cross-country income inequality is plagued by several problems. Firstly there are very few estimates of Gini coefficients available over time for each country, secondly the specific years for which the estimates are available differ from country to country and thirdly some countries use income levels while others use expenditure levels to compute the Gini coefficients. Benabou (1996) calls for further research on convergence of income distribution by using better data sets "looking across states or regions". In an attempt to avoid problems associated with cross-country data, we focus on Gini coefficients across different states in India. We use the data set on Gini coefficients provided in Jha (2000). This is a panel data set covering 14 major states in India for 25 different years; starting from 1959 till 1997.[25] Within each state, Gini coefficients are calculated separately for the rural and the urban sectors. Values of the Gini coefficients for all states are calculated using the same data source, i.e. per capita expenditure levels collected by the National Sample Survey Organization of India (NSS). Note that in order to calculate Gini coefficients, expenditure levels need not be adjusted for differences in prices across different states or differences in prices over the years.

[25]Although the actual time span from 1959 to 1997 consists of 39 years, we have a total of 25 observations because data on Gini coefficients for some years in between is not available in the data set.

5.4 Results

Table 5.1 gives the summary statistics for the average All-India Gini coefficient for the rural sector and the urban sector. The average is taken across states, $\overline{G}_{\_t} = \frac{1}{N}\sum_{i=1}^{N} G_{it}$ for each year, $t = 0,1,.....25$. It is seen that in both the rural and the urban sector, the average Gini coefficients did not vary significantly from 1959 to 1997. The standard deviation was quite low and was equal to 1.56 in the rural sector and 1.28 in the urban sector. Other papers studying income inequality in India also find significantly low variation in the Gini coefficients across the states in India during this period (Li et al, 1998, Jha, 2000, Singh et al, 2002). Thus, over the past four decades income distribution in India has been fairly stable and has not undergone drastic changes. Comparing between two sectors, we find that the Gini coefficient was higher in the urban sector than in the rural sector, indicating higher levels of income inequality in the urban sector compared to the rural sector. Figures 5.1 and 5.2 show the movement of the average Gini coefficient from 1959 to 1997, in the rural sector and in the urban sector respectively. In the rural sector, the Gini coefficient, declined over the period of time whereas it did not decline much over the same period of time in the urban sector.[26]

Looking beyond the averages, we summarize the state specific features of income inequality as follows. In the rural sector, Rajasthan and Kerala were two states with high inequality levels. In these two states the Gini coefficient was the highest among all states for most of the years. In Assam inequality was among the lowest throughout the period. In the urban sector, the states of Maharashtra and Kerala had high levels of inequality while the Gini coefficient was among the lowest most often in Assam, Gujarat and Punjab. Among all the states,

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[26] We estimated a simple regression equation $\overline{G}_{\_t} = \alpha + \beta t + e$. We found that in the rural sector the slope coefficient for this equation is negative and significant at 5% level whereas in the urban sector it is negative but insignificant at 5% level.

in both the rural and the urban sector, Andhra Pradesh had the least variance in the Gini coefficient over the four decades.

We test for convergence in Gini indices by using the different methods discussed above. We find that the qualitative results are robust to the method adopted. There is no evidence of convergence in the Gini coefficients across states in the rural sector in contrast to significantly strong convergence in Gini coefficients across states in the urban sector.

Tables 5.2 and 5.3 give parameter estimates for different tests of convergence for the rural sector and the urban sector respectively. Results are also given for the log of Gini coefficients. The conventional method (Benabou 1996) of testing convergence as given in equation (1) needs only cross-sectional data and uses 14 observations, one observation per state. However, the other two methods given in equation (6) and equation (6') assuming a quadratic trend, use cross-sectional as well as time series data, leading to a considerable increase in the number of observations included (total of 322 observations). Both these tests deal with the problem of measurement error. It is seen that, for both the equations (6 and 6'), estimation results differ significantly with alternative use of the ordinary least squares method and the two stage least squares method. This confirms the supposition that bias is present due to measurement error in the initial inequality levels. Hence we present the unbiased results given by the two stage least squares method. We use the Gini coefficient in year 1959 as the instrument to observe convergence in the Gini index from 1960 to 1997.

Following the conventional method, we find the slope coefficient beta to be negative but insignificant at the 5% level in the rural sector (Table 5.2). Correcting for a possible measurement error and assuming a linear trend, the slope coefficient beta becomes positive and is significant at the 5% level. Similarly, when we assume a quadratic trend, we find that the change in the trend is positive ($\beta + 2\gamma\overline{G}_{-1}$) and is significant at 5% level. Hence, by using all the three different methods, we find no evidence of convergence in the Gini indices and log of Gini indices, in the rural sector. In fact correcting for measurement error, we find that the income distribution has diverged across the states in the rural sector.

Consider two states in the rural sector. In 1997 the Gini coefficient in Orissa was 25.36. In the same year, in Bihar, the Gini coefficient was as high as 38.79. In a period of 15 years, the quadratic trend model predicts that Orissa's Gini coefficient will decrease to 23.58 and Bihar's Gini coefficient will increase to 72.73; thus the gap between the levels of inequality will be further accentuated and income distribution across the states will diverge.

On the other hand, we find evidence of convergence in Gini coefficients across states in the urban sector (Table 5.3). Following the conventional method and Ravallion's method, we find that the beta coefficient is negative and significant at the 5 % level. Assuming a quadratic trend, too, it is seen that the change in the trend is negative ($\beta + 2\gamma\overline{G}_{-1}$) and significant at 5% level. Thus convergence is seen in the Gini coefficient as well as the log of the Gini coefficient, across the urban sectors in the different states in India.

Consider two states in the urban sector. In 1997, the Gini coefficient in Tamil Nadu was lowest among all states and was equal to 26.49. In the same year, Maharashtra's Gini coefficient was highest and was equal to 37.48. In a period of 15 years, the quadratic trend model predicts Tamil Nadu's Gini coefficient will increase to 33.04 and Maharashtra's Gini coefficient will decrease to 32.75; thus the gap between the levels of inequality will be reduced and income distribution across the states will converge.

Figures 5.3 and 5.5 show plots of the linear trend and the quadratic trend for the rural and the urban sector respectively. As is seen in Figure 5.3 the linear as well as the quadratic trend in the Gini coefficients in the rural sector are upward sloping, showing further evidence of divergence. However, in the urban sector (Figure 5.5), the trend in the Gini coefficient is downward sloping, meaning thereby that the Gini coefficients across states were converging. Comparing the linear trend model versus the quadratic trend model, we see that plots of both the trends differ significantly in the rural sector, while they fit more or less closely in the urban sector. This fact is supported by the regression estimate of parameter (γ), which distinguishes the quadratic trend from the linear trend. The estimate of the (γ) coefficient in equation (6') for the rural sector is significant at the 5% level (Table 5.2) while it is not significant at the 5% or 10% level in the urban sector (Table 5.3). Thus compared to the linear trend model, the quadratic trend model fits better in the rural sector than in the urban sector of the states in India.

Figures 5.4 and 5.5 show the rate of change (slope) in trend in the Gini coefficients in the rural and urban sectors respectively. In both the figures, the rate of change is constant and is equal to (β) as implied by Ravallion's model. However, we find that in the rural sector, with a rise in initial inequality, the trend in Gini coefficients rises at an increasing rate ($\gamma > 0$). In the urban sector, we find that with a rise in initial inequality, the expected trend declines at a decreasing rate ($\gamma < 0$). Hence the speed of convergence and divergence varies for each state, depending on the initial level of inequality.

5.5 Conclusions

The purpose of this chapter was to study convergence in income distribution across the different states in India. In the past four decades, from the 1960s to the 1990s, we found that overall income inequality in India declined in the rural sector whereas it did not change much in the urban sector. We tested for convergence in income distribution across states using different methods. In particular, we allowed the speed of convergence to vary according to the initial level of inequality. We found that, in India, in the rural sector, income distribution was diverging while in the urban sector it was converging across the states.

In future research, it would be interesting to identify the factors, which have played an important role in shaping the distribution of income in the rural, and the urban sectors of different states. This would have important policy implications because it could suggest policies, which could stimulate a more equal distribution of income within the different states in the country.

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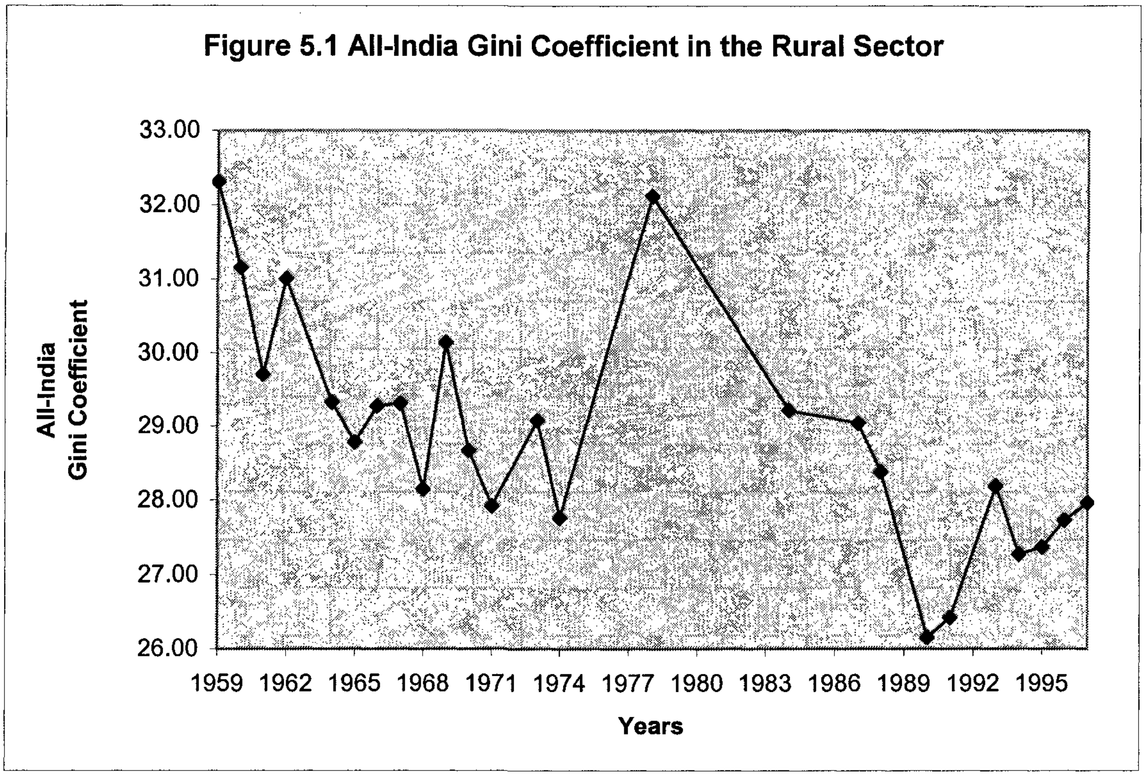
Figure 5.1 All-India Gini Coefficient in the Rural Sector
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
All-India
Gini Coefficient
1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992 1995
Years

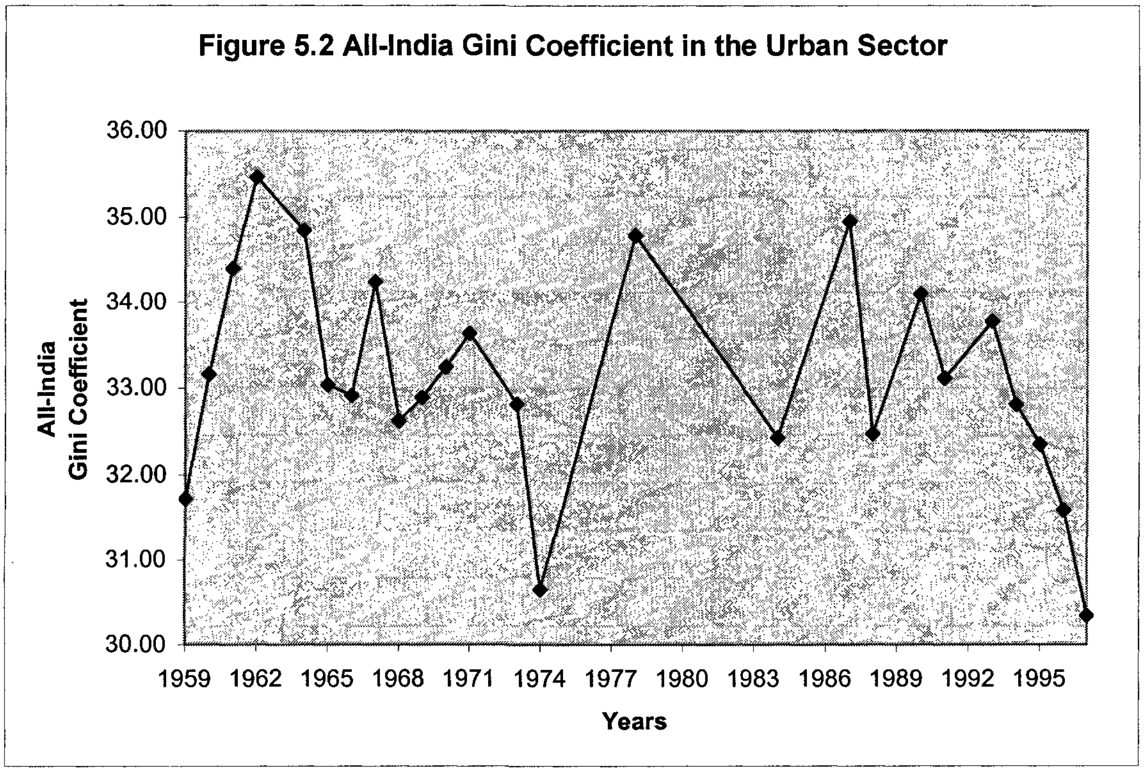
Figure 5.2 All-India Gini Coefficient in the Urban Sector
36.00
35.00
34.00
33.00
32.00
31.00
30.00
All-India
Gini Coefficient
1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992 1995
Years

Figure 5.3 Linear versus Quadratic Trend in Gini Coefficients in the Rural Sector

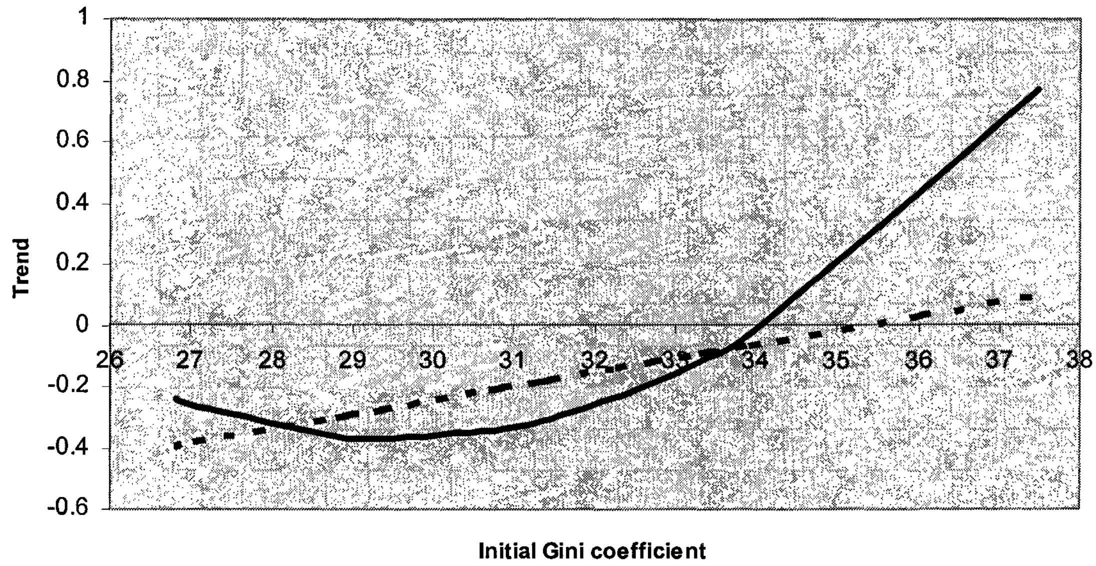

Figure 5.4 Rate of Change in Trend in Gini Coefficient in Rural Sector

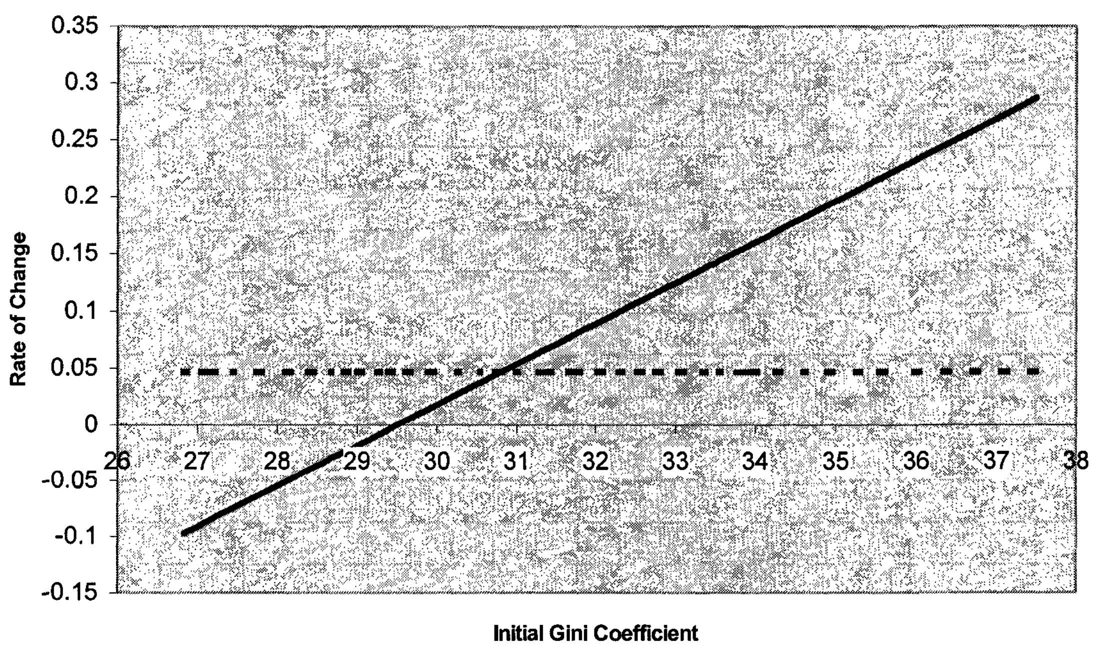

Figure 5.5 Linear versus Quadratic Trend in Gini Coefficients in the Urban Sector

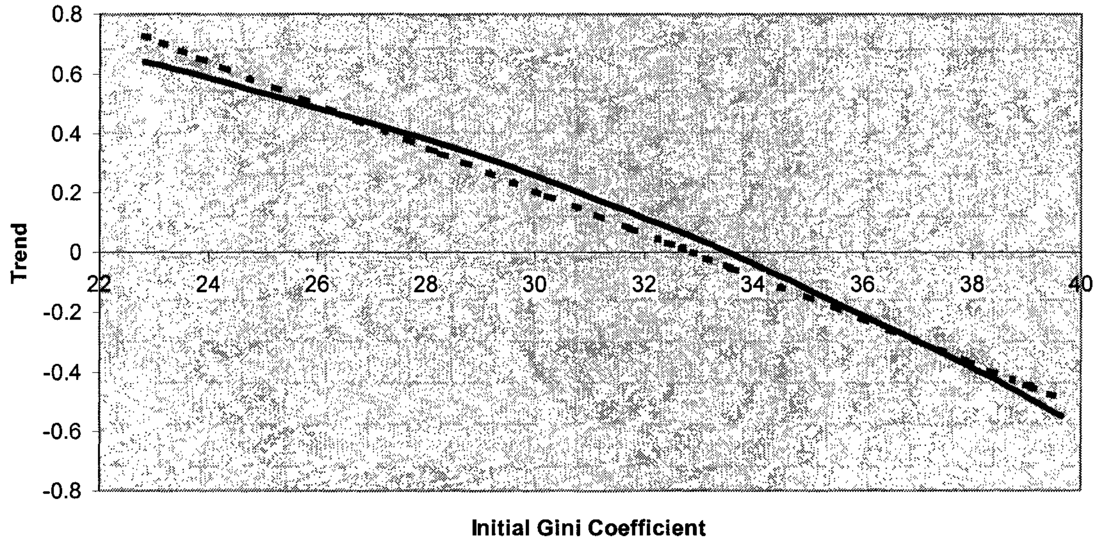

Figure 5.6 Rate of Change in Trend in Gini Coefficient in Urban Sector

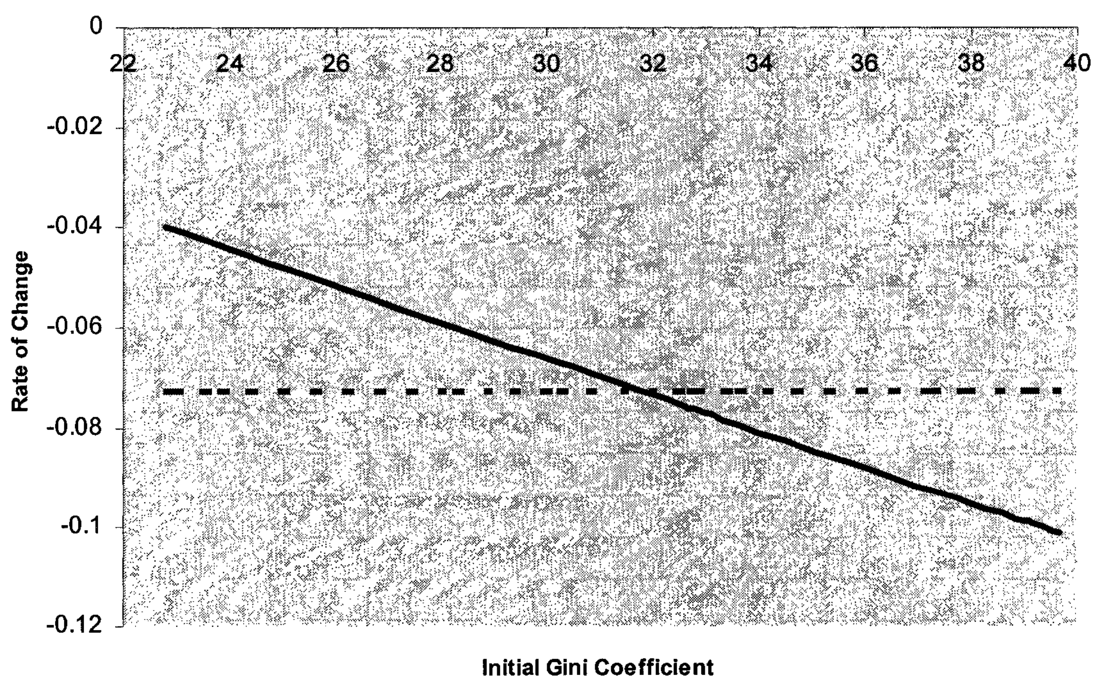

Table 5.1 Summary Statistics: Average Gini Coefficient from 1959 to 1997

Sector	Min	Max	Mean	Std. Dev.
Rural	26.16	32.31	28.90	1.56
Urban	30.35	35.46	33.13	1.28

Table 5.2 Tests for Convergence in Income Distribution in the Rural Sector

Gini Coefficients			
Parameter	Conventional	Linear Trend	Quadratic Trend
α	23.19 (13.22)	-1.63* (0.65)	15.27 (8.24)
β	-0.85 (0.41)	0.05* (0.02)	-1.06* (0.54)
γ			0.02* (0.01)
$\beta + 2\gamma \overline{G}_{-1}$			0.06* (0.02)
Log of Gini Coefficients			
Parameter	Conventional	Linear Trend	Quadratic Trend
α	2.50 (1.52)	-0.25* (0.09)	11.05* (4.79)
β	-0.76 (0.44)	0.07* (0.03)	-6.54* (2.80)
γ			0.96* (0.41)
$\beta + 2\gamma \ln \overline{G}_{-1}$			0.09* (0.03)
No. of obs.	14	322	322

White Heteroskedasticity- Consistent Standard Errors given in parentheses.
* denotes significance at 5% level.

Table 5.3 Tests for Convergence in Income Distribution in the Urban Sector

Gini Coefficients			
Parameter	Conventional	Linear Trend	Quadratic Trend
α	23.61*	2.38*	0.61
	(6.98)	(0.38)	(1.19)
β	-0.79*	-0.07*	0.04
	(0.22)	(0.01)	(0.08)
γ			-0.002
			(0.001)
$\beta + 2\gamma \overline{G}_{-1}$			-0.08*
			(0.01)
Log of Gini Coefficients			
Parameter	Conventional	Linear Trend	Quadratic Trend
α	2.72*	0.24*	-0.46
	(0.66)	(0.04)	(0.44)
β	-0.8*	-0.07*	0.34
	(0.19)	(0.01)	(0.26)
γ			-0.06
			(0.04)
$\beta + 2\gamma \ln \overline{G}_{-1}$			-0.05*
			(0.01)
No. of obs.	14	322	322

White Heteroskedasticity- Consistent Standard Errors given in parentheses.
* denotes significance at 5% level.

Chapter 6: CONCLUSIONS

The essays compiled for this dissertation have examined the changes in economic growth, income inequality and poverty in India in the era of globalization. This conclusion recapitulates the principal findings in each chapter and suggests directions for future research.

6.1 Economic Liberalization and its Impact on Income Distribution

During the last two decades, many countries adopted globalization policies. Globalization is often associated primarily with the liberalization of international trade and investment. International trade is certainly affecting more and more workers all over the world. Though there is empirical evidence that liberal trade policies led to rapid economic growth among countries, there is a growing debate on how these policies have affected income inequality within these countries.

Chapter 2 studied the impact of trade on the distribution of income within a country. It considered a simple model with a two-commodity, two-factor economy, which is incompletely specialized and where perfect competition, prevailed. The economy produced food in the rural sector and manufacturing goods in the urban sector. Production of food was assumed to be relatively labor intensive and while that of manufacturing goods to be relatively capital intensive. The economy had abundance of labor and had a comparative advantage in producing food. Removal of protection to the manufacturing industry in the form of tariffs led to a decrease in the price of the manufacturing good and an increase in the price of food. The paper analyzed the model in two cases; in the short run, when capital is temporarily locked in and cannot be adjusted instantaneously and in the long run when capital is able to freely shift from one sector to the other sector.

In the short run, with fixed capital and mobile labor, it was shown that rural wages fell with free trade. The total wage bill declined as well. The effect of tariff removal on the return to capital varied across the sectors. Free trade led to an increase in the real rate of return on capital employed in the rural sector while it led to a decline in the rate of return on capital employed in the urban sector. These results stand in contrast to those found in the Stolper-Samuelson theorem. The theorem predicts that free trade increases incomes for the abundant factor, labor, and reduce incomes for the scarce factor, capital. In the long run, however, it was shown that the prediction of the theorem remained valid, even after relaxing the assumption of full employment of labor as was made in the original theorem. A decrease in the relative price of the manufacturing good led to a more than proportionate increase in the rural wage rate and to a decrease in rent on capital. Although the effect of free trade on the distribution of income was ambiguous, it was shown that free trade led to a decline in unemployment in the short run as well as the long run. Thus the chapter showed that free trade does not always favor the incomes of the poor.

6.2 Economic Liberalization and Poverty in India

Chapter 3 dealt with the issue of the effect of liberalization policies on poverty levels in an economy. The chapter focused on comparing changes in poverty levels in India before and after the country adopted economic reforms. Economic policies in India underwent significant change over the last decade. Economic liberalization succeeded in placing the economy on a higher growth path. However the rapid growth in the 1990s was also accompanied by increase in income inequality.

In order to separate the impact of a rise in the mean income level from the impact of changes in the distribution of income on poverty, a decomposition of poverty measures was undertaken in chapter 3. A methodology was developed to rigorously decompose changes in poverty measures into growth and distributional effects. The decomposition was carried out by estimating counterfactual poverty levels: i) what would have been the poverty level if only the mean income had changed without any changes in the distribution of income; and ii) what would have been the poverty level if the distribution of income had changed with no change in the mean income level. Three different measures of poverty were calculated and analyzed; namely, the head count ratio, which gives the proportion of population having per capita income below the poverty line and denotes the incidence of poverty; the poverty gap, which gives the average income shortfall of the poor as a proportion of the poverty line, capturing the depth of poverty; and the squared poverty gap, which is the sum of the squared shortfall of the poor people's income as a proportion of the poverty line and is used to measure the severity of poverty.

The impact of growth and changes in the distribution of income on poverty was studied over a period of two decades, namely, the pre-reform period from 1983-84 to 1993-94 and the post-reform period from 1993-94 to 1999-2000. The decomposition of the changes in poverty indicated that in most of the states a rapid rise in the income levels, especially since the economic reforms, led to a decline in poverty levels. Poverty declined not only as the head count ratio but also as the poverty gap and squared poverty gap. In the pre-reform period, the changes in the distribution of income in many states contributed to lowering the poverty levels. In the post-reform period, however, changes in the distribution of income in most states adversely affected the poor. The distribution component put an upward pressure on the poverty levels, especially in the urban sector. As a result, the potential of growth in reducing poverty was not fully realized. During both the periods, growth in income levels was the most important factor contributing to a decline in poverty in India.

6.3 Regional Variation in Poverty in India

A similar decomposition analysis was conducted in chapter 4, but in another dimension. One of the most interesting aspects of India's development record is its remarkable regional diversity in the elimination of poverty. The performance of the states in terms of the mean income level, the distribution of income and the poverty levels varies significantly across India. In this chapter, for the first time, a spatial decomposition of poverty was undertaken. It measured the extent to which the total difference in state and national poverty levels is accounted for by the difference between their mean income levels and the extent to which the total difference is accounted for by the difference between their distributions of income.

The analysis has interesting implications. In 1999-00, many states in India had a higher incidence of poverty compared to the all-India ratio. The number of poor in these states would have declined significantly had these states raised their average income to the national level without altering the distribution of income. In contrast, had these states adopted the national distribution of income, without changing the average income, poverty in most of the states would have increased. Of course, the question remains open whether the required changes in the level of income and the distribution of income were politically feasible in each state. Nevertheless, the decomposition analysis provided important information by revealing the fact that in India, differences in the state and national income levels were relatively more significant compared to differences in their distributions of income, in explaining the differences in state and national poverty levels.

6.4 Regional Variation in Income Inequality in India

The hypothesis tested in chapter 5 was whether distribution of income across the states converged over the past four decades, from 1960s to 1990s. The test was carried out using different methods. The conventional method, also called the beta convergence, involves regressing changes in income inequality over time on the initial inequality levels across different states. The observation that inequality falls in high initial inequality countries and rises in low initial inequality countries is evidence of convergence among states towards a common distribution of income. However there is a possibility that the speed of convergence can be biased due to measurement error in the initial inequality measure. To correct for the bias introduced by the measurement error, the hypothesis that the trend in inequality depends on its initial level was tested. In the previous literature, a linear relationship between the trend and initial inequality was assumed. However, the assumption of linearity in trend is restrictive and implies that the rate of change in trend is independent of the initial level of inequality. But this may not necessarily be true since Gini coefficients differ significantly across countries. In chapter 5, a more general setting was introduced. A non-linear (quadratic) relationship between the trend and initial inequality was assumed. Thus the rate of change in the trend and consequently the speed of convergence were allowed to vary across countries or states.

All the three tests gave results that were qualitatively similar. No evidence of convergence was found across states in the rural sector in the past four decades. This result is in contrast to the earlier studies, which show evidence of convergence among Gini coefficients across countries and also among Gini coefficients across different states in the US. In India, although inequality declined in the rural sector, the distribution of income diverged across the states. In the urban sector, contrary to the rural sector the income distribution across the states converged though the overall level of income inequality also increased.

The four essays in this dissertation highlighted significant changes brought about in economic growth, distribution of income and poverty levels in India. Economic liberalization led to rapid economic growth as well as increase in income inequality. The decomposition of the poverty measures showed that growth was the single most important factor leading to a significant decline in the poverty levels in the last two decades. Changes in the distribution of income, after the economic reforms, adversely affected the poor, particularly in the urban sector. Also, most of the regional variation in poverty levels across the states in India was accounted for largely by the variation in the state average incomes rather than by differences in the states' distribution of income. Over a period of time, the distribution of income converged in the urban sectors but it diverged in the rural sectors of the states in the country.

6.5 Directions for Future Research

It would be interesting to investigate the link between economic liberalization, growth and poverty more closely. The analysis of the impact of trade on the distribution of income can be extended further to study the effect of other policies promoted by liberalization on the distribution of income. For example, in the case of India, policies like the removal of agricultural subsidies are of particular relevance, since a majority of the poor in the country live in the rural sector. The results of the decomposition analysis lead to further questions about the prevalence of regional disparity in average incomes as well as inequality levels across the states in India. What are the factors, which have caused the economic performance of the states to vary so much over the years? This would have important implications because it could suggest policies, which would help the states share, more equally, the benefits of rapid economic growth experienced by the Indian economy since its integration with the rest of the world.