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Prices, Inequality and Poverty: Methodology and Indian Evidence

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Prices, Inequality and Poverty: Methodology and Indian Evidence[1]

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ABSTRACT

This paper uses a methodology for evaluating the distributional implications of price movement for inequality and poverty measurement. The methodology is based on a distinction between inequalities in nominal expenditures, where the expenditures are either measured in nominal terms or a common price deflator is applied for all households, and inequalities in real expenditures which take into account the varying household preferences in converting the nominal to real expenditures. The empirical application to the Indian budget data sets from NSS rounds 50, 55 and 61 shows the usefulness of the proposed procedures. The relative price changes in India have tended to be inequality and poverty reducing as confirmed by formal statistical tests. The result is robust to expenditure dependent equivalence scales. The progressivity of the relative price changes weakened in the second half of our time period as Fuel and Light overtook the composite group called "Miscellaneous" in recording the largest price increase. While the poverty rates registered a decline, which was marginal in the urban areas, there was a sharp increase in inequality.

Keywords: Real Expenditure Poverty, Equivalence Scales, Bootstrapping, Generalised Entropy, Head Count Poverty Rate.

JEL codes: C13, D12, D63, I32.

1. Introduction

Since expenditure pattern varies across households, primarily due to differences in their economic circumstances and in their household size and composition, differential movement in prices of items over time will have a differential impact on welfare across households. For example, inflation that is accompanied by an increase in the relative price of food vis-a- vis non-food items will affect the poorer household groups more adversely than the affluent ones. Similarly, if the prices of items that are consumed primarily by children increase more than those consumed primarily by adults, then households with large numbers of children will be hit harder than, say, childless households. Again, if the price increases are concentrated on items that exhibit substantial economies of scale, then inflation will hit the smaller households harder than the larger households simply because the former are unable to benefit from bulk purchase to the same extent as the latter. All that this means is that the aggregate figure of inflation published routinely by authorities may hide substantial differences in the effective inflation rates across households. The two areas where this has immediate implications are the measurement of inequality and poverty over time.

Relative price changes also have implications for the equivalence scales which are required in welfare comparisons between households, though the link is not so clear cut and direct in this case. The equivalence scales are aggregate expenditure deflators that measure the compensation, in the form of expenditure scaling, to households with children to enable them to enjoy the same level of welfare as childless households. The concept of equivalence scale, which measures compensation in relation to demographic change, is therefore similar to the concept of a true cost of living index which measures compensation in response to price changes. Since the latter depends on the reference utility level and the structure of relative prices, so will the former, unless assumed away as is done, rather unrealistically, with the use

of price and expenditure invariant equivalence scales. This link between the two concepts was established by Barten (1964)'s pioneering contribution which showed that the household composition effects that the scales measure are analogous to the price induced substitution effects estimated in conventional demand analysis. Since such "quasi price" demographic effects do vary with household affluence and with relative prices, the equivalence scales will be expenditure and price dependent. If equivalence scales vary with relative prices, then the expenditure deflators that adjust for differences in household size and composition will change over time with inflation and realignment of relative prices with consequent implications for the inequality and poverty calculations. This possibility is ruled out with the use of price invariant equivalence scales or the use of household size as the expenditure deflator. The issue of price sensitivity of equivalence scales is hence not unrelated to the issue of the redistributive effect of relative price changes that motivated this study.

This study employs a parametric test of the price sensitivity of the equivalence scale based on the hypothesis that a subset of the demographic parameters estimated from the demographic demand system is individually and jointly insignificant. The approach taken here is different from that adopted in Pendakur (2002). While Pendakur (2002) specifies the demographic demand system so as to allow the equivalence scales to vary with prices, the present study follows Ray (1983) in taking the reverse route of first specifying the equivalence scales directly as function of prices, and then working out the corresponding demographic demand system which then contains the price invariant equivalence scales as a nested specification.

With regard to the direct effect of relative price changes on inequality, the point was recognised by Muellbauer (1974) over three decades back when he distinguished between real and nominal expenditure inequality and showed the divergence between the two during the 6 years, 1964-1970, of Labour rule in the UK. Muellbauer's contribution, that included a methodology for investigating the distributional consequences of price movements, was

extended to allow more realistic and flexible demand responses to price changes and applied to UK data in Ray (1985) and, more recently, to Australian data in Nicholas, Ray and Valenzuela (2008). There have not been many similar attempts on other data sets to investigate the distributional effects of relative price changes, and none on the data set of a developing country. Pendakur (2002) provided indirect evidence of the importance of price movements in inequality calculations by showing that price dependent equivalence scales affect measured family expenditure inequality in Canada, but he did not investigate directly the redistributive effect of relative price changes. Such an attempt for India is made in the present study.

The issue of the differential impact of price changes across households is also relevant in poverty comparisons. The criticism of the World Bank methodology for calculating poverty rates made by, among others, Reddy and Pogge (forthcoming), is based on the idea that, given their varying consumption pattern, the poor households face a price vector that is different from that faced by the non poor. One can extend this point to argue that the effective price index varies from one poor household to another thus questioning the use of household invariant price index in making temporal adjustment to the poverty line in comparing poverty rates over time. The issue gets more complex in international poverty comparisons since the exchange rates used in converting an internationally specified poverty lines denominated in , say, the US dollar into the national currencies must be converted using exchange rates that are more relevant for the poor. The idea here is the same-due to differences in the households' spending power and in their size and composition, the price index used in deflating the nominal expenditures in comparing poverty over time will vary not only between households below and above the poverty lines but also between households at varying levels of poverty. This aspect is rarely acted upon by government agencies in devising and revising poverty lines in response to price movements.

A logical implication of the above discussion is that ,based on the same vector of item prices, each household will face a different overall effective price index depending on its expenditure allocation over the various consumption categories. Since this effective price index will vary across households, this will cause a divergence between nominal and real expenditure inequalities, and between official and "real" poverty rates. We define nominal expenditure inequality as that which calculates inequality in per capita or per adult equivalent money expenditures, and real inequality as the measure of inequality where we deflate the money expenditures by the household specific price indices. In case of poverty comparisons, the corresponding distinction is between poverty rates based on poverty lines used in official poverty calculations and poverty rates based on this idea of household specific inflation adjustments to their nominal expenditures. Much of the recent debate over poverty lines in India[4] has been between the advocates of the "direct method", where the poverty line is specified in terms of the minimal calorie needs, and advocates of the more conventional "indirect method" based on expenditures and an expenditure based poverty line that was originally derived from a calorie norm but then periodically revised using official price indices. The present exercise abstracts from that debate and compares the official "indirect" method with another "indirect method" that questions the use of the official price index in updating the poverty lines in the same manner for all households and that too using a weighting scheme to aggregate the item wise prices into an overall price index using a non representative consumption basket for the poor.

The principal motivation of this paper is to provide a unified methodology for incorporating the differential effect of price movements in the welfare comparisons involved in inequality and poverty calculations and apply it to Indian data. The period considered, 1993/94 – 2004/5, is particularly significant for it covers the period of what is commonly referred to as

[4] See, for example, Lancaster and Ray (2005), Ray (2007), and Sen (2005).

first and generation economic reforms in India. This paper provides evidence on inequality and poverty movements in India over this period and looks at the role played by the price changes in these movements. Another feature of this study is the formal statistical testing using boot strap methods of the inequality and poverty rate estimates and of their changes over time.

The plan of the rest of the paper is as follows. Section 2 introduces the price dependent equivalence scale specification and the corresponding demographically extended quadratic "almost ideal" demand system (PS-QAIDS). Section 3 derives the expression for real expenditure that is used to calculate "real expenditure inequality" and "real expenditure poverty". Section 4 describes briefly the data sets. Section 5 presents the demographic demand parameter estimates and reports the Indian evidence on the price sensitivity of the equivalence scale. The inequality and poverty estimates are presented and analysed in Sections 6 and 7 respectively. Evidence on the sensitivity of the results to the presence of expenditure dependent scales in reported in Section 8. Section 9 concludes the paper.

2. Equivalence Scale Specification and Demographic Demand System

The Price Scaling[5] (PS) demographic technique, introduced in Ray (1983), stems from the definition of the general equivalence scale, m_{oh} , as the ratio of costs of obtaining a reference utility level, u, at a given vector of prices, p, of a household h with z children and a reference household, R.

$$c_h(u,p,z) = m_{oh}(z,p,u)c_R(u,p) \qquad (1)$$

If one specifies a suitable functional form for the cost function of the reference household, $c_R(u,p)$, which satisfies the usual economic theoretic conditions of linear homogeneity in prices, symmetry and concavity, then the choice of a suitable functional form for

[5] A referee felt that this procedure is more appropriately termed "expenditure scaling" However, we have retained the "price scaling" terminology to relate it to that used in Ray (1983).

$m_{oh}(z,p,u)$[6] gives us the corresponding form for the cost function of household *h*. The latter yields, on application of Shephard's Lemma, the price scaled demographic demand equations.

Pollak and Wales (1979) were the first to point out that equivalence scales cannot be estimated from demand data. Blackorby and Donaldson (1993) have however shown that the assumption of utility independence allows the scale to be identified from budget data that are pooled across different time periods containing price variation[7].

We choose the following functional form for the utility invariant general equivalence scale, $m_{oh}(z,p)$:

$$m_{oh}(z,p) = (na_h + \rho z_h) \prod_k p_k^{\delta_k z_h} \prod_k p_k^{\varphi_k na_h} \qquad (2)$$

$$\sum_k \delta_k = 0.$$

na_h denotes the number of adults in household *h*, z_h denotes the corresponding number of children[8], ρ is the equivalence scale. $\varphi_k \ and \ \delta_k$ denote price sensitivity of the equivalence scale interacting with the number of adults, number of children, respectively. ρ can be interpreted as the "cost" of a child in the base year (when p=1) relative to an adult whose scale is normalised at 1. A test of the hypothesis that the parameters φ_k and δ_k are jointly insignificant constitutes a test of the price invariance of the equivalence scale.

The application of (1) – (2) on the QAI expenditure function proposed by Banks, Blundell and Lewbel (1997) gives us the demographic QAI demand system which in budget share terms, $w_{i,h}$, is as follows.

[6] $m_{oh}(z,p,u)$ is homogenous of degree 0 in prices, p.

[7] A referee pointed out that Pendakur (1999) has shown that under certain circumstances, such as in the present study, one does not need price variation to identify the equivalence scales.

[8] A child is defined as someone who is aged 18 years or below.

$$w_{ih} = \alpha_i + \delta_i z_h + \sum_j \gamma_{ij}\, lnp_j$$

$$+ \beta_i \left[lnx_h - \alpha_0 - \sum\nolimits_k \alpha_k\, lnp_k - \frac{1}{2}\sum\nolimits_i \sum\nolimits_j \gamma_{ij} lnp_i\, lnp_j - \ln(na_h + \rho z_h) \right.$$

$$\left. - \sum\nolimits_k \varphi_k\, na_h lnp_k - \sum\nolimits_k \delta_k\, z_h lnp_k \right] + \lambda_i \prod\nolimits_k p_k^{-\beta_k} \left[lnx_h - \alpha_0 \right.$$

$$\left. - \sum\nolimits_k \alpha_k\, lnp_k - \frac{1}{2}\sum\nolimits_i \sum\nolimits_j \gamma_{ij} lnp_i\, lnp_j - \ln(na_h + \rho z_h) - \sum\nolimits_k \varphi_k\, na_h lnp_k \right.$$

$$\left. - \sum\nolimits_k \delta_k\, z_h lnp_k \right]^2 \qquad (3)$$

x_h denotes the nominal expenditure of household *h*. In the estimations that are reported below, we set α_o a priori at zero. The λ_i s. measure the quadratic expenditure effects and if they are all 0, then eqn.(3) specialises to the conventional Almost Ideal Demand System.

3. Nominal and Real Expenditure Inequality and Poverty

Following Muellbauer (1974, pg 42), we define real expenditure of household *h* in year t, namely,$\check{x}_{ht}$ as the minimum expenditure needed to obtain current year utility, u_t at base year price, p_0. In other words:

$$\check{x}_{ht} = c(p_0, u_t, z_h) \qquad (4)$$

The expression for real expenditure in case of the demographically extended QAI is given as follows[9]:

$$\check{x}_{ht} = \bar{m}_{oh}(z_h) \prod\nolimits_k p_{kt}^{\delta_k z_h} \prod\nolimits_k p_{kt}^{\phi \delta_k na_h}\, a_0$$

$$exp\left[\frac{b_0}{\left(c_t + \dfrac{b_t}{lnx_t - lna_t - ln\bar{m}_o - \sum_k \varphi_k na_h\, lnp_{kt} - \sum_k \delta_k z_h lnp_{kt}} - c_0 \right)} \right] \qquad (5)$$

[9] See Mishra and Ray (2009) for details on derivation.

$\bar{m}_{0h}(= na_h + \rho z_h)$ is the base year equivalence scale, and a_t, b_t, c_t are functions of prices, p_t. It is readily verified from (5) that in the base year the real and nominal expenditures are equal (i.e. $\breve{x}_{ho} = x_{h0}$) and, consequently, the nominal and real expenditure inequalities will coincide. The magnitude and sign of the difference between the inequalities in real and nominal expenditures per adult equivalent, i.e. between the inequalities in $(\breve{x}_{ht}/m_{0h})$ and (x_{ht}/m_{0h}) , will depend on the movement in relative prices. In the case of no change in relative prices between current year *t* and base year, 0, the two inequalities will coincide.

Besides the Gini inequality index, we have used the Generalised Entropy inequality index, GE(α)[10]. The parameter, α, can be interpreted as a measure of equality-aversion. As α decreases, the index becomes more sensitive to transfers at the lower end of the distribution, and less weight is attached to transfers at the top; when α =2, the index attaches the same weight to transfers at all expenditure levels. The GE (α) family of inequality indices includes as special cases GE (1) and GE (2) which have been proposed by Theil (1967). In the empirical application below, we have used the GE (0), GE (1) and GE (2) inequality measures. The GE measure of inequality has the attractive feature that it can be decomposed into between group and within group inequality[11]. Shorrocks (1980) has derived the entire class of measures that are decomposable under relatively weak restrictions on the form of the index.

The real and nominal inequality indices, which are defined over real and nominal expenditure per adult equivalent are given by I_t^R and I_t^N, respectively. $(I_t^R - I_t^N) > 0$ implies that the

[10] See Sen (1997) for the expression of the GE(α) inequality index and an analysis of its decomposability properties.

[11] See Mishra and Ray (2009) for Indian evidence on the decomposition of the inequalities between and within family groups by social class and by household composition.

relative price movement has been regressive or inequality increasing, while the reverse is indicated if$(I_t^R - I_t^N) < 0$.

Analogous to the definitions of nominal and real expenditure inequalities, we can define the nominal and real poverty rates as those that omit and include, respectively, the distributional impact of price movements. The nominal poverty rates, P_t^N, are those that assume that all households face the same price vector and consequently are based on the official poverty line and, its periodic revision in line with inflation, as published for the various rounds by the Govt. of India and used in the official poverty rate calculations. In contrast, the concept of real poverty rate, P_t^R, that is proposed here bases the poverty rate calculations not on the revision of the poverty line but on the revision of the total expenditure per equivalent adult so as to compensate for the inflation and the change in relative prices, taking into account the household preferences and substitution between items by the households in response to changes in the relative prices. In other words, while the nominal poverty rates, P_t^N are the poverty rates calculated using the nominal expenditures per adult equivalent and the official poverty lines, the real poverty rates are based on the real expenditures per adult equivalent, and the poverty line in the initial year, ie. NSS round 50 in this study. As with the inequality rates, the nominal and real poverty rates will coincide in the base year (NSS round 50), but will diverge in the comparison years (NSS rounds 55 and 61). $(P_t^R - P_t^N) > 0$ implies that the official revision of the poverty line leads to a downward bias in the poverty rates, while the reverse is indicated if $(P_t^R - P_t^N) < 0$. The bias in the nominal poverty rates (P_t^N) in relation to the real expenditure poverty rates (P_t^R) is due to the use in calculating the former of an household invariant temporal adjustment to the household expenditures to compensate for price movements that may not reflect the true nature of price inflation faced by the individual households. The head count poverty rate was used in the poverty calculations reported below.

4. Data Sets

This study uses the detailed information on expenditure on various items, on household size, composition and the socio economic class of the household contained in the unit records from the 50th (July, 1993-June, 1994), 55th (July, 1999-June, 2000) and 61st (July, 2004-June, 2005) rounds of India's National Sample Surveys (NSS). All these rounds are "thick" rounds being based on large samples and are comparable. These three surveys cover a reasonably long time interval (1993-2004) to make the comparisons of poverty and inequality meaningful and significant since it covers the period of economic reforms in India. The price information was obtained from published price series put out by the Government of India and the RBI. The State specific poverty lines are made available by the Planning Commission[12]. Frequency weights, in the form of "multipliers", are provided in the data sets. Households which differ in size will have different weights. The multipliers provided us with the household weights based on the number of individual members in the household. These were used in the inequality and poverty calculations reported below.

Table 1 provides information on the sample size in the NSS data sets and the estimation samples that we have used. The estimation sample is somewhat smaller than the actual NSS sample because we excluded some of the smaller states and concentrated on the 21 major states in India. Given the sample size in various NSS rounds, as shown in Table 1, we have enough observations to provide reliable estimates of inequality and poverty. This is confirmed by the well determined estimates of inequality and poverty rates and the tight confidence intervals reported later.

Place Table 1 here

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[12] Further details are available on request.

The demand systems were estimated on the following 4 item breakdown of household expenditure: Food (i=1), Fuel and Light (i=2), Clothing, Bedding and Footwear (i=3), and Miscellaneous (i=4).While the Consumer Price Index for Agricultural Labourers (CPIAL) for these major commodity groupings was used as rural prices, the Consumer Price Index for Industrial Workers (CPIIW) was used as the urban prices. The "Miscellaneous" category includes the following: education, medical care, entertainment, toilet articles, etc. The "Miscellaneous" category does not include consumer durables or housing. The choice of the items for inclusion in "Miscellaneous" category and the 4 item disaggregation of consumer expenditure is, principally, due to the fact that the definition of "Miscellaneous" and the 4 items used here match up exactly with the published price series on these items. As Table 2 shows, these four expenditure categories together constitute the major share of expenditure for a median household, more so for a household below the poverty line.

Place Table 2 here

Table 3 reports the price series of the 4 groups of items used in the demand estimation. The all India price indices were obtained as the population share weighted average of the State price indices. The CPI for agricultural workers and that for industrial workers were taken as the rural and urban price series, respectively. Fuel and Light and the composite item, called Miscellaneous, recorded the larger price increases over this period. While the Miscellaneous group had the largest price increase between rounds 50 and 55, Fuel & Light over took this composite group in its price increase between rounds 55 and 61.There was a significant realignment of prices leading to changes in relative prices in both rural and urban areas.

Place Table 3 here

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5. Demographic Demand Estimates and Price Sensitivity of Equivalence Scales

The demographic demand parameter estimates are presented in Table 4 (rural) and Table 5 (urban).The estimates are mostly well determined and highly significant. The estimates of λ_i , that are mostly highly significant, confirm the presence of rank three demand, i.e. quadratic effects of household expenditure on budget shares, and point to non linear Engel curves. The estimated price parameters, the γ_{ij} s, confirm the presence of significant price sensitivity of the expenditure allocation over the chosen period. The significant estimates of φ_i and δ_i show that the equivalence scales vary with the structure of relative prices, and this is true in both rural and urban areas. There are some rural urban differences in the parameter estimates, especially in the nature of the quadratic expenditure effects on budget share as measured by the estimated λ_is.The equivalence scale is well determined in both areas confirming that the proposed demographic demand system is capable of yielding sensible and precise estimates of the household size deflator. A child costs around 30 % of an adult in the base year (1993-1994) in both rural and urban areas.

Place Table 4 and Table 5 here

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6. Prices and Expenditure Inequality.

Tables 6 and 7 present the expenditure shares in rural and urban areas, respectively, of households in the five quintiles of the expenditure distribution, arranged in an ascending order of household expenditure per adult equivalent. The tables report the shares of the quintiles in terms of both nominal expenditure per adult equivalent and real expenditure per adult equivalent .There has been expenditure redistribution in both rural and urban areas from the bottom three quintiles to the top quintile throughout the reforms period and beyond (1993/94-2004/2005).The expenditure distribution in both nominal and real terms is more unequal in the urban areas compared to the rural as reflected in the lower share of the bottom

three quintiles in the urban sector. A comparison of the nominal and real expenditure shares suggests that the price movements have been progressive over this period since the real expenditure shares of the lower quintiles exceed the corresponding nominal expenditure shares in NSS rounds 55 and 61[13], and this is true in both rural and urban areas. This is not surprising if we recall that, during this period, the price of the composite group of luxury items called Miscellaneous increased more than those of the items of necessities, notably, Food.

The progressive nature of the price movements in India during the 1990s and the early part of the new millennium is seen more directly from Tables 8 and 9 which present the nominal and real expenditure inequalities in the two sectors. These tables report the inequality estimates calculated using the Gini inequality measure and the decomposable Generalised Entropy (GE) inequality index at varying levels of distribution sensitivity. The qualitative picture on inequality is generally robust to the inequality measure employed. Inequality has been increasing in both rural and urban areas. These tables also report the standard errors that were calculated using bootstrap methods following the procedures outlined in Mills and Zandvakili (1997), Biewen (2002) and Athanasopoulos and Vahid (2003).The estimates are well determined and all the inequality estimates are highly significant. The confidence intervals have been shifting to the right between rounds consistent with the increase in the inequality magnitudes over time. The increase in inequality has been particularly large in both areas in the second half, namely, between 1999/2000 and 2004/2005. The nominal expenditure inequalities exceed their real counterpart in both the comparison rounds 55 and 61. This suggests that the movement in relative prices in India during this period has been progressive with an inequality reducing bias, unlike the Australian experience reported in Nicholas, Ray

[13] Since the prices are normalised at unity in the base round 50, the nominal and real expenditure shares are the same in that round. This remark also holds for inequality and poverty rates.

and Valenzuela (2008). Tables 8 and 9 also confirm that the urban expenditure distribution is more unequal than the rural in both nominal and real terms.

Place Table 8 and Table 9 here

The above discussion has assumed the absence of economies of household size. In order to examine the role played by the economies of household size, we allow size economies by generalising the equivalence scale specification [eq. (2)] via the introduction of the parameter, θ, as follows:

$$m_{oh}(z,p) \;=\; (na_h + \rho z_h)^{\theta} \prod_k p_k^{\delta_k z_h} \prod_k p_k{}^{\phi_k\, na_h} \qquad (6)$$

θ=1 assumes the absence of economies of household size. As θ declines from 1 , the household experiences economies of scale that increase as θ declines further towards 0, while as θ increases beyond 1, the household experiences diseconomies of scale. The precise nature of the relationship between inequality and θ has been a matter of some controversy [see Coulter et. al. (1992), Banks and Johnson (1994)]. Figures 1 and 2 provide evidence from India's rural and urban areas , respectively, on this issue by plotting the graphs of nominal and real expenditure inequalities against a range of θ values varying from θ=0 to θ=1.2[14] based on the 61st round of the National Sample Survey. The gap between the two graphs is a measure of the bias in the nominal inequalities in relation to the real expenditure inequalities. These figures confirm that in both areas of the Indian economy, the price movement across items has been progressive resulting in a reduction of real expenditure inequality from nominal inequality during the 61st round. The figures show that this result is robust to a wide range of θ values. A comparison of Figures 1 and 2 shows that the bias has been much less in

[14] θ=0 implies that household expenditures are uncorrected for differences in household size and composition, 0<θ<1 implies consumption economies of scale that favour larger sized households, while θ>1 implies diseconomies that favour smaller sized households.

the urban areas than in the rural .The graphs also establish a mild U shaped relationship between inequality and economies of household size.

Place Figure 1 and Figure 2 here

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7. Prices and Expenditure Poverty

Table 10 presents the head count poverty rates during the three NSS rounds considered in this study[15].The introduction of adult child relativities via the estimated equivalence scales leads to a sharp reduction in the nominal poverty rates from the per capita based figures in both areas. The boot strapped standard errors show that the poverty rates are well determined and highly significant. Notwithstanding some rural urban differences, the overall picture conveyed by Table 10 is one of declining poverty in India during the period considered in this study. The decline was however quite marginal in the urban areas.

Place Table 10 here

A comparison of the nominal and real poverty rates based on the expenditures on the four included items shows that the nominal poverty rates that use the official poverty lines had an upward bias in relation to the real poverty rates[16]. This is also evident from the left ward shift in the 95 % confidence interval as we move from the nominal to the real poverty rate estimates. This parallels the earlier result that the price movements had a progressive, inequality reducing effect through the realignment of relative prices. The narrowing of the difference between the nominal and real poverty rates in both areas between the 55th and the

[15] The poverty line for the expenditure calculations based on the 4 included items were obtained by multiplying the official poverty lines by the median Engel ratios of the 4 included items to total expenditure.

[16] This is explained by the higher price increases in the "Miscellaneous" category compared to the other items along with the fact that the budget share of this composite item has also increased significantly over this period. The nominal expenditure poverty rates that are based on the official poverty lines do not take into account these changes in the expenditure pattern and the relative prices unlike the real expenditure poverty rates that do.

61st rounds suggests, however, that the progressive nature of the relative price changes weakened in the second half of our chosen period. This is also evident in a similar narrowing of the difference between the nominal and real expenditure inequalities between these two NSS rounds evident from Tables 8 and 9. This is explained by the item wise inflation figures presented in Table 3. As noted earlier, while the Miscellaneous group of luxury items recorded the largest price increase among the 4 groups between the 50th and 55th rounds, it was overtaken by Fuel & Light, an item of necessity, during the period between the 55th and 61st rounds, thus reducing the redistributive impact of the relative price changes during the latter time period.

The progressive nature of the relative price changes in India over the period covered in this study is formally established by the confidence intervals of the estimates of the difference between the nominal and real magnitudes of inequality and poverty that are presented in Table 11. Bootstrap methods using 5000 replications were used to calculate the confidence intervals. The positive magnitudes of the differences along with the fact in no case does 0 fall in the confidence intervals confirm one of the key empirical results of this study.

Place Table 11 here

Figure 3 and 4 present evidence on the impact of economies of scale of household size on the poverty calculations[17] in the rural areas and urban areas, respectively, by plotting the graphs of the nominal and real poverty rates against a range of θ values in case of NSS round 61. Once again, there is a similarity with the inequality results. The real poverty rates are lower than the nominal poverty rates and the gap between the two increases as the size economies decrease. In case of the assumed value of θ .being 0.6 or less, the two poverty rates are

[17] See Meenakshi and Ray (2002) for previous evidence from India, Lanjouw and Ravallion (1995) for evidence from Pakistan and Lancaster, Ray and Valenzuela (1999) for cross country evidence from a range of developing and developed countries on the sensitivity of the poverty estimates to household size economies in consumption.

virtually identical, and this is true of both rural and urban areas. In other words, the official poverty line based poverty rates provide a reasonably accurate picture of real expenditure poverty only if there exists significant economies of household size in consumption. The graphs agree that there is a positive relationship between the calculated poverty rates and the assumed value of the size economies parameter, θ, used in the poverty calculations- in other words, the larger the size economies, the lower the estimated poverty rate. This is explained by the fact that in the NSS data sets the larger sized households, that can take advantage of economies of household size, dominate the samples[18].

Place Figure 3 and Figure 4 here

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8. Sensitivity of Inequality and Poverty Estimates to Expenditure Dependent Equivalence Scales

The discussion so far and all the results presented above have assumed expenditure invariant equivalence scales. This is consistent with the requirement of "equivalence scale exactness" for identifying equivalence scales from cross section data [see, for example, Blackorby and Donaldson (1993)]. However, Canadian evidence presented recently by Donaldson and Pendakur (2002) suggest that the equivalence scales decrease with income. This makes intuitive sense since the ability of poorer households to substitute adult items by items of child consumption is more limited than those of the more affluent households and, consequently, the "cost of a child" that the scale measures is likely to be larger for the former. To examine how the use of expenditure dependent equivalence scales affects our results, we chose the following specification for the equivalence scales that extends eq. (2) as follows:

$$m_{oh}(z,p) = \left(\frac{x_h^p}{x_m^p}\right)^{\Phi}(na_h + \rho z_h)\prod\nolimits_k p_k^{\delta_k z_h}\prod\nolimits_k p_k^{\varphi_k na_h} \qquad (7)$$

[18] Typically, two thirds or more of the households have two or more adults and 1 or more children.

x_h^p, x_m^pdenote, respectively, the per capita expenditure of household ,h, and of the "median household" (ie. with median per capita expenditure), respectively. Note that (7) extends (2) and allows the scales to depend on household expenditure via the parameter Φ. If Φ=0, then (7) specialises to the case of expenditure invariant scales considered above. The equivalence scales that we estimated and used earlier can then be interpreted as those of a household at median per capita expenditure. The sign of Φ determines the nature of expenditure variation of the equivalence scale. The results of Donaldson and Pendakur (2002) and our intuition suggest that Φ is negative, so that the scales decrease with household affluence.

The sensitivity of the nominal and real expenditure inequality estimates to expenditure dependent equivalence scales is shown in Figures 5 and 6 which plot the relationship between the inequality magnitude and Φ in the rural and urban areas, respectively, in the 61st. round of the NSS. The calculations were performed using the Gini, and GE(0) inequality measures.

Place Figure 5 and Figure 6 here

The inequality estimates reported in Tables 8 and 9 are the same as the ones at Φ=0 in Figs. 5 and 6, respectively. The overall picture is one of high sensitivity of the inequality estimates to expenditure dependent scales. The figures show that if the scales decrease with expenditure, i.e. if Φ is negative as the available evidence suggests, then the measured inequalities increase in case of both nominal and real inequality. One possible explanation lies in the fact that, in the case of developing countries such as India, the larger sized households with 2 or more children, and for whom the expenditure deflators are now larger and the per equivalent expenditures lower, tend to be the less affluent households that are situated at the bottom end of the expenditure distribution.

Our calculations of the inequality magnitudes underlying these graphs, not reported here for space reasons, also show that the nominal inequality exceeds the real expenditure inequality

at all values of Φ. In other words, the finding of this study that the relative price changes in India during this period have been progressive is robust to the introduction of expenditure dependent equivalence scales. The inequality magnitudes at various values of Φ also show that the progressive nature of the relative price changes becomes more and more evident as Φ declines further and further away from 0.This is true more for the rural estimates than the urban.

The corresponding sensitivity of the head count poverty rates to expenditure dependent scales in the rural and urban areas is reported in Figs. 7 and 8 respectively. There is a negative relationship between poverty rate and Φ similar to that between inequality and Φ. The rationale is the same as that in case of inequality. The less affluent households are the ones with larger household size and they now appear poorer since their expenditure deflators are now larger. Similar to the result on inequality, the finding of this study that the nominal poverty rate exaggerates the real poverty rates in India during this period is robust to the presence of expenditure dependent scales except at very high positive values of Φ. Note, also, that if the scales decrease with household affluence, ie. if Φ is negative, then the gap between the two poverty rates increases, more so in the rural areas than in the urban. This parallels the result on inequality reported above.

Place Figure 7 and Figure 8 here

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9. Conclusion

This study evaluates the distributional implications of price movement for inequality and poverty measurement. Changes in relative prices will cause the inflation to affect different household groups differently depending on their household size and composition and their level of relative affluence. For example, inflation that is accompanied by an increase in the relative price of food visa-a-visa non food will affect the poorer household groups more

adversely than the affluent ones. The methodology is based on a distinction between inequalities in nominal expenditures, where the expenditures are either measured in nominal terms or a common price deflator is applied for all households, and that in real expenditures which takes into account the varying household preferences and differences in household composition in converting the nominal to real expenditures. Inflationary price movements that are accompanied by changes in relative prices open up a divergence between inequalities in nominal expenditures, which uses a common price deflator, and that in real expenditures. The logic of this argument is extended to poverty measurement to argue that nominal poverty rates that are based on periodic revision of the poverty line using a common inflation rate across households will differ from real poverty rates which are based on the real expenditures which adjust each household's nominal expenditure for price increases by taking into account its preferences, demographics and the movement in relative prices.

The empirical application to the Indian budget data sets shows the usefulness of the procedures. The Indian empirical evidence is of particular interest since the period chosen (1993-2005) covered both first and second generation reforms in India. Much of world attention has been focussed on India over this period due to the wide ranging nature of the economic reforms and consequently a study of their impact on household welfare is of particular significance. The results suggest that while rural poverty rates, in both nominal and real terms, fell sharply during this period, it was accompanied by an increase in both nominal and real expenditure inequality. The poverty statistics in urban India are less encouraging since they show little or no decline in the urban poverty rates. Of further interest is the result that the price movement has been inequality reducing throughout much of this period. In the poverty context, our calculations suggest that the nominal poverty rates which are based on the official poverty lines and the assumption of a household invariant price adjustment for the inflation had an upward bias in relation to the real expenditure poverty rates. The results of

this study on the inequality and poverty reducing nature of the relative price changes during the chosen period is shown to be robust to the introduction of expenditure dependent equivalence scales.

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Tables

Table 1: Sample Size

NSS Rounds	NSS Sample		Estimation Sample	
	Rural	**Urban**	**Rural**	**Urban**
50th Round	69206	46148	53484	43072
55th Round	71386	48924	64792	43043
61st Round	79298	45346	66088	37523

Table 2: Expenditure Share

NSS Rounds	Percentage Share of Food, Fuel & Light, Clothing, Bedding & Footwear and Miscellaneous categories in Total Expenditure					
	Median Household		**Households below Poverty Line**		**Household above Poverty Line**	
50th	84.3%	78.8%	89.0%	86.4%	82.2%	76.1%
55th	78.1%	73.5%	80.9%	79.2%	77.9%	72.7%
61st	92.7%	88.2%	93.6%	91.3%	92.5%	87.2%
Average	**85.0%**	**80.2%**	**87.8%**	**85.6%**	**84.2%**	**78.7%**

Table 3: Prices Indices for Rural and Urban Samples with 50th Round as Base-Period

Commodity Group	Rural			Urban		
	50th	**55th**	**61st**	**50th**	**55th**	**61st**
Food Group	1.000	1.414	1.508	1.000	1.655	1.869
Fuel & Light Group	1.000	1.485	1.912	1.000	1.689	2.609
Clothing, Bedding & Footwear	1.000	1.366	1.628	1.000	1.536	1.732
Miscellaneous Group	1.000	1.551	1.832	1.000	1.684	2.111

Table 4: PS-QUAIDS Parameter Estimates (Rural) for 4 Commodity Groups[a]

Parameter	Estimates[b]	Parameter	Estimates[b]	Parameter	Estimates[b]	Parameter	Estimates[b]
α1	-0.984	δ1	0.000	ρ	0.303	γ33	-2.309
	(0.000)		(0.506)		(0.000)		(0.000)
α2	0.373	δ2	-0.004	γ11	-3.044	γ43	-3.897
	(0.000)		(0.000)		(0.000)		(0.000)
α3	0.075	δ3	0.000	γ21	-3.435	γ44	-3.707
	(0.000)		(0.000)		(0.000)		(0.000)
α4	1.535	δ4	0.004	γ31	2.453	λ1	-0.059
	(0.000)		(0.000)		(0.000)		(0.000)
β1	0.650	φ1	-0.004	γ41	4.027	λ2	0.002
	(0.000)		(0.000)		(0.000)		(0.000)
β2	-0.058	φ2	-0.007	γ22	-3.896	λ3	-0.001
	(0.000)		(0.000)		(0.000)		(0.032)
β3	0.008	φ3	0.002	γ32	3.753	λ4	0.057
	(0.000)		(0.000)		(0.000)		(0.056)
β4	-0.600	φ4	0.009	γ42	3.578		
	(0.000)		(0.981)		(0.000)		

a. These correspond to the 4 item (as shown in Table 3) breakdown of household expenditure.
b. The figures in brackets denote p-values.

Table 5: PS-QUAIDS Parameter Estimates (Urban) for 4 Commodity Groups[a]

Parameter	Estimates[b]	Parameter	Estimates[b]	Parameter	Estimates[b]	Parameter	Estimates[b]
α1	-0.810	δ1	0.004	ρ	0.299	γ33	0.007
	(0.000)		(0.506)		(0.000)		(0.994)
α2	0.164	δ2	-0.004	γ11	-0.966	γ43	-2.056
	(0.000)		(0.000)		(0.180)		(0.016)
α3	0.388	δ3	-0.003	γ21	-1.546	γ44	-1.378
	(0.000)		(0.000)		(0.069)		(0.082)
α4	1.257	δ4	0.003	γ31	0.643	λ1	-0.054
	(0.000)		(0.000)		(0.431)		(0.000)
β1	0.582	φ1	-0.006	γ41	1.868	λ2	-0.003
	(0.000)		(0.000)		(0.013)		(0.000)
β2	0.014	φ2	-0.005	γ22	-1.426	λ3	0.006
	(0.000)		(0.000)		(0.156)		(0.000)
β3	-0.079	φ3	-0.001	γ32	1.406	λ4	0.051
	(0.000)		(0.000)		(0.145)		(0.000)
β4	-0.516	φ4	0.013	γ42	1.566		
	(0.000)		(0.986)		(0.079)		

a. These correspond to the 4 item (as shown in Table 3) breakdown of household expenditure.
b. The figures in brackets denote p-values.

Table 6: Quintile Shares of Total Expenditure in Rural Areas

	Nominal Expenditure Share			Real Expenditure Share		
Quintile	**50th**	**55th**	**61st**	**50th**	**55th**	**61st**
1	10.237	9.746	9.188	10.237	9.813	9.374
2	14.344	13.858	13.145	14.344	13.945	13.377
3	17.837	17.495	16.785	17.837	17.582	16.955
4	22.443	22.415	21.820	22.443	22.479	21.925
5	35.139	36.485	39.062	35.139	36.182	38.368

Table 7: Quintile Shares of Total Expenditure in Urban Areas

	Nominal Expenditure Share			Real Expenditure Share		
Quintile	**50th**	**55th**	**61st**	**50th**	**55th**	**61st**
1	9.039	8.477	7.792	9.039	8.580	7.854
2	13.399	12.940	11.593	13.399	13.065	11.679
3	17.250	16.945	15.874	17.250	17.064	15.968
4	22.621	22.657	22.446	22.621	22.735	22.558
5	37.691	38.981	42.295	37.691	38.556	41.941

Table 8: Nominal and Real expenditure Inequalities in Rural Areas

Rounds	Nominal				Real			
	Gini	Generalized Entropy			Gini	Generalized Entropy		
		GE(0)	GE(1)	GE(2)		GE(0)	GE(1)	GE(2)
50th	**0.2369**	**0.0926**	**0.1024**	**0.1980**	**0.2369**	**0.0926**	**0.1024**	**0.1980**
SE[a]	0.0019	0.0020	0.0069	0.0775	0.0019	0.0020	0.0069	0.0775
95% UB	0.2406	0.0965	0.1159	0.3498	0.2406	0.0965	0.1159	0.3498
95% LB	0.2331	0.0886	0.0889	0.0462	0.2331	0.0886	0.0889	0.0462
55th	**0.2522**	**0.1047**	**0.1137**	**0.1790**	**0.2499**	**0.1028**	**0.1107**	**0.1656**
SE[a]	0.0015	0.0016	0.0040	0.0372	0.0014	0.0014	0.0038	0.0274
95% UB	0.2550	0.1077	0.1216	0.2519	0.2526	0.1054	0.1181	0.2193
95% LB	0.2493	0.1016	0.1058	0.1061	0.2471	0.1001	0.1033	0.1119
61st	**0.2941**	**0.1466**	**0.1970**	**0.4991**	**0.2826**	**0.1345**	**0.1729**	**0.3747**
SE[a]	0.0061	0.0077	0.0212	0.1224	0.0053	0.0064	0.0157	0.0792
95% UB	0.3060	0.1617	0.2386	0.7389	0.2929	0.1470	0.2037	0.5300
95% LB	0.2822	0.1314	0.1555	0.2592	0.2723	0.1219	0.1422	0.2194

a. SE = bootstrap standard error of the estimate; UB = Upper bound, LB= Lower bound

Table 9: Nominal and Real expenditure Inequalities in Urban Areas

Rounds	Nominal				Real			
	Gini	Generalized Entropy			Gini	Generalized Entropy		
		GE(0)	GE(1)	GE(2)		GE(0)	GE(1)	GE(2)
50th	**0.2756**	**0.1260**	**0.1334**	**0.1926**	**0.2756**	**0.1260**	**0.1334**	**0.1926**
SE[a]	0.0021	0.0023	0.0048	0.0284	0.0021	0.0023	0.0048	0.0284
95% UB	0.2798	0.1306	0.1427	0.2483	0.2798	0.1306	0.1427	0.2483
95% LB	0.2714	0.1215	0.1240	0.1369	0.2714	0.1215	0.1240	0.1369
55th	**0.3033**	**0.1550**	**0.1800**	**0.6055**	**0.2988**	**0.1503**	**0.1710**	**0.4901**
SE[a]	0.0036	0.0047	0.0156	0.2498	0.0034	0.0041	0.0126	0.1790
95% UB	0.3104	0.1643	0.2107	1.0952	0.3055	0.1583	0.1956	0.8409
95% LB	0.2963	0.1458	0.1494	0.1159	0.2922	0.1423	0.1464	0.1392
61st	**0.4133**	**0.2864**	**0.3975**	**1.1909**	**0.4061**	**0.2758**	**0.3754**	**1.0503**
SE[a]	0.0194	0.0304	0.0726	0.4711	0.0179	0.0269	0.0656	0.3922
95% UB	0.4514	0.3459	0.5397	0.2677	0.4412	0.3286	0.5040	0.2816
95% LB	0.3752	0.2268	0.2553	2.1142	0.3709	0.2230	0.2468	1.8189

a. SE = bootstrap standard error of the estimate; UB = Upper bound, LB= Lower bound

Table 10: Head-Count Poverty Rates

Rounds	Rural			Urban		
	Over expenditure on four included commodity groups[a]		Over all items	Over expenditure on four included commodity groups[a]		Over all items
	Nominal[b] Poverty Rate (per adult equiv.)	Real Poverty Rate (per adult equiv.)	Nominal Poverty Rate (per capita)	Nominal[b] Poverty Rate (per adult equiv.)	Real Poverty Rate (per adult equiv.)	Nominal Poverty Rate (per capita)
50th	**0.1196**	**0.1196**	**0.2889**	**0.1294**	**0.1294**	**0.2361**
SE[c]	0.0017	0.0017	0.0023	0.0025	0.0025	0.0029
95% UB	0.1230	0.1230	0.2935	0.1342	0.1342	0.2417
95% LB	0.1162	0.1162	0.2843	0.1246	0.1246	0.2305
55th	**0.1368**	**0.0852**	**0.2299**	**0.1373**	**0.0880**	**0.1800**
SE[c]	0.0017	0.0014	0.0021	0.0028	0.0023	0.0030
95% UB	0.1401	0.0879	0.2341	0.1428	0.0925	0.1858
95% LB	0.1335	0.0824	0.2257	0.1319	0.0836	0.1742
61st	**0.0185**	**0.0108**	**0.1045**	**0.0796**	**0.0693**	**0.2295**
SE[c]	0.0008	0.0006	0.0020	0.0031	0.0028	0.0049
95% UB	0.0200	0.0119	0.1084	0.0857	0.0749	0.2392
95% LB	0.0170	0.0097	0.1006	0.0736	0.0638	0.2199

a. The included groups of items are: Food; Fuel and Light; Clothing, Bedding and Footwear; Miscellaneous.
b. The nominal poverty lines used in these calculations were obtained by scaling down the official poverty lines by multiplying them by the median budget share of the four commodity groups in total expenditure (0.944 for rural and 0.919 for urban) in the 61st round.
c. SE = bootstrap standard error of the estimate; UB = Upper bound, LB= Lower bound

Table 11: Differences between Nominal and Real Expenditure Inequality and between Nominal and Real Poverty Rate (per adult equivalent)

	Rural Sample		Urban Sample	
	Expenditure Inequality[a]	Poverty Rate[b] (per adult equiv.)	Expenditure Inequality[a]	Poverty Rate[b] (per adult equiv.)
NSS 55th. round	**0.00240**	**0.03175**	**0.00394**	**0.07410**
95% CI	[0.00243, 0.00238]	[0.03234, 0.03116]	[0.00396, 0.00391]	[0.07489, 0.07331]
NSS 61 st. round	**0.00738**	**0.02072**	**0.00392**	**0.00915**
95% CI	[0.00746, 0.00731]	[0.02141,0.02004]	[0.00398, 0.00386]	[0.00939, 0.00892]

a. Expenditure inequalities are measured by Gini coefficients.
b. Head count measure used to calculate poverty rate.

Figures

Figure 1: Gini Coefficient for 61st Round at Varying Values of θ in Rural Sample

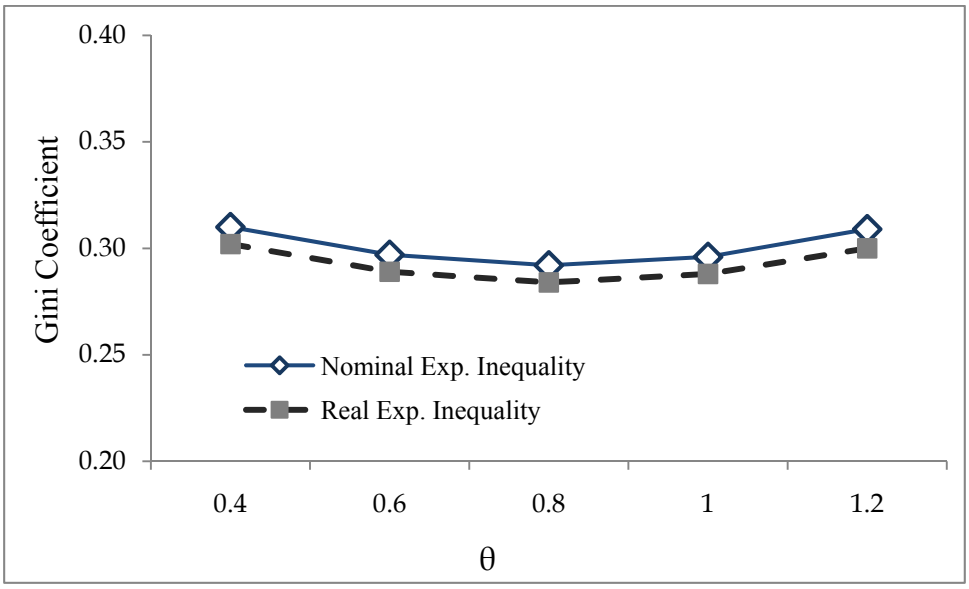

Figure 2: Gini Coefficient for 61st Round at Varying Values of θ in Urban Sample

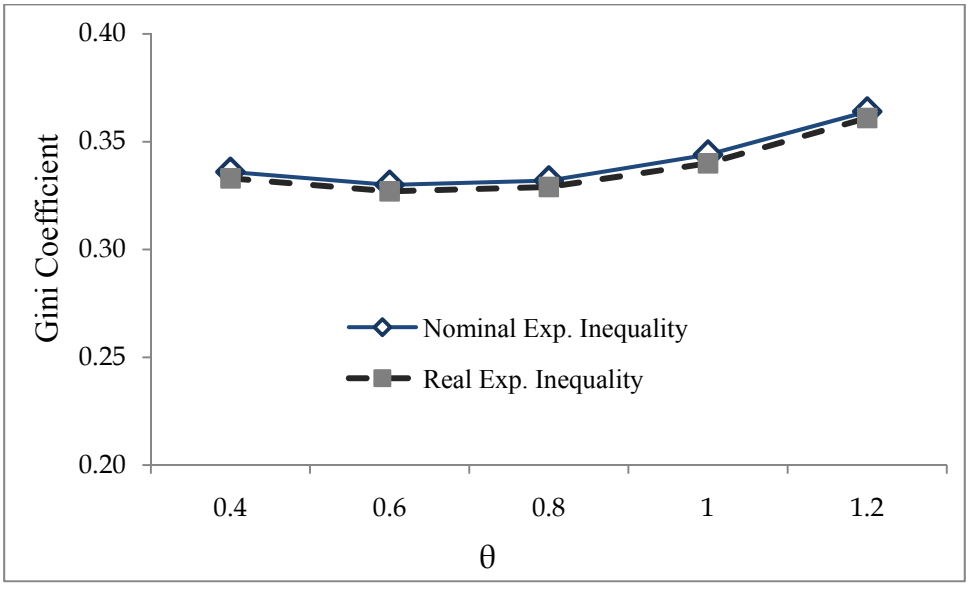

Figure 3: Head-Count Rural Poverty Rates at Varying Values of θ in 61st Round

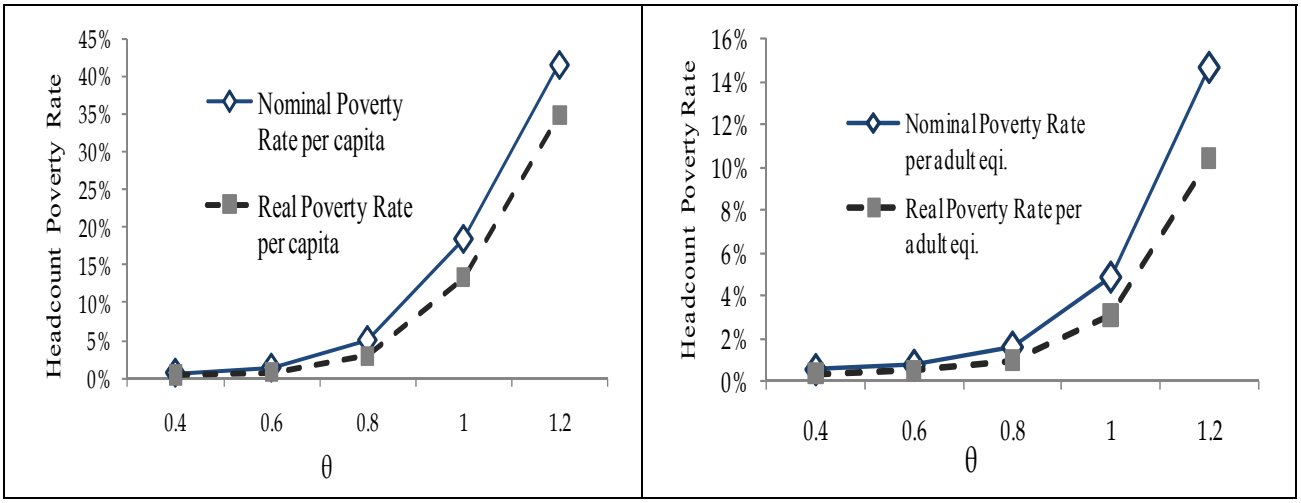

Figure 4: Head-Count Urban Poverty Rates at Varying Values of θ in 61st Round

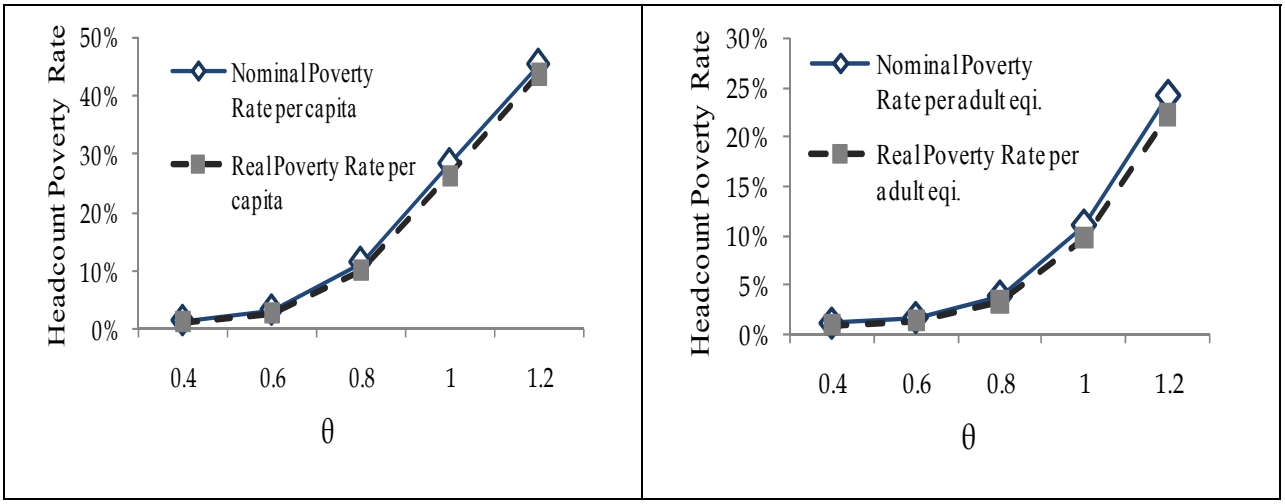

Figure 5: Sensitivity of Rural Expenditure Inequality to Expenditure Dependent Equivalence Scales in 61st Round

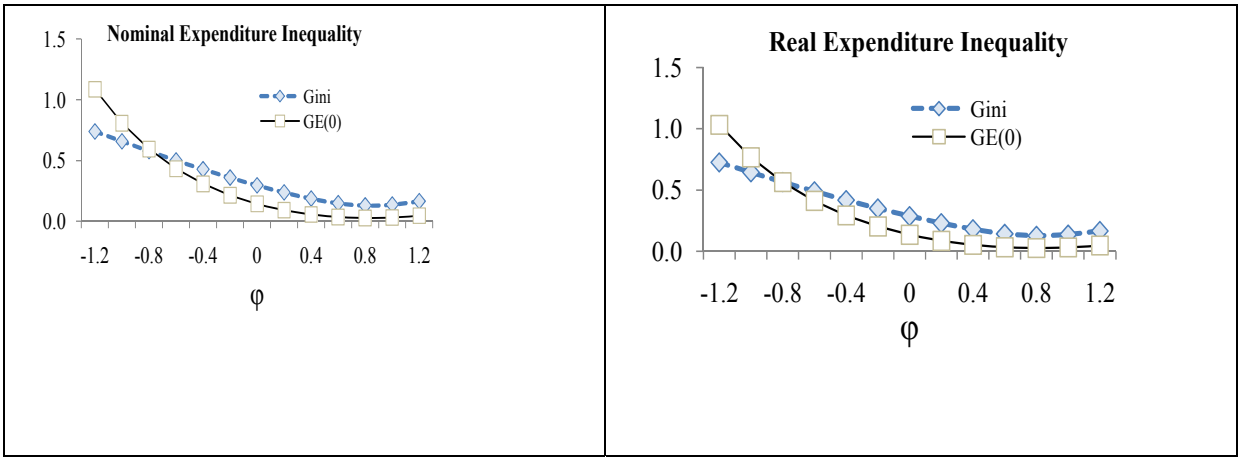

Figure 6: Sensitivity of Urban Expenditure Inequality to Expenditure Dependent Equivalence Scales in 61st Round

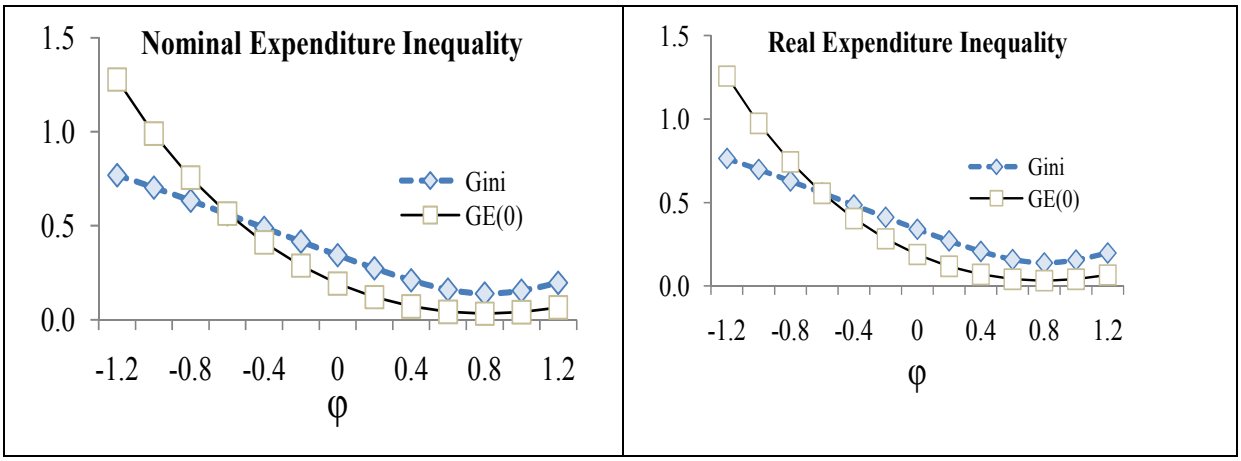

Figure 7: Sensitivity of Rural Poverty Rates to Expenditure Dependent Equivalence Scales in 61st Round

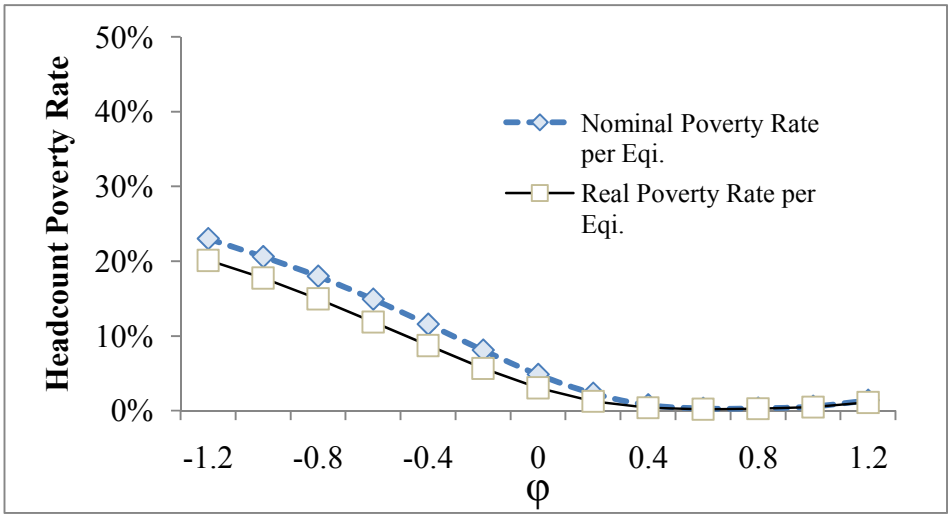

Figure 8: Sensitivity of Urban Poverty Rates to Expenditure Dependent Equivalence Scales in 61st Round