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Preferences, Spatial Prices and Inequality

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Consistent with the policy of this journal, the data sets will be made available on request.

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Abstract

This study examines the effect of prices on inequality in the heterogeneous country context of rural India during the period of economic reforms and beyond (1999/2000 – 2009/2010). It proposes a framework for calculating "exact" price indices, based on the recent "Exact Affine Stone Index" (EASI) demand system, and shows its usefulness by calculating spatial prices and regionally varying temporal prices that allow for both differences in preferences between states and over time. The study finds that the nature of inflation has been regressive during the first half (1999/2000 – 2004/2005) and progressive during the second half (2004/5-2009/2010) and the effects of temporal price inflation and spatial prices on inequality are qualitatively different. The study of the behaviour of inequality as a country develops and experiences high growth rates is important, given that rising inequality may lead to increasing marginalisation even while the poverty rates may have declined.

Key words: Exact Affine Stone Index, Expenditure Inequality, Spatial Prices, Exact Price Index.

JEL Classification Number: C43, D12, E31, I31, O53.

Preferences, Spatial Prices and Inequality

1. Introduction

Much of the recent literature on growth and development has concentrated on temporal movement in the poverty rates as a country develops [Ahluwalia (1978), Lipton and Ravallion (1995), Ravallion and Datt (2002), Reddy and Pogge (2007)]. In the context of India[1], that recorded impressive growth rates in recent years, the literature has paid much more attention to poverty rates than to inequality. This feature stands out against the fact, documented in, for example, Kotwal, Ramaswami and Wadhwa (2011), that in India, while the poverty rates generally record a decline during the period of economic reforms in the 1990s and 2000s, the evidence on inequality suggests the reverse [Deaton and Dreze (2002), Mishra and Ray (2011)]. Basu (2011) has recently made a strong plea for bringing inequality to the centre of policy debate in the context of a growing economy. The present study on India is in such a spirit.

This paper is devoted to the subject of expenditure inequality in rural India during the period, 1999/2000 to 2009/2010. Though largely dictated by the availability of expenditure information in India's National Sample Surveys that provided the data for this study, and the lack of comparable information on income, the use of expenditure inequality over income inequality has been justified by Blundell and Preston (1998), and is consistent with the practice adopted in the economics literature (e.g. Barrett, Crossley and Worswick, 2000; Blacklow and Ray, 2000).

The present study provides evidence on a set of largely unexplored issues. These, listed as follows, provide the distinctive features and motivation of this study.

First, this study provides a methodology for evaluating whether a change in prices has been progressive or regressive. In his pioneering study of the redistributive role of UK inflation, Muellbauer (1974) established the close link between the specification of consumer preferences and evaluation of the distributive consequences of inflation. Muellbauer's study, based on the restrictive Linear Expenditure System (LES) functional form, was extended by Ray (1985), to include the Almost Ideal Demand System (AIDS) functional form (Deaton

and Muellbauer, 1980) that was further extended in Nicholas, Ray and Valenzuela (2010), Mishra and Ray (2011) to incorporate the more general Quadratic AIDS (QAIDS) functional form proposed by Banks, Blundell and Lewbel (1997). Using an alternative methodology that employs a price dependent equivalence scale, but also based on the QAIDS functional form, Pendakur (2002) provides Canadian evidence on the redistributive consequences of inflation. The present study extends this literature by using the `Exact Affine Stone Index' (EASI) demand system due to Lewbel and Pendakur (2009) that is more general than QAIDS. EASI allows for flexible interactions between prices and expenditures, permits almost any functional form for Engel curves, and allows error terms in the model to correspond to unobserved preference heterogeneity.[2]

Second, the study focuses attention on spatial price differences in the large heterogeneous country context of India. As reported in Majumder, Ray and Sinha (2012), there are large and significant spatial differences in the prices of individual items between India's rural and urban areas. This study extends that finding to provide evidence on state wise differences in prices of individual items that translate into large differences in spatial price indices.

Third, this study deviates from the practice of using fixed weight based Divisia price indices by proposing preference consistent, "exact" price indices for the calculation of the spatial and temporal price indices. The methodology adopted is in the expenditure function based tradition of Feenstra, Ma and Rao (2009). Such an approach allows the incorporation of price induced substitution effects between items[3].

Finally, the paper uses the price information to provide evidence on the redistributive effects of inflation in India by comparing the nominal and real expenditure inequalities by state and in each time-period. It extends the study by Ravallion and Datt (2002) by moving the focus from poverty to inequality and provides evidence on magnitudes such as the spatial and temporal price elasticities of inequality on which currently there is hardly any evidence.

The rest of the paper is organised as follows. Section 2 describes briefly the methodology for calculating the 'exact' spatial and temporal price indices used in evaluating the distributional effects of price movements. The EASI demand system that provides the demand framework for estimating the preference parameters required in the welfare analysis is described in online Appendix A. Section3 describes the data and the constructed prices by states and over

time (detailed estimates are in online Appendix B, Tables B1 to B8, and online Appendix C, Tables C1 to C8). Section 4 presents the estimated spatial and temporal prices using the "exact" price indices corresponding to the EASI demand system. Section 5 presents evidence on the robustness of the estimates of spatial prices and preferences to the procedure used to construct prices from the unit values. Section 6 focuses on inequality. Section 7 concludes the paper and notes limitations.

2. The Exact Price Indices and The Distributive Impact of Inflation

The "True Cost of Living Index" (TCLI), or the "exact price index", is the ratio of the expenditures for attaining the same utility level, u^*, in two price situations, $\boldsymbol{p}_1$and $\boldsymbol{p}_0$. Denoting the former as the price vector in situation "1", and the latter as the base price vector (situation "0"), the TCLI is, in logarithmic form, as follows:

$$lnP\,(\boldsymbol{p}_1, \boldsymbol{p}_0, u^*) = \sum_{j=1}^{J} m^j\,(u^*, \mathbf{z})\,(\ln p_1^j - \ln p_0^j) + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}\,(\mathbf{z})\,\ln p_1^j \ln p_1^k - \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}\,(\mathbf{z})\ln p_0^j \ln p_0^k + \sum_{j=1}^{J} \varepsilon^j\,(\ln p_1^j - \ln p_0^j). \quad (1)$$

$\boldsymbol{p}$ denotes the vector of prices, $\boldsymbol{z} = \{z_1, \ldots, z_T\}$ denotes the vector of demographic characteristics of the household, u is the utility level, $\boldsymbol{\varepsilon} = \{\varepsilon^1, \ldots, \varepsilon^J\}$ is a vector of unobserved preference heterogeneity parameters for the consumer, and we assume that $E\{\boldsymbol{\varepsilon}\} = 0_J$. We can obtain an observable expression for the TCLI by substituting the unobservable, u^*, by the expression of the right hand side of the EASI utility function [see online Appendix A]. The resulting expression is as follows:

$$ln\,P(\boldsymbol{p}_1, \boldsymbol{p}_0, u^*) = \sum_{j=1}^{J} w_0^j\,(\ln p_1^j - \ln p_0^j) + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}\,(\ln p_1^j - \ln p_0^j)(\ln p_1^k - \ln p_0^k); \quad (2)$$

u^*, the reference utility level, corresponds to that in the base year with price vector, $\boldsymbol{p}_0$,and $\boldsymbol{w_0}$ is the vector of budget shares (w_0^j) in the base year.

The expression on the right hand side of equation (2) allows the calculation of both spatial and temporal prices. In case of the former, we use the median household in the distribution of

households over the whole of India in a particular survey as the reference household, and calculate the state wise price indices with respect to that of the whole country normalised at one. In case of the temporal TCLI, we use the median household in the base year as the reference household. Even in the temporal case, we keep the spatial element in mind in calculating the temporal TCLI, state by state, and for All India. In the temporal case, we also calculate the TCLI s in each time-period by quartiles, by taking the median household in the four quartiles in the base year as the reference household. This allows us to examine the inflation over the period; 1999/2000 – 2009/2010; by quartiles. In using the quartile specific TCLI as the price deflator to convert a household's expenditure from nominal to real expenditures, we open up a divergence between nominal and real expenditure inequalities. The sign of the difference between nominal and real expenditure inequalities tells us the distributive impact of the inflation over the period considered, with a positive sign indicating that the nature of price increase has been progressive, and regressive, otherwise.

3. The Data and the Quality Adjusted Unit Values

This study uses the detailed rural information on household purchases of food and non- food items in both quantity and value terms, along with that on household size, composition and household type, contained in the unit records from the 55th (July, 1999- June, 2000), 61st (July, 2004- June, 2005), and 66th(July, 2009- June, 2010) rounds, which are the three recent rounds of India's National Sample Surveys[4]. We focus on rural sector only because in India the majority of households (about 70%) live in rural areas. The 10 items used in the demand estimation along with the unit of their prices are listed in the online Appendix Table C1 (hereafter note that all appendices are online and appendix tables are prefixed by B or C). Note that only the items, for which unit values can be calculated, are included. This excludes items like housing, transportation and a number of durables, but the included items constitute approximately 63-65% of the per capita total expenditure for the two lower quartile groups and 50-60% for the two upper quartile groups for all rounds considered here. As can be seen from Table 1 below, the calculated CPIs based on these are not very different from the official figures. The exclusion of items such as housing and transportation means that the picture on inequality presented later is at best a partial one. The 15 major states considered in this study, along with the number of districts in each state in each round, are listed in Table C2.

The calculation of "exact" temporal and spatial price indices based on complete demand systems requires item wise price information for estimates of the demand parameters. To estimate the preference parameters, we need the price information by households and over time. This study follows the practice in Majumder, Ray and Sinha (2012, 2013a, 2013b) in using the raw unit values of the items as proxies for prices, but adjusted for quality and demographic and other relevant factors (like `household type')[5] using the procedure introduced by Cox and Wohlgenant (1986) and extended by Hoang (2009)[6]. In the absence of data and a consistent subdivision of each district into smaller regions, we assume that the prices do not vary within the districts.

The median quality adjusted unit values in the three rounds are presented in Appendix Tables B1-B3. A few features are worth noting. First, the inflation in all the items was much higher in the second half (2004/5- 2009/10) than in the first half (1999/2000- 2004/5). Second, the price increase in the second half has been quite uneven between the 10 items, with the three non-food items, Fuel, Clothing and Footwear recording much higher inflation than the food items. Third, there is large spatial variation in the unit values, and the inflation has been quite uneven between the principal states of India. Appendix Table C3 reports the variation in median prices between quartiles at the all India level. These show that they increase continuously from the first to the fourth quartile, and that the increase is larger in case of the non-food items, especially Fuel, than in case of the food items. The increase is much sharper between the top two quartiles than between the others and this adds to the redistributive nature of inflation over this period[7].

4. Spatial and Temporal Price Indices in India using the 'Exact' Cost of Living Index

Appendix Table B4 presents two sets of indices of spatial prices by states (rural) in each year of the three NSS rounds with All India (rural) treated as the reference point[8]. The first set of spatial price indices, referred to as Set 1 and reported in columns 2-4, are evaluated using EASI parameters estimated on pooled All-India data. The second set of spatial price indices referred to as Set 2 and reported in columns 5-7, are evaluated using EASI parameters estimated separately for each state.[9] Thus, in the former, all states are assumed to have the same underlying preference structure, which is the All-India preference. These spatial price indices satisfy transitivity, which enables comparison across states. In the latter, each state has its own preference structure. Hence, the indices are not transitive and one can only

compare a state with All-India, which is assumed to have the same preference structure as that of the particular state for each comparison. Thus, in this case the indices are not comparable directly across states. A spatial price for a state that is higher than one indicates a higher than average cost of living in that state, and the reverse if the spatial price is less than one. While some states, such as Kerala and Tamil Nadu, have retained their status as 'high' cost of living states and Bihar, Orissa and Uttar Pradesh as 'low' cost of living states throughout the decade, there has been considerable movement in case of several of the other states. The neighbouring states of Haryana and Punjab record a gradual increase in their cost of living throughout this period. The quartile disaggregated picture underlying Table B4 is presented in Table C4, which reports the spatial prices by expenditure quartile. These show that the spatial prices are generally robust to quartile changes with Kerala and Uttar Pradesh making up the two extremes for all the quartiles. An interesting exception and reversal occurs for the top two quartiles in Kerala in NSS Round 66. The spatial prices presented in Table C4 allowed for both preferences and the prices to vary between the 4 quartiles, since the spatial price indices were calculated using EASI parameter estimates that varied between quartiles along with the quartile specific median prices. Table C4a presents the state wise spatial prices (for the 66^{th} round only) by quartiles where the price indices were calculated at the median prices over all the quartiles, i.e. we allow preferences to vary between quartiles but assume that all the quartiles face the same median price vector. It shows that the spatial prices are almost identical between the 4 quartiles. A comparison between the Tables C4 and C4a shows that the difference in spatial prices between the quartiles is due to differences in prices faced by households in the quartiles and not due to differences in preferences and expenditure patterns. This is confirmed in Table C3 which presents the quality adjusted unit values by quartiles for all India. Clearly, the median prices increase as we move from the lower to the higher quartiles, and the price spread between the quartiles has increased markedly over time.

Table 1 about here

Table 1 presents the temporal 'exact' price indices for each state and for All-India in NSS Rounds 66 and 61 with respect to NSS round 55 as the base year. To see how these indices compare with the official Consumer Price Indices (CPIs) reported by Labour Bureau, Government of India[10], we also report the official CPIs for the corresponding years. Consistent with our earlier discussion and Tables B1-B3, Table 1 shows that in both cases the second half (2004/5- 2009/10) witnessed a much larger increase in prices than the first half

(1999/2000- 2004/5) of the decade. The similarity between the qualitative pictures painted by the NSS, 10 items based 'exact' indices and the official cost of living estimates, evident from Table 1, confirms that the prices of the excluded items have not moved that differently from those of the included items to have large distributional implications that could question the robustness of the principal welfare conclusions of this study. Table 1 also underlines the spatial dimension in the price increases by recording considerable variation between the principal states in their temporal price inflation. As inflation accelerated sharply from the first half to the second half of the decade, so did the spatial dispersion in the temporal price indices between the states. By the end of the decade, a wide gulf had opened up with, for example, Punjab recording almost a doubling of prices over the period in contrast to Kerala which recorded a much lower rate of inflation.

Table B5 presents the disaggregated picture underlying Table 1 by reporting the temporal inflation figures by quartile. In case of several states, but not in all states, the top most quartile records the highest price increase. The lack of a robust picture on inflation, that holds for all the states in India, and some of the differences are quite noticeable, points to the need to investigate the spatial dimension in the context of a large Federal country with heterogeneous preferences and affluence such as India to a much greater extent than has been done before. The evidence on spatial price differences in India is consistent with similar findings for Brazil [Aten and Menezes (2002)] and Indonesia [McKelvey (2011)].

The spatial and temporal price indices reported and discussed in this section have been based on the EASI parameter estimates reported in Table C5. While Table C5 reports the EASI estimates on the data pooled over the three rounds, with time dummies introduced for NSS rounds 61 and 66 with respect to NSS round 55, Tables C5a, C5b and C5c report the EASI estimates for the individual rounds 55, 61 and 66, respectively. A comparison between the three sets of round wise estimates shows considerable instability between the coefficient estimates in the three rounds. Note, however, that, the evidence in support of higher order expenditure effects on budget shares beyond the quadratic is present in each round. Table C6 provides formal evidence in favour of dynamic expenditure patterns by reporting the joint tests of significances of the two time dummies in the EASI estimation on the pooled data.

Table C7 provides a check on the reasonableness of the EASI parameter estimates reported in Table C5 by reporting the 10×10 matrix of uncompensated price elasticities for the 10 items.

The own price elasticities are all negative with most of the items turning out to be price inelastic items. The cross price elasticities are also mostly, but not always, sensible. Examples of two implausible estimates are the large and negative magnitude of uncompensated elasticities of the demand for footwear with respect to the price of Cereals & Cereal Substitutes (suggesting complementarity) and the large positive magnitude with respect to the price of Milk & Milk Products (suggesting substitutability). This highlights the limitations implied by assuming separability when there are omitted categories. For example, it is possible that richer households spend a relatively greater share of income on meat (an omitted product) and on footwear, so consumption of meat products will be correlated with footwear, and prices of meat will be highly correlated with cereal prices, hence the apparent complementarity of footwear and cereals (we are grateful to a referee for pointing this out).

5. Sensitivity of estimated spatial prices to the procedure for constructing prices from household level unit values

The use of the Cox and Wohlgenant (1986) procedure, along with the assumption that all households within a district face the same prices, though convenient, raises the issue of robustness of the price series constructed from the adjusted unit values to (a) the use of an alternative procedure due to Deaton (1988)[11], and (b) relaxation of the assumption of price invariance within a district to the weaker assumption of price invariance within a cluster. In the context of our study, a cluster is a 'village', and the 'district' is a larger geographical unit that is made up of villages. The Deaton procedure is more sophisticated than the modified Cox and Wohlgenant procedure that has been used here as it does not assume price invariance within a district, only within a cluster. However, the Deaton procedure requires information on which cluster (i.e. village) the household resides in. Such information may not be available in many data sets. This study uses the information from the 66th round to provide useful comparative evidence between the two procedures.

The Deaton (1988) procedure for the construction of spatial prices is described in online Appendix D. Table B6 compares the State wise prices between the two procedures for round 66. To simplify calculations, the comparison is based on the principal 5 food items, which constitute nearly 70 % of the total expenditure on the 10 items considered here (see Table C8). While the Cox and Wohlgenant/Hoang procedure retains price invariance within a district, Deaton's procedure relaxes this assumption. Clearly, the two sets of adjusted unit values are quite different for every state. Without exception, Deaton's quality adjusted unit values are

smaller in magnitude and the variation in absolute adjusted unit values between states is lower for the Deaton procedure. Note, however, from Table B7 that the correlation between the state wise adjusted unit values obtained from the two procedures is close to one. This suggests that the estimated spatial prices are robust to the procedure used for adjusting the unit values.

Table B8 compares the EASI demand estimates for the five equation system between the two procedures for generating prices. Consistent with the differences between the two sets of adjusted unit values, the EASI estimates are also quite different. The R-square values are higher in the Cox and Wohlgenant procedure than in the Deaton procedure. However, consistent with Table B7, Table 2 shows that the spatial prices are quite robust between the two procedures. This picture of robustness of spatial prices to the method for constructing prices also holds when preferences are allowed to vary between states.

Table 2 about here

6. Expenditure Inequalities and the determinants of their Variation between States

The first sub-section below presents the two sets of expenditure inequalities distinguishing between the nominal and real expenditure inequalities. The former does not explicitly incorporate the changes in relative prices and the differential impact of the price changes on different household groups depending on their affluence, unlike the latter. The second sub-section correlates the differences in inequality between states with some of the state characteristics along with the state specific changes in relative prices and inflation.

6.1 The Expenditure Inequalities and the Distributive Impact of Inflation

Table 3 presents the Gini measure of the nominal and real expenditure inequalities (household level) both by state and for each time period. In this table, the nominal inequality refers to the case where all the households within a state face the same price, while real inequality refers to the case where we allow the prices to differ between households by quartiles. Note that the two sets of inequalities are equal in the base year, 1999/2000. The following features are worth noting. First, there is considerable variation in the magnitude of the inequalities between states. This is true of both nominal and real expenditure inequalities. Second, while in most states, the inequalities were static or even recorded a decline during

1999/2000- 2004/5, there was a sharp increase in inequality, in both nominal and real terms, in most states during the second half, 2004/5- 2009/10. The increase in inequality was particularly large in case of Kerala and Punjab making them two of the most unequal states in India at the end of our sample period. While the sharp increase in case of Kerala is possibly due to the increased inflow of remittances from the gulf that favoured some households over others, the inequality increase in Punjab reflects the gain for the large farmers that benefitted from growth enhancing reforms and the large subsidy to diesel and fertilisers. The increase in inequality in nearly all the states during the period, 2004/5 – 2009/10, is reflected in the sharp increase in inequality recorded by the All India figures in both nominal and real terms. Third, neither the magnitude nor the direction of change in inequality over the two sub periods is identical for all the states nor is it robust between nominal and real expenditure inequality. For example, in Gujarat, while nominal inequality increased sharply during the period between NSS rounds 61 and 66, real expenditure inequality declined. In Haryana, while there was a sharp increase in nominal inequality over this sub period, real expenditure inequality remained unchanged.

Table 3 about here

Note, however, that the qualitative result on the sharp increase in nominal expenditure inequality between rounds 61 and 66 is generally robust between states. Table 3 contains evidence on the distributive impact of inflation. If the real expenditure inequality exceeds nominal expenditure inequality then it indicates that the relative price changes have been regressive and progressive if otherwise. A comparison of the two sets of inequalities suggests that, along with the magnitude, the nature of inflation has changed between the two sub periods. The price inflation was regressive in several states during the first sub period (1999/2000- 2004/5) and this is reflected in the real expenditure inequality (0.235) exceeding the nominal inequality (0.215) in round 61 at the All India level. However, during the second sub period, (2004/5- 2009/10), with items such as Fuel, Clothing and Footwear recording much greater price increases than most of the food items, the inflation has tended to moderate the increase in inequality via the change in relative prices. This is reflected in the fact that, in most states, the nominal expenditure inequality exceeds the real expenditure inequality in round 66, often by large margins. Note, however, that the progressive nature of the relative price changes during the sub period, 2004/5- 2009/10, only helped to slow down the inequality increase, not reverse it. At the all India level, while the nominal inequality

increased quite sharply from 0.215 in round 61 to 0.290 in round 66, the real expenditure inequality also recorded a large increase, from 0.235 to 0.288, though less in proportionate terms than the increase in nominal expenditure inequality. It is important to recognise that the second half of our sample period, which saw a sharp rise in inflation, was also associated with a sharp increase in inequality. This brings into focus the relationship between inflation and inequality, an issue we turn to in the following section.

6.2 The Effect of Inflation on Inequality

The above discussion suggests that high inflation is associated with a sharp increase in inequality. Inflation can worsen inequality in principally two ways: first, those at the lower end of the distribution, namely, those on fixed income and the unemployed will see a slower increase in their purchasing power, if at all, in relation to those at the upper end whose earnings, mainly business income and indexed salaries, will increase with inflation; second, the less affluent households have limited substitution possibilities in relation to the more affluent households. This raises the question: what is the estimate of the elasticity of inequality with respect to prices and to the state of development? Surprisingly, there is hardly any evidence in the literature on this issue[12], though there is considerable evidence on the elasticity of poverty with respect to growth and prices [see, for example, Ravallion and Datt (2002)].

To answer this question, we created a state level panel from the three rounds of the National Sample Surveys that have been used in this study (NSS Rounds 55, 61 and 66), and ran panel regressions with the state level nominal and real expenditure inequality as the dependent variables. Besides the measures of temporal and spatial prices, we tried several other state level variables as determinants, most of which proved insignificant. All the variables were estimated in log form, so that the coefficients are readily interpreted as elasticities. Several variants of the models were estimated by using various combinations of the state level variables.[13] The final model that emerged is:

$$lnG_{it} = \alpha + \beta^{NFP} lnNFP_{it} + \beta^{GOV} lnGOV_{it} + \beta^{TI} lnTI_{it} + \beta^{SI} lnSI_{it} + \eta_i + \varepsilon_{it}, \quad (3)$$

where *G* denotes Gini coefficient (nominal/real), *NFP* is the real non-farm output per capita, *GOV* is the (real) state development expenditure per capita, *TI* is the temporal index (Table 1), *SI* is the spatial index (Table B4), *i* stands for states, *t* stands for time points and η_i is the state

specific (fixed/random) effect.The F-tests rejected pooled regression and, based on Hausman test statistic, the most efficient models (panel fixed model/ panel random model) were arrived at[14]. The results are presented in Tables 4(a) and 4(b), with the left column in each table showing the estimated coefficients in the panel regression of nominal inequality, the right column showing that for real expenditure inequality. Table 4(a) reports the results based on the first set of spatial prices, reported under Set 1 in table 4 (columns 2-4), i.e., spatial indices evaluated using EASI parameters estimated on pooled All-India data. Table 4(b) is based on the second set of spatial prices, reported under Set 2 in Table B4 (last three columns), i.e., spatial indices, which are evaluated using parameters of state-specific EASI demand system.

Tables 4(a) and 4(b) about here

The model adequacies are evident from the LR tests. In Table 4(a), the Hausman test statistic is consistent with the fact that in case of nominal inequality, the state dummies include several state specific unobserved characteristics which may be correlated with the other state specific variables, in particular the spatial indices, as the dependent variable is unadjusted for any state specific variation. On the other hand, in case of real expenditure inequality, the state to state variations due to price changes have been incorporated in forming the left hand side variable. Hence, the remaining impact of the state is purely random and uncorrelated with the included state specific other variables in the regression. In contrast, in Table 4(b) both turn out to be random effects models and the difference in the nominal inequality model is due to introduction of state specific preference consistent spatial price indices. The implication is clear. While the spatial indices in Table 4(a) contain state specific variation only in prices, those in Table 4(b) contain variation in both prices and preferences. The remaining impact of the states in the latter case thus becomes purely random and hence the model becomes a random effects model.

To focus our attention, the tables report the estimated coefficients of the principal variables of interest in this study, namely, the temporal and spatial price indices and two measures, of development, real non-farm output per person (NFP) and real per capita state development expenditure (GOVT). These tables allow interesting comparisons between the principal determinants of nominal and real expenditure inequality, and neither the magnitude nor the sign are always the same for the estimated coefficients in the panel regressions of the two inequality measures.[15] In Table 4(a) Non-farm output has no effect on nominal inequality, but

has a significantly positive effect on real expenditure inequality. A plausible explanation is as follows. Since the rural sector is dominated by agriculture, an increase in non-farm output shifts the income (in real terms, as here the inequality is based on quartile wise price deflated expenditures as opposed to the case with nominal inequality) towards that section of people, engaged in non- agricultural activities, who are generally rich and this increases inequality. Real per capita development expenditure reduces both nominal and real inequality, with the effect much greater in both size and significance for real than for nominal inequality. The elasticity estimates of -0.11 (nominal) and -0.21 (real) suggest that, ceteris paribus, with a doubling of rural development expenditure, there will be a 11% reduction in nominal inequality, and a 21% reduction in real expenditure inequality. The benefits of rural development spending are mainly felt by the less affluent households and the elasticity estimates point to a significant role that rural development schemes can play in moderating inequality increases in a period of high growth.

Of particular interest are the price elasticities[16] of inequality, and here we distinguish between temporal and spatial prices. The temporal price elasticity is positive and highly significant in both cases, with an estimate of 0.690 for nominal inequality, and 0.451 for real inequality. A ceteris paribus doubling of temporal prices will increase nominal inequality by 69%, and will increase real inequality by 45%. The lower elasticity of the latter is consistent with the results discussed in the previous section that suggested that during the period of high inflation in India that marked the second half, 2004/5– 2009/10, the progressive nature of the relative price changes tended to moderate the inequality increase that is taken into account in the measure of real expenditure inequality, but not nominal expenditure inequality. Both the elasticity estimates do agree, however, that inflation has a large adverse impact on expenditure distribution. In contrast to temporal inflation, spatial prices have a negative impact on inequality which suggests that the more expensive states are associated with lower inequality. The magnitude and size of significance is larger in case of nominal inequality than for real inequality. Note, however, that spatial prices have a weaker effect than temporal prices on both measures of inequality.

Table 4(b) shows a slightly different picture. Here Non-farm output has significantly positive effect on both nominal real expenditure inequalities. Real per capita development expenditure reduces both nominal and real inequality, with the effect greater in both size and significance for nominal than for real inequality, with elasticity estimates of -0.22 (nominal) and -0.19

(real). While the temporal price elasticity is positive and highly significant in both cases, as in the previous case, with an estimate of 0.609 for nominal inequality, and 0.446 for real inequality, the spatial indices turn out to be negative and non-significant. One common feature of the two tables is that most of the state specific variation in inequality is captured through the state specific temporal price indices.

7. Conclusion

The significant features of this study are described as follows.

First, the paper focuses attention on the role of prices in inequality movements. This study draws a distinction between real and nominal expenditure inequalities. An examination of the differences between the two inequalities will tell us whether the structure of relative prices facing the different households has been progressive or regressive both in a given year and in their changes over time. The proposed methodology is shown to be useful by reporting that the price movements in India have been regressive or (at best) neutral during the first sub period (1999/2000- 2004/5), but largely progressive during the second sub period (2004/5-2009/10).

Second, the study explores the link between preferences and prices in proposing utility based methodologies for calculating "exact" price indices that incorporate differences in preferences and in the prices of individual items between the various states. This study shows the usefulness of the information on unit values available in many household budget surveys in welfare applications requiring prices.

Third, the study presents evidence on the effects of spatial and temporal prices on inequality that suggest that the effects can be quite different between the two sets of prices. While there is unambiguous evidence that temporal price inflation has a positive (and highly significant) effect on inequality, the evidence on spatial prices is to the contrary, i.e., they have a mildly negative effect or no effect on inequality. The qualitative picture is shown to be robust between the incorporation of state specific preferences and the assumption of identical preferences.

Finally, based on the panel regressions, the evidence suggests that per capita real state expenditure reduces both nominal and real expenditure inequality. This phenomenon has

important policy implications. On one hand, the inequality increase due to price inflation may be moderated through an increase in rural developmental spending. On the other hand, an increase in non-farm productivity may shift the balance in favour of the skilled in the rural areas against the landless and the unemployed and this tends to increase inequality. The second half of our chosen period, 2004/5- 2009/10, witnessed a large surge in prices and a redistribution of rural output from farms to non-farms. The increase in rural developmental spending has not been able to negate the upward push to inequality from these two forces and the result has been a sharp increase in both nominal and real expenditure inequalities during 2004/5 – 2009/10. Such an inequality increase may have occurred simultaneously with a reduction in the poverty rates. This underlines the need to provide more focus on inequality. That is the principal message of this study. This study needs to be extended to consider the excluded items once new information is made available in the future NSS rounds.

Notes

[1] See Kotwal, Ramaswami and Wadhwa (2011) for a recent survey of India's growth, employment and poverty experiences over the last three decades.

[2]Application of the model to Canadian data by Lewbel and Pendakur (2009) shows significant departures from linear and quadratic demands that substantially affect social welfare calculations such as the cost of living impacts of price changes.

[3]The issue of price induced substitution effectshas been addressed by Deaton and Tarozzi (2000) and Deaton (2003) in the context of poverty analysis.

[4]Since NSS goes way back in time, one can do this exercise over many years. In this study, we focus on the last three rounds to keep the calculations manageable and to ensure consistency in the definitions of variables between surveys.

[5] In India for the rural sector'Household type' has the following categories: *self-employed in non-agriculture, agricultural labour, other labour, self-employed in agriculture* and *others.*

[6] Gibson and Rozelle (2005) suggest the use of 'price opinion' as better than adjusted unit values that they consider biased measures of prices but, as McKelvey (2011) has found recently, such price information is not free of bias either.

[7] One needs to qualify this remark by noting that while the affluent households are paying higher prices they are also consuming qualitatively superior quality items. Though our procedure controls for quality, there is still considerable heterogeneity in preferences that is driving this result.

[8]These have been calculated using equation (2). The reference point corresponds to the all India median budget shares and All-India prices (calculated from the pooled sample over all the states).

[9] Using observed values of w_0^j in equation (2) does not change the values much. The results are fairly robust.
[10]Labor Bureau, Govt. of India, publishes two series of CPIs, viz., CPI for Agricultural laborers (CPIAL) and CPI for Rural laborers (CPIRL) for the rural sector.

[11] See Kedir (2005), McKelvey (2011) for recent applications of the Deaton procedure.

[12]Pendakur (2002) is one the few studies that estimate the price elasticity of inequality and does so in the heterogeneous and spatially diverse context of Canada similar to the present study on India.

[13]In view of the relatively small number of observations these estimates may be considered as descriptive rather than structural.

[14]Note that there may be problems of endogeneity in regressing inequality measures on state specific variables, despite the use of fixed effects. The results here may be interpreted from a descriptive perspective.

[15] It may, however, be pointed out here that the difference between the nominal and real expenditure inequalities can be interpreted as the difference between indirect utilities defined over nominal and real expenditures, namely, between V(ln$x$) and V(ln$x$-ln$P$). Hence the covariance and variance terms, missing in the former, get added to the error term in the regression. This may induce endogeneity in the coefficient estimates.

[16]We should qualify this discussion by noting that these elasticites, which depend on the nature of movement in relative prices, need not be stable over time.

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Table 1: State specific and All India Temporal Price Indices: Rural sector
Base: NSS 55th Round

State	`Exact' Indices			Official Estimates*			
	NSS Rounds			2004-2005		2009-2010	
	55th	61st	66th	CPIAL	CPIRL	CPIAL	CPIRL
Andhra Pradesh	1.000	1.092	2.010	1.126	1.123	1.741	1.730
Assam	1.000	1.049	1.616	1.078	1.084	1.615	1.632
Bihar	1.000	1.056	1.727	1.149	1.148	1.773	1.761
Gujarat	1.000	1.071	1.703	1.115	1.114	1.713	1.708
Haryana	1.000	1.125	1.862	1.147	1.150	1.879	1.857
Karnataka	1.000	1.036	1.631	1.126	1.118	1.772	1.757
Kerala	1.000	1.058	1.545	1.093	1.086	1.545	1.549
Madhya Pradesh	1.000	1.034	1.718	1.065	1.073	1.694	1.700
Maharashtra	1.000	1.072	1.844	1.155	1.155	1.855	1.838
Orissa	1.000	1.011	1.666	1.053	1.053	1.628	1.632
Punjab	1.000	1.098	1.975	1.123	1.122	1.854	1.828
Rajasthan	1.000	1.021	1.665	1.113	1.106	1.842	1.817
Tamil Nadu	1.000	1.070	1.888	1.161	1.164	1.719	1.702
Uttar Pradesh	1.000	1.097	1.755	1.140	1.142	1.777	1.756
West Bengal	1.000	1.062	1.671	1.140	1.147	1.726	1.727
Coefficient of variation (%)	-	2.84	7.48	2.97	2.96	5.51	4.91
ALL INDIA (Rural)	1.000	1.076	1.790	1.125	1.124	1.743	1.729

*These were calculated from the published figures of CPIAL and CPIRL for the years corresponding to the three NSS rounds with 1986-87 as base. The figures in this table were obtained by dividing the 2004-2005 and 2009-2010 figures by the 1999-2000 figures for each state and All India.

Table 2: State specific Spatial Price Indices with respect to All India: 66th Round, Rural sector

State	(Set 1) Evaluated using EASI parameters estimated at All-India level and		(Set 2) Evaluated using EASI parameters estimated at State level and	
	Cox and Wohlgenant, Hoang Unit value	Deaton Unit value	Cox and Wohlgenant, Hoang Unit value	Deaton Unit value
Andhra Pradesh	1.389	1.354	1.215	1.163
Assam	1.179	1.197	1.098	1.109
Bihar	0.881	0.915	0.926	0.957
Chattisgarh	1.032	1.029	1.021	1.004
Gujarat	0.979	0.989	1.001	1.021
Haryana	0.847	0.857	0.911	0.957
Jharkhand	0.934	0.983	0.960	0.983
Karnataka	0.991	1.014	0.993	0.976
Kerala	1.384	1.272	1.198	1.136
Madhya Pradesh	0.789	0.828	0.874	0.910
Maharastra	1.025	1.041	1.022	1.037
Orissa	0.884	0.877	0.932	0.909
Punjab	0.859	0.867	0.925	0.954
Rajasthan	0.776	0.783	0.866	0.881
Tamil Nadu	1.351	1.297	1.190	1.127
Uttar Pradesh	0.731	0.767	0.834	0.872
Uttaranchal	0.918	0.926	0.955	0.957
West Bengal	1.037	1.055	1.024	0.999
All India (Rural)	1.000	1.000	1.000	1.000
Coefficient of Variation	**0.2129**	**0.1839**	**0.1201**	**0.0921**

Table 3: State specific and All India Gini Coefficients (Nominal and Temporal Price Deflated): Rural sector

State	Gini Coefficient (nominal)*	Gini Coefficient: Temporal Price Deflated (with respect to 55th Round)			
		Within a state all households face the same price (nominal)		Within a state all households within a quartile face the same price (real)	
	55th Round	61st Round	66th Round	61st Round	66th Round
Andhra Pradesh	0.226	0.204	0.265	0.202	0.250
Assam	0.189	0.141	0.232	0.128	0.219
Bihar	0.192	0.175	0.227	0.167	0.226
Gujarat	0.221	0.204	0.256	0.240	0.221
Haryana	0.243	0.232	0.287	0.260	0.260
Karnataka	0.228	0.195	0.252	0.192	0.221
Kerala	0.283	0.249	0.351	0.256	0.341
Madhya Pradesh	0.222	0.211	0.305	0.225	0.318
Maharashtra	0.240	0.207	0.246	0.214	0.235
Orissa	0.205	0.193	0.267	0.190	0.253
Punjab	0.221	0.205	0.313	0.179	0.258
Rajasthan	0.222	0.205	0.272	0.233	0.275
Tamil Nadu	0.264	0.204	0.290	0.213	0.273
Uttar Pradesh	0.232	0.211	0.253	0.226	0.253
West Bengal	0.202	0.187	0.232	0.174	0.233
ALL INDIA (Rural)	0.222	0.215	0.290	0.235	0.288

* The 'nominal' and 'temporal price deflated' Gini Coefficients are the same for the 55th round.

Table 4(a): Panel Regressions for State wise Overall Gini Coefficients (Nominal and Temporal Price Deflated): Rural sector (preferences assumed identical for all states)

Explanatory Variables (measured in logarithms)	Dependent variable: log (Gini coefficient)	
	Within a state all households face the same price (Nominal)	Within a state all households within a quartile face the same price
	(Fixed effects model)$	(Random effects model)$
Real non-farm output per person (NFP)	-0.111 (0.386)	0.213 (0.033)**
Real per capita state development expenditure (GOVT)	-0.110 (0.073)***	-0.206 (0.001)*
Temporal Index (TI) [from Table 5]	0.690 (0.000)*	0.451 (0.000)*
Spatial Index (SI) [from Table 4: set 1]	-0.293 (0.015)**	-0.204 (0.099)***
Constant	0.279 (0.747)	-2.170 (0.001)*
Likelihood Ratio (LR) Test: (χ_4^2)	94.66 (0.000)*	28.28 (0.000)*
Hausman Test Statistic: (χ_4^2)	9.74 (0.045)**	2.84 (0.585)

Figures in parentheses are the p-values. [*p<0.01, ** p<0.05, ***p<0.10 are level of significance.]

$ Among several other variants, including pooled regression, that were tried out, these turned out to be the most efficient models for the respective cases.

Table 4(b): Panel Regressions for State wise Overall Gini Coefficients (Nominal and Temporal Price Deflated): Rural sector (preferences allowed to vary between states)

Explanatory Variables (measured in logarithms)	Dependent variable: log (Gini coefficient)	
	Within a state all households face the same price (Nominal)	Within a state all households within a quartile face the same price
	(Random effects model)$	(Random effects model)$
Real non-farm output per person (NFP)	0.191 (0.024)**	0.190 (0.054)***
Real per capita state development expenditure (GOVT)	-0.221 (0.000)*	-0.193 (0.001)*
Temporal Index (TI) [from Table 5]	0.609 (0.000)*	0.446 (0.000)*
Spatial Index (SI) [from Table 4: set 2]	-0.067 (0.579)	-0.166 (0.324)
Constant	-1.857 (0.001)*	-2.033 (0.002)*
Likelihood Ratio (LR) Test: (χ_4^2)	54.11 (0.000)*	26.57 (0.000)*
Hausman Test Statistic: (χ_4^2)	3.07 (0.546)	7.48 (0.112)

Figures in parentheses are the p-values. [*p<0.01, ** p<0.05, ***p<0.10 are level of significance.]

$ Among several other variants, including pooled regression, that were tried out, these turned out
to be the most efficient models for the respective cases.

Appendix A: The EASI demand system

The 'Exact Affine Stone Index' (EASI) Demand System, proposed by Lewbel and Pendakur (2009), is derived from the following expenditure functionin logarithmic form (this exposition follows, quite literally, that in Pendakur (2009) which was a companion piece to Lewbel and Pendakur (2009)).

$$\ln C\,(\boldsymbol{p}, u, z, \boldsymbol{\varepsilon}) = u + \sum_{j=1}^{J} m^j(u,z) \ln p^j + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p^j \ln p^k + \sum_{j=1}^{J} \varepsilon^j \ln p^j. \tag{A1}$$

$\boldsymbol{p}$ denotes the vector of prices, $\boldsymbol{z} = \{z_1, \ldots, z_T\}$ denotes the vector of demographic characteristics of the household,u is the utility level, $\boldsymbol{\varepsilon} = \{ \varepsilon^1, \ldots, \varepsilon^J \}$ is a vector of unobserved preference heterogeneity parameters for the consumer, and we assume that $E\{\boldsymbol{\varepsilon}\} = 0_J$. The generality of the EASI demand system stems from the higher order polynomial in the utility variable, u, given by $m^j(u, z)$. FollowingLewbel and Pendakur (2009), we consider a 5thorder polynomial in u, which is given in observable form,y, in terms of the observable variables,by

$$y = u = \ln x - \sum_{j=1}^{J} w^j \ln p^j + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p^j \ln p^k. \tag{A2}$$

The budget shares, $w^j = w^j(\mathbf{p}, u)$are observable in the data,x is per equivalent household expenditure, with the OECD equivalence scale, defined as the square root of household size, used as the expenditure deflator (a more general form could introduce higher order terms in the polynomial (i.e. beyond the 5th order) and utility dependent price elasticities. However, we have retained the simple form for computational simplicity).

In budget share form, the EASI demand system is as follows:

$$w^j = m^j(y, \mathbf{z}) + \sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p^k + \varepsilon^j, \tag{A3}$$

Where $\alpha^{jk}(\mathbf{z}) = \alpha^{kj}(\mathbf{z})$ for all j,k .

$m^j(y,\boldsymbol{z})$ is assumed to be additively separable in $y,\boldsymbol{z}$; linear in $\boldsymbol{z}$ and polynomial in $\boldsymbol{y}$ and is given by

$$m^j(\mathrm{y},\mathbf{z}) = \sum_{r=1}^{R} b_r^j\, y^r + \sum_{t=1}^{T} g_t^j\, z_t. \qquad \text{(A4)}$$

As suggested in Lewbel and Pendakur (2009), Pendakur (2009), a polynomial in $\boldsymbol{y}$ of order 5, that is,$R=5$, is considered in the present exercise. The household is the unit of behaviour.The vector of demographic variables, $\boldsymbol{z}$, consisted of three elements, namely, the number of adults (z_1) and the number of children (z_2) in the household, and time variables (as described in the text, the EASI demand model was estimated on household expenditure data sets for three survey periods separately and also on pooled data over three survey periods. Time dummies were used in the estimation with pooled data to capture the impact of variation over time).

Estimation of (A3) followed the IV procedure explained in Lewbel and Pendakur (2009). The endogenous regressors are the R powers of y_n, and y_n is a function of exogenous lnx, z_t and lnp^j (as well as endogenous w^j). Pendakur (2009) has provided the computer algorithm for the estimation of the EASI demand system.

Reference:

Pendakur, K. (2009) EASI made easier. In D. Slottje (Ed.) *Quantifying Consumer Preferences,* (Contributions in Economic Analysis Series) (pp. 179-206), Emerald Group Publishing,London.

Appendix B:

Table B1: Quality Adjusted Unit Values in NSS 55th Round: Rural sector

State	Cereals and cereal Substitutes*	Pulses and products**	Milk and milk Products*	Edible oil*	Vegetables*	Sugar, salt, fruits*	Spices and Beverages*	Fuel**	Clothing and Bedding***	Footwear****
Andhra Pradesh	10.0	27.7	8.8	38.2	6.6	9.0	57.6	0.6	40.6	42.5
Assam	11.9	27.0	11.9	45.8	5.9	9.4	78.0	0.7	54.3	50.8
Bihar	9.5	22.1	11.3	41.7	4.2	9.1	61.5	1.0	41.4	37.4
Gujarat	8.2	26.4	12.7	43.4	8.0	13.3	93.5	0.9	42.1	48.2
Haryana	6.7	23.4	10.0	38.3	6.3	14.5	83.4	1.0	61.1	71.3
Karnataka	9.6	25.1	9.1	40.6	6.3	12.0	70.5	0.7	40.4	53.3
Kerala	12.0	28.5	12.5	50.3	9.3	11.9	67.9	1.2	49.9	50.2
Maharashtra	7.9	20.9	10.1	35.4	5.2	9.3	72.4	0.8	39.5	38.4
Madhya Pradesh	8.4	24.5	11.0	37.8	7.4	14.6	81.4	0.9	40.7	46.8
Orissa	9.7	25.0	9.5	42.2	5.0	6.5	59.7	0.6	44.2	33.6
Punjab	6.8	24.2	10.3	38.6	5.5	15.2	86.8	1.4	60.3	80.2
Rajasthan	7.0	22.0	10.1	42.9	6.9	12.8	77.6	0.9	48.2	63.4
Tamil Nadu	10.9	29.1	10.1	39.6	8.3	6.1	64.6	1.0	39.2	37.2
Uttar Pradesh	7.2	22.9	9.9	38.6	4.3	10.3	70.6	0.9	47.3	47.9
West Bengal	10.7	27.8	10.1	43.9	5.0	8.6	66.4	1.0	43.1	39.3
ALL INDIA (Rural)	9.1	24.7	10.4	40.7	5.9	10.3	70.6	0.9	44.7	46.1

*Values are in Rupee per Kilogram, ** Values are in Rupee per Litre, ** *Values are in Rupee per Piece, ** **Values are in Rupee per Pair.

Table B2: Quality Adjusted Unit Values in NSS 61st Round: Rural sector

State	Cereals and cereal Substitutes*	Pulses and products**	Milk and milk Products*	Edible oil*	Vegetables*	Sugar, salt, fruits*	Spices and Beverages*	Fuel**	Clothing and Bedding***	Footwear****
Andhra Pradesh	10.5	28.4	10.3	51.4	7.7	12.8	56.9	0.6	46.3	49.5
Assam	10.9	30.4	15.2	59.2	7.3	13.3	74.4	0.7	66.8	77.6
Bihar	8.7	24.6	12.3	57.8	5.3	13.9	55.9	1.4	48.2	48.9
Gujarat	8.3	26.7	14.2	53.6	9.8	16.3	78.9	0.9	42.9	56.8
Haryana	6.7	27.6	12.5	50.1	7.3	16.9	80.1	1.1	44.7	77.8
Karnataka	9.3	26.8	10.1	52.7	6.6	15.0	66.1	0.6	42.2	64.2
Kerala	12.2	30.8	13.6	66.0	9.9	15.6	59.9	1.1	58.0	72.8
Maharashtra	7.1	23.9	10.6	48.9	6.5	13.6	68.6	0.8	42.3	48.4
Madhya Pradesh	8.5	26.2	12.0	51.3	8.6	18.1	72.2	0.9	42.9	56.5
Orissa	8.3	25.3	10.0	59.1	6.6	12.5	58.6	0.7	56.5	49.3
Punjab	7.0	27.1	11.4	50.6	6.9	17.3	84.2	1.5	56.8	82.7
Rajasthan	6.8	24.8	10.6	53.3	8.3	15.1	71.2	0.7	45.0	66.5
Tamil Nadu	11.8	29.8	10.4	55.8	9.2	9.8	58.0	0.8	46.4	43.0
Uttar Pradesh	7.1	25.3	10.7	51.8	5.8	14.5	65.5	1.0	45.7	54.0
West Bengal	10.4	30.1	11.8	58.0	6.0	13.5	64.7	0.9	50.5	53.2
ALL INDIA (Rural)	8.8	26.8	11.5	54.1	7.3	14.5	66.8	0.9	47.7	58.2

*Values are in Rupee per Kilogram, ** Values are in Rupee per Litre, ** *Values are in Rupee per Piece, ** **Values are in Rupee per Pair.

Table B3: Quality Adjusted Unit Values in NSS 66th Round: Rural sector

State	Cereals and cereal Substitutes*	Pulses and products*	Milk and milk Products*	Edible oil*	Vegetables*	Sugar, salt, fruits*	Spices and Beverages*	Fuel**	Clothing and Bedding***	Footwear****
Andhra Pradesh	20.5	68.2	20.1	54.3	14.4	10.8	87.9	1.6	84.8	88.7
Assam	17.7	61.1	21.2	68.5	11.5	9.3	99.6	1.5	87.8	115.1
Bihar	14.2	49.7	20.0	67.2	9.8	9.5	104.0	2.7	77.7	77.2
Gujarat	14.3	61.5	21.7	60.8	15.0	9.6	120.4	1.4	62.8	83.6
Haryana	12.5	54.2	22.6	59.9	13.2	12.9	132.6	3.6	78.6	128.5
Karnataka	16.5	59.3	15.3	57.5	13.0	11.2	92.7	0.8	69.0	102.4
Kerala	20.4	64.4	20.1	56.0	17.4	8.4	98.0	1.2	98.3	125.6
Maharashtra	12.7	55.9	18.1	53.6	11.8	9.3	112.9	1.6	65.0	81.7
Madhya Pradesh	15.3	60.7	20.5	55.2	16.4	22.6	115.4	2.1	62.9	91.4
Orissa	14.7	61.9	15.0	64.9	12.6	8.2	98.5	0.9	82.1	77.6
Punjab	12.9	55.6	21.3	60.4	13.6	11.0	123.9	9.2	103.0	126.8
Rajasthan	12.6	53.0	17.4	64.3	14.0	8.3	110.6	1.5	63.2	88.3
Tamil Nadu	21.3	55.5	17.9	58.6	16.1	7.1	101.4	3.1	71.1	74.9
Uttar Pradesh	12.1	50.3	18.0	62.1	10.8	9.3	117.8	2.0	62.3	76.4
West Bengal	16.8	62.5	16.6	68.1	10.5	8.8	101.9	1.6	81.4	86.2
ALL INDIA (Rural)	15.7	57.9	18.7	61.0	13.1	10.4	108.0	2.0	76.1	91.6

*Values are in Rupee per Kilogram, ** Values are in Rupee per Litre, ** *Values are in Rupee per Piece, ** **Values are in Rupee per Pair.

Table B4: State specific Spatial Price Indices with respect to All India: Rural sector

State	Evaluated using EASI parameters estimated at All-India level (Set 1)			Evaluated using EASI parameters estimated at State level (Set 2)		
	NSS Rounds			NSS Rounds		
	55th	61st	66th	55th	61st	66th
Andhra Pradesh	1.040	1.111	1.135	0.991	0.998	0.827
Assam	1.405	1.413	1.087	1.160	1.157	0.926
Bihar	0.981	0.955	0.851	0.974	0.980	0.966
Gujarat	1.065	1.070	1.082	1.078	1.069	1.112
Haryana	0.790	0.822	1.044	0.948	0.966	1.238
Karnataka	1.033	0.979	0.853	1.009	0.966	0.861
Kerala	1.592	1.656	1.257	1.253	1.240	0.910
Madhya Pradesh	0.802	0.725	0.821	0.900	0.877	1.043
Maharashtra	0.995	1.008	1.106	1.031	1.026	1.072
Orissa	0.967	0.863	0.805	0.940	0.928	0.911
Punjab	0.821	0.854	0.989	0.976	1.004	1.168
Rajasthan	0.804	0.751	0.790	0.946	0.908	1.020
Tamil Nadu	1.243	1.334	1.263	1.093	1.084	0.953
Uttar Pradesh	0.744	0.754	0.794	0.881	0.899	1.087
West Bengal	1.163	1.179	0.977	1.047	1.033	0.944
ALL INDIA (Rural)	1.000	1.000	1.000	1.000	1.000	1.000

Table B5: State specific and All India Temporal Price Indices by Expenditure Quartiles: Rural sector

State	Quartile1			Quartile2			Quartile 3			Quartile 4		
	55th Round	61st Round	66th Round	55th Round	61st Round	66th Round	55th Round	61st Round	66th Round	55th Round	61st Round	66th Round
Andhra Pradesh	1.000	1.146	1.852	1.000	1.131	2.005	1.000	1.090	1.996	1.000	1.183	2.069
Assam	1.000	1.079	1.560	1.000	1.151	1.663	1.000	1.050	1.492	1.000	1.188	1.774
Bihar	1.000	1.087	1.900	1.000	1.211	2.012	1.000	1.195	1.933	1.000	1.155	1.861
Gujarat	1.000	1.237	1.457	1.000	1.116	1.549	1.000	1.045	1.628	1.000	0.998	1.755
Haryana	1.000	0.948	1.314	1.000	0.859	1.325	1.000	0.780	1.438	1.000	0.766	1.528
Karnataka	1.000	1.074	1.633	1.000	1.074	1.655	1.000	1.095	1.779	1.000	1.083	1.892
Kerala	1.000	1.058	1.634	1.000	1.147	1.704	1.000	1.157	1.653	1.000	1.082	1.755
Maharashtra	1.000	1.126	1.809	1.000	1.091	1.631	1.000	1.105	1.723	1.000	1.028	1.681
Madhya Pradesh	1.000	1.083	1.635	1.000	1.089	1.585	1.000	1.011	1.499	1.000	1.067	1.699
Orissa	1.000	1.212	1.733	1.000	1.251	1.844	1.000	1.219	1.784	1.000	1.244	1.892
Punjab	1.000	0.854	1.222	1.000	0.949	1.482	1.000	0.886	1.660	1.000	1.019	1.932
Rajasthan	1.000	1.087	1.529	1.000	1.056	1.497	1.000	0.999	1.475	1.000	0.946	1.485
Tamil Nadu	1.000	1.187	1.846	1.000	1.172	1.702	1.000	1.159	1.760	1.000	1.135	1.909
Uttar Pradesh	1.000	1.041	1.458	1.000	1.018	1.464	1.000	0.954	1.389	1.000	0.973	1.503
West Bengal	1.000	1.167	1.948	1.000	1.124	1.893	1.000	1.179	1.808	1.000	1.209	1.998
ALL INDIA (Rural)	1.000	1.065	1.776	1.000	1.084	1.819	1.000	1.069	1.905	1.000	1.093	2.044

Table B6: Quality Adjusted Unit Values in NSS 66th Round: Rural sector

State	Our (Cox and Wohlgenant, Hoang) Unit values					Deaton Unit values				
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk	Edible oils	Vegetables	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk	Edible oils	Vegetables
Andhra Pradesh	20.39	68.26	20.08	54.40	14.43	9.28	29.90	18.17	39.62	9.56
Assam	17.71	61.13	21.22	68.46	11.51	8.18	27.34	19.88	50.05	7.82
Bihar	14.22	49.78	19.95	67.22	9.82	6.79	22.12	18.40	49.99	6.58
Chattisgarh	16.41	58.36	17.60	59.61	14.04	7.66	24.14	16.56	44.40	8.92
Gujarat	14.28	61.46	21.72	60.79	15.00	6.68	27.07	19.81	44.68	9.71
Haryana	12.51	54.24	22.57	59.88	13.22	5.84	23.39	20.99	43.57	8.58
Jharkhand	15.26	52.40	18.56	66.61	9.99	7.36	23.48	17.36	49.91	6.55
Karnataka	16.46	59.33	15.27	57.45	13.01	7.77	26.35	14.48	42.06	8.54
Kerala	20.42	64.40	20.11	56.03	17.39	8.81	26.72	18.61	40.42	10.67
Madhya Pradesh	12.73	55.93	18.08	53.55	11.81	6.11	24.67	17.33	39.89	7.80
Maharastra	15.29	60.69	20.45	55.22	16.37	7.21	26.66	18.71	40.82	10.62
Orissa	14.67	62.01	14.96	64.88	12.58	6.82	26.13	14.19	47.44	7.97
Punjab	12.92	55.59	21.25	60.43	13.61	6.08	22.82	19.88	44.15	8.77
Rajasthan	12.59	53.00	17.36	64.31	14.03	5.90	23.31	16.06	47.50	9.25
Tamil Nadu	21.27	55.47	17.89	58.59	16.07	9.44	24.33	16.82	40.74	10.50
Uttar Pradesh	12.08	50.34	17.98	62.06	10.77	5.85	21.88	16.96	45.67	7.15
Uttaranchal	14.68	57.59	17.67	64.48	13.11	6.84	25.27	16.55	47.35	8.64
West Bengal	16.79	62.42	16.62	68.06	10.46	7.94	26.87	15.55	49.09	6.99
All India	15.59	57.91	18.85	61.22	13.18	7.25	25.14	17.57	44.85	8.59

Table B7: Correlation Coefficient between State wise Adjusted Unit values using two Methods

Correlation	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables
Between Unit price	0.991	0.950	0.993	0.981	0.991
Between Log(Unit price)	0.993	0.950	0.994	0.980	0.993

Table B8: Estimates of EASI Parameters: All India, All Households, Rural Sector 66th Round

Variable	Coefficients of Budget share equation using							
	Cox and Wohlgenant, Hoang Unit values				Deaton Unit values			
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils
y1	0.2313 (0.1440)	0.7468 (0.0647)	-0.7367 (0.1400)	-0.0316 (0.0313)	-6.9150 (1.5209)	2.7641 (0.6727)	4.1043 (1.7042)	0.5315 (0.2632)
y2	-0.2589 (0.1074)	-0.6670 (0.0482)	1.0254 (0.1044)	-0.0377 (0.0234)	2.5737 (0.7614)	-1.6029 (0.3368)	-0.7187 (0.8532)	-0.3286 (0.1318)
y3	0.2061 (0.0379)	0.2353 (0.0170)	-0.5120 (0.0368)	0.0208 (0.0082)	-0.3214 (0.1857)	0.4301 (0.0821)	-0.2107 (0.2081)	0.0913 (0.0321)
y4	-0.0569 (0.0064)	-0.0376 (0.0029)	0.1086 (0.0062)	-0.0039 (0.0014)	-0.0042 (0.0220)	-0.0551 (0.0098)	0.0756 (0.0247)	-0.0120 (0.0038)
y5	0.0049 (0.0004)	0.0022 (0.0002)	-0.0081 (0.0004)	0.0003 (0.0001)	0.0022 (0.0010)	0.0027 (0.0005)	-0.0058 (0.0011)	0.0006 (0.0002)
z1	0.0132 (0.0005)	0.0033 (0.0002)	-0.0172 (0.0005)	0.0006 (0.0001)	0.0160 (0.0006)	0.0043 (0.0002)	-0.0216 (0.0006)	0.0009 (0.0001)
z2	0.0218 (0.0007)	-0.0004 (0.0003)	-0.0194 (0.0006)	-0.0005 (0.0001)	0.0214 (0.0007)	0.0000 (0.0003)	-0.0207 (0.0008)	-0.0003 (0.0001)
np1	0.2204 (0.0042)	0.0001 (0.0021)	-0.1726 (0.0036)	-0.0001 (0.0010)	0.2208 (0.0035)	-0.0246 (0.0016)	-0.1553 (0.0034)	-0.0106 (0.0007)
np2	0.0001 (0.0021)	-0.0045 (0.0025)	-0.0135 (0.0019)	-0.0201 (0.0010)	-0.0246 (0.0016)	0.0458 (0.0018)	-0.0245 (0.0017)	-0.0098 (0.0007)
np3	-0.1726 (0.0036)	-0.0135 (0.0019)	0.1807 (0.0039)	-0.0153 (0.0010)	-0.1553 (0.0034)	-0.0245 (0.0017)	0.1906 (0.0041)	-0.0095 (0.0007)
np4	-0.0001 (0.0010)	-0.0201 (0.0010)	-0.0153 (0.0010)	0.0262 (0.0009)	-0.0106 (0.0007)	-0.0098 (0.0007)	-0.0095 (0.0007)	0.0232 (0.0007)
Const	0.0027 (0.0740)	0.0923 (0.0334)	0.2197 (0.0720)	0.1631 (0.0161)	6.4904 (1.1838)	-1.4998 (0.5235)	-4.5792 (1.3264)	-0.2448 (0.2047)
R^2	0.254	0.299	0.358	0.247	0.191	0.241	0.105	0.217

Appendix C

Table C1: List of Items along with units of prices

Food Items: **Item Unit**	
1. Cereal & Cereal substitute	Rupees/Kg
2. Pulses	Rupees/Kg
3. Milk and Milk Products	Rupees/Kg
4. Edible Oil	Rupees/Kg
5. Vegetables	Rupees/Kg
6.Sugar, salt, Fresh and dry fruits	Rupees/Kg
7. Spices and Beverages	Rupees/Kg
Non-Food Items:	
8. Fuel and Light	Rupees/litre
9. Clothing	Rupees/piece
10.Footwear	Rupees/pair

Note: For all the rounds, data on 30 day recall period for the food items and fuel and light, and 365 recall periodfor clothing and footwear were used.

Table C2: Number of Districts in Each State in the Rural Sector for All 3 Rounds considered for quality-adjusted unit value regression [See equation 9]

States	NSS-55th round	NSS-61st Round	NSS-66th round
AndhraPradesh	22	22	22
Assam	23	23	27
Bihar	52	37	38
Gujarat	19	25	25
Haryana	17	19	20
Karnataka	20	27	27
Kerala	14	14	14
Madhya Pradesh	44	45	48
Maharashtra	29	33	33
Orissa	30	30	30
Punjab	14	17	18
Rajasthan	30	32	32
Tamil Nadu	22	28	30
Uttar Pradesh	71	70	70
West Bengal	16	17	18

Table C3: Item specific Quality Adjusted Unit values by Expenditure Quartiles: All IndiaRural sector

Items	NSS 55th Round				NSS 61st Round				NSS 66th Round			
	Quartiles				Quartiles				Quartiles			
	1	2	3	4	1	2	3	4	1	2	3	4
Cereal & Cereal substitutes	8.584	9.036	9.252	9.247	8.170	8.674	9.093	9.457	13.828	14.924	15.883	17.704
Pulses & Pulse Products	23.943	24.556	25.192	25.426	26.010	26.755	27.108	27.596	52.155	56.982	58.607	61.593
Milk and Milk Products	10.185	10.297	10.553	10.715	10.925	11.332	11.588	11.995	17.647	18.436	18.952	19.868
Edible oils	39.842	40.224	40.876	41.761	52.560	53.825	54.480	55.145	61.732	60.826	60.585	61.303
Vegetables	5.719	5.693	5.989	6.446	7.028	7.234	7.505	7.848	11.743	12.730	13.450	14.983
Sugar, salt, Fresh and dry fruits	7.991	9.543	10.791	12.607	12.780	13.896	15.047	16.421	8.310	10.153	11.928	15.669
Spices and Beverages	56.174	59.392	63.393	94.758	61.572	65.406	68.515	72.792	103.369	105.442	108.155	111.372
Fuel and Light	0.847	0.870	0.927	0.996	0.880	0.963	0.951	1.285	1.934	1.958	2.155	6.427
Clothing	38.240	42.392	47.415	54.782	41.538	46.178	49.937	57.796	63.620	70.413	76.352	94.932
Footwear	36.037	41.820	49.844	66.845	45.020	53.470	63.236	79.947	64.424	79.468	94.855	127.292

Table C4: State specific Spatial Price Indices by Expenditure Quartiles: Rural sector

State	NSS 55th Round				NSS 61st Round				NSS 66th Round			
	Quartiles				Quartiles				Quartiles			
	1	2	3	4	1	2	3	4	1	2	3	4
Andhra Pradesh	1.042	1.078	1.070	1.087	1.073	1.115	1.133	1.194	1.120	1.194	1.083	1.647
Assam	1.197	1.351	1.393	1.440	1.327	1.300	1.317	1.398	1.162	1.161	1.091	1.170
Bihar	1.002	0.978	0.968	1.006	1.072	0.986	0.948	0.922	1.061	1.004	1.191	0.878
Gujarat	0.987	0.996	1.008	1.087	1.067	1.046	1.015	1.106	0.994	0.954	0.766	0.802
Haryana	0.826	0.789	0.765	0.745	0.947	0.854	0.790	0.732	0.976	0.918	0.880	0.835
Karnataka	0.946	1.007	1.052	1.148	0.968	1.029	1.000	1.111	0.923	0.843	0.596	0.914
Kerala	1.511	1.544	1.547	1.658	1.652	1.588	1.586	1.573	1.327	1.128	0.760	0.804
Madhya Pradesh	0.823	0.843	0.808	0.824	0.773	0.770	0.749	0.727	0.870	0.853	0.750	0.610
Maharashtra	0.938	0.967	1.030	1.125	0.905	0.985	1.075	1.148	1.018	1.012	0.980	1.032
Orissa	0.987	0.998	0.979	0.977	0.924	0.881	0.856	0.807	0.892	0.842	0.814	0.664
Punjab	0.953	0.814	0.812	0.760	0.884	0.952	0.839	0.738	1.028	1.244	1.399	0.993
Rajasthan	0.775	0.790	0.768	0.760	0.785	0.763	0.729	0.648	0.830	0.772	0.628	0.478
Tamil Nadu	1.249	1.276	1.282	1.359	1.371	1.359	1.337	1.486	1.270	1.303	1.754	1.412
Uttar Pradesh	0.770	0.761	0.738	0.726	0.855	0.788	0.730	0.677	0.830	0.791	0.787	0.618
West Bengal	1.117	1.126	1.147	1.199	1.199	1.154	1.169	1.146	1.146	1.061	0.822	0.939
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table C4a: State specific Spatial Price Indices by Expenditure Quartiles: (All quartiles face the same overall price) Rural sector, 66th Round

State	NSS 66th Round			
	Expenditure Quartiles			
	1	2	3	4
Andhra Pradesh	1.133	1.135	1.137	1.136
Assam	1.087	1.088	1.088	1.087
Bihar	0.849	0.850	0.851	0.852
Gujarat	1.080	1.083	1.084	1.086
Haryana	1.037	1.043	1.048	1.051
Karnataka	0.850	0.854	0.857	0.856
Kerala	1.254	1.257	1.260	1.259
Madhya Pradesh	0.820	0.821	0.821	0.822
Maharashtra	1.105	1.106	1.107	1.106
Orissa	0.804	0.806	0.807	0.807
Punjab	0.980	0.989	0.999	0.995
Rajasthan	0.790	0.791	0.791	0.790
Tamil Nadu	1.259	1.265	1.268	1.268
Uttar Pradesh	0.792	0.793	0.794	0.795
West Bengal	0.975	0.977	0.978	0.979
All India	1.000	1.000	1.000	1.000

Table C5: Estimates of Parameters of EASI System: All India, All Households, Rural Sector

Variable	Coefficients of Budget share equation								
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables	Sugar, salt, Fresh and dry fruits	Spices and Beverages	Fuel and Light	Clothing
y1	-5.980 (0.000)	0.695 (0.000)	(omitted)	0.738 (0.000)	1.747 (0.000)	0.561 (0.000)	3.062 (0.000)	-0.772 (0.000)	0.306 (0.026)
y2	3.651 (0.000)	-0.310 (0.000)	-0.296 (0.000)	-0.354 (0.000)	-0.842 (0.000)	-0.310 (0.000)	-1.696 (0.000)	0.210 (0.000)	-0.194 (0.005)
y3	-0.957 (0.000)	0.068 (0.000)	0.110 (0.000)	0.080 (0.000)	0.189 (0.000)	0.079 (0.000)	0.435 (0.000)	-0.025 (0.321)@	0.051 (0.002)
y4	0.114 (0.000)	-0.007 (0.000)	-0.013 (0.000)	-0.009 (0.000)	-0.020 (0.000)	-0.009 (0.000)	-0.053 (0.000)	0.001 (0.755)@	-0.006 (0.002)
y5	-0.005 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.001 (0.000)	0.000 (0.000)	0.002 (0.000)	0.000 (0.868)@	0.0001 (0.003)
z1	0.009 (0.000)	0.001 (0.000)	-0.006 (0.000)	0.000 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.002 (0.000)	0.0001 (0.000)
z2	0.016 (0.000)	-0.001 (0.000)	-0.006 (0.000)	-0.001 (0.000)	-0.002 (0.000)	-0.001 (0.000)	-0.002 (0.000)	-0.003 (0.000)	0.001 (0.000)
z3	-0.059 (0.000)	-0.007 (0.000)	0.009 (0.000)	0.018 (0.000)	0.008 (0.000)	0.005 (0.000)	-0.011 (0.000)	0.027 (0.000)	0.010 (0.000)
z4	0.060 (0.000)	0.038 (0.000)	-0.088 (0.000)	-0.022 (0.000)	-0.036 (0.000)	-0.026 (0.000)	-0.042 (0.000)	0.076 (0.000)	0.032 (0.000)
np1	0.191 (0.000)	0.003 (0.000)	-0.137 (0.000)	0.007 (0.000)	0.002 (0.018)	-0.036 (0.000)	-0.012 (0.000)	-0.009 (0.000)	0.007 (0.000)
np2	0.003 (0.000)	0.011 (0.000)	-0.008 (0.000)	-0.015 (0.000)	0.005 (0.000)	0.012 (0.000)	0.006 (0.000)	-0.001 (0.000)	-0.008 (0.000)
np3	-0.137 (0.000)	-0.008 (0.000)	0.107 (0.000)	0.001 (0.132)	0.014 (0.000)	-0.001 (0.016)	-0.004 (0.000)	0.015 (0.000)	0.001 (0.312)@
np4	0.007 (0.000)	-0.015 (0.000)	0.001 (0.132)@	0.008 (0.000)	0.007 (0.000)	0.007 (0.000)	0.001 (0.034)	-0.001 (0.001)	-0.009 (0.000)
np5	0.002 (0.018)	0.005 (0.000)	0.014 (0.000)	0.007 (0.000)	-0.027 (0.000)	-0.014 (0.000)	0.027 (0.000)	0.000 (0.037)	-0.008 (0.000)
np6	-0.036 (0.000)	0.012 (0.000)	-0.001 (0.016)	0.007 (0.000)	-0.014 (0.000)	0.032 (0.000)	0.001 (0.002)	-0.001 (0.000)	-0.001 (0.001)
np7	-0.012 (0.000)	0.006 (0.000)	-0.004 (0.000)	0.001 (0.034)	0.027 (0.000)	0.001 (0.002)	-0.013 (0.000)	-0.002 (0.000)	-0.007 (0.000)
np8	-0.009 (0.000)	-0.001 (0.000)	0.015 (0.000)	-0.001 (0.001)	0.000 (0.037)	-0.001 (0.000)	-0.002 (0.000)	0.002 (0.000)	-0.002 (0.000)
np9	0.007 (0.000)	-0.008 (0.000)	0.001 (0.312)@	-0.009 (0.000)	-0.008 (0.000)	-0.001 (0.001)	-0.007 (0.000)	-0.002 (0.000)	0.025 (0.000)
Cons t	3.152 (0.000)	-0.506 (0.000)	0.747 (0.000)	-0.449 (0.000)	-1.230 (0.000)	-0.359 (0.000)	-1.823 (0.000)	1.181 (0.000)	-0.081 (0.448)@
R^2	0.291	0.165	0.294	0.471	0.304	0.362	0.426	0.033	0.146

1. Figures in parentheses are the p-values. All parameters, except those marked by @ are significant at 5% level.
2. y1-y5: 5 powers of y, the log of Stone index deflated nominal expenditure; z1: no. of adults; z2: no. of children; z3-z4: time dummies for rounds 61 and 66, respectively; np1-np9: log of prices of 9 items normalized with respect to price of item 10.
3. The "omitted" variables are dropped owing to multicollinearity.
4. An alternative formulation of the model could be to normalize y=0, z=0 for values of demographics, expenditure and prices in the middle of the data, so that the constant terms can be read directly as budget shares.

Table C5a: Estimates of Parameters of EASI System: All India, All Households, Rural Sector: 55th Round

Variable	Coefficients of Budget share equation								
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables	Sugar, salt, Fresh and dry fruits	Spices and Beverages	Fuel and Light	Clothing
y1	Omitted	0.125	-2.405	0.751	2.023	-0.840	4.670	-4.392	0.688
Std err		0.283	0.607	0.236	0.380	0.240	0.245	0.375	0.235
y2	-0.046	-0.036	1.840	-0.424	-1.042	0.562	-2.999	2.320	-0.445
Std err	0.050	0.164	0.352	0.137	0.220	0.139	0.142	0.217	0.136
y3	0.135	0.002	-0.652	0.108	0.249	-0.178	0.885	-0.609	0.121
Std err	0.025	0.045	0.097	0.038	0.061	0.038	0.039	0.060	0.038
y4	-0.041	0.000	0.108	-0.013	-0.028	0.027	-0.124	0.078	-0.015
Std err	0.005	0.006	0.013	0.005	0.008	0.005	0.005	0.008	0.005
y5	0.003	0.000	-0.007	0.001	0.001	-0.002	0.007	-0.004	0.001
Std err	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
z1	0.007	0.001	-0.007	0.000	-0.001	0.000	0.000	-0.002	0.001
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
z2	0.018	-0.001	-0.006	-0.001	-0.003	-0.002	-0.002	-0.003	0.000
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
np1	0.265	-0.023	-0.123	-0.011	-0.006	-0.045	-0.034	-0.010	0.011
Std err	0.003	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
np2	-0.023	0.019	-0.001	-0.007	0.006	0.008	0.016	-0.002	-0.016
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
np3	-0.123	-0.001	0.032	0.004	0.025	0.016	0.006	0.007	0.015
Std err	0.002	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
np4	-0.011	-0.007	0.004	0.014	0.007	0.006	-0.004	0.003	-0.011
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001
np5	-0.006	0.006	0.025	0.007	-0.031	-0.018	0.038	-0.001	-0.014
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001
np6	-0.045	0.008	0.016	0.006	-0.018	0.035	0.005	-0.005	-0.002
Std err	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
np7	-0.034	0.016	0.006	-0.004	0.038	0.005	-0.018	-0.004	-0.009
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001
np8	-0.010	-0.002	0.007	0.003	-0.001	-0.005	-0.004	0.017	-0.001
Std err	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000
np9	0.011	-0.016	0.015	-0.011	-0.014	-0.002	-0.009	-0.001	0.026
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001
_cons	-0.427	-0.084	1.160	-0.339	-1.324	0.469	-2.339	3.546	-0.230
Std err	0.076	0.185	0.399	0.155	0.249	0.157	0.161	0.245	0.154
R^2	0.313	0.067	0.377	0.137	0.073	0.219	0.299	0.066	0.041

Table C5b: Estimates of Parameters of EASI System: All India, All Households, Rural Sector: 61st Round

Variable	Coefficients of Budget share equation								
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables	Sugar, salt, Fresh and dry fruits	Spices and Beverages	Fuel and Light	Clothing
y1	Omitted	0.716	8.582	0.314	(omitted)	-3.63637	-0.886	(omitted)	-3.222
Std err		0.449	1.060	0.508		0.531	0.373		0.520
y2	0.080	-0.338	-4.045	-0.129	-0.027	1.837	0.467	-0.086	1.403
Std err	0.052	0.218	0.517	0.247	0.023	0.258	0.182	0.032	0.253
y3	0.063	0.081	0.859	0.032	0.012	-0.457	-0.129	0.028	-0.301
Std err	0.024	0.052	0.124	0.059	0.010	0.062	0.043	0.014	0.060
y4	-0.025	-0.010	-0.080	-0.005	-0.002	0.056	0.017	-0.003	0.032
Std err	0.004	0.006	0.015	0.007	0.002	0.007	0.005	0.002	0.007
y5	0.002	0.001	0.002	0.000	0.000	-0.003	-0.001	0.000	-0.001
Std err	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
z1	0.010	0.001	-0.010	0.001	-0.001	0.000	0.000	-0.003	0.001
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
z2	0.014	0.000	-0.005	-0.001	-0.001	-0.002	-0.002	-0.004	0.001
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
np1	0.131	0.016	-0.110	0.020	0.001	-0.038	0.000	-0.006	-0.005
Std err	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
np2	0.016	0.004	-0.008	-0.015	-0.005	0.007	0.009	-0.003	0.004
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001
np3	-0.110	-0.008	0.094	0.009	0.027	-0.012	-0.012	0.008	-0.003
Std err	0.002	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
np4	0.020	-0.015	0.009	-0.024	0.010	0.009	0.007	-0.002	-0.007
Std err	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.000	0.001
np5	0.001	-0.005	0.027	0.010	-0.026	-0.024	0.022	0.000	-0.002
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001
np6	-0.038	0.007	-0.012	0.009	-0.024	0.081	-0.015	-0.001	-0.008
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001
np7	0.000	0.009	-0.012	0.007	0.022	-0.015	-0.003	-0.004	-0.008
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
np8	-0.006	-0.003	0.008	-0.002	0.000	-0.001	-0.004	0.010	0.000
Std err	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000
np9	-0.005	0.004	-0.003	-0.007	-0.002	-0.008	-0.008	0.000	0.025
Std err	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001
_cons	-0.843	-0.524	-6.436	-0.157	0.170	2.887	0.850	0.479	2.934
Std err	0.097	0.363	0.859	0.410	0.043	0.429	0.302	0.059	0.420
R^2	0.222	0.114	0.253	0.208	0.098	0.214	0.335	0.066	0.035

Table C5c: Estimates of Parameters of EASI System: All India, All Households, Rural Sector: 66th Round

Variable	Coefficients of Budget share equation								
	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables	Sugar, salt, Fresh and dry fruits	Spices and Beverages	Fuel and Light	Clothing
y1	(omitted)	-0.778	3.734	-0.018	-0.011	1.108	0.028	(omitted)	-3.421
Std err		0.636	1.105	0.299	0.437	0.188	0.233		0.591
y2	0.866	0.380	-2.232	0.016	0.023	-0.487	0.025	-0.013	1.219
Std err	0.077	0.273	0.478	0.128	0.188	0.081	0.100	0.048	0.254
y3	-0.308	-0.087	0.585	-0.005	-0.013	0.101	-0.013	-0.006	-0.223
Std err	0.030	0.058	0.103	0.027	0.040	0.017	0.021	0.018	0.054
y4	0.040	0.009	-0.070	0.001	0.002	-0.010	0.002	0.002	0.021
Std err	0.004	0.006	0.011	0.003	0.004	0.002	0.002	0.003	0.006
y5	-0.002	0.000	0.003	0.000	0.000	0.000	0.000	0.000	-0.001
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
z1	0.012	0.001	-0.004	0.000	-0.001	-0.001	-0.001	-0.005	-0.002
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
z2	0.018	-0.001	-0.006	0.000	-0.002	0.000	-0.001	-0.005	-0.001
Std err	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
np1	0.157	0.019	-0.167	0.005	-0.008	0.000	0.004	-0.013	0.015
Std err	0.003	0.002	0.003	0.001	0.001	0.000	0.001	0.001	0.001
np2	0.019	0.005	-0.017	-0.007	0.016	0.004	-0.002	0.000	-0.015
Std err	0.002	0.002	0.002	0.001	0.001	0.000	0.001	0.000	0.001
np3	-0.167	-0.017	0.196	-0.008	-0.007	-0.009	-0.001	0.023	-0.016
Std err	0.003	0.002	0.004	0.001	0.001	0.000	0.001	0.001	0.001
np4	0.005	-0.007	-0.008	0.013	0.008	0.002	-0.003	0.000	-0.005
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
np5	-0.008	0.016	-0.007	0.008	-0.019	-0.002	0.010	-0.002	0.003
Std err	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.001
np6	0.000	0.004	-0.009	0.002	-0.002	0.010	-0.003	0.001	0.000
Std err	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
np7	0.004	-0.002	-0.001	-0.003	0.010	-0.003	-0.003	0.000	-0.003
Std err	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000
np8	-0.013	0.000	0.023	0.000	-0.002	0.001	0.000	-0.006	-0.003
Std err	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000
np9	0.015	-0.015	-0.016	-0.005	0.003	0.000	-0.003	-0.003	0.026
Std err	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.001
_cons	-2.189	0.734	-1.908	0.052	0.069	-0.912	-0.043	0.413	3.992
Std err	0.202	0.583	1.025	0.274	0.401	0.173	0.214	0.125	0.542
R^2	0.156	0.075	0.216	0.047	0.081	0.115	0.142	0.128	0.055

Table C6: F-test* for testing joint significance of time dummies of pooled of EASI System: All India, All Households, Rural Sector: (H_0: z3=z4=0)

Item	**F(*q*,*n*-*k*)**
Cereal & Cereal substitutes	1791.24
Pulses & Pulse Products	3725.98
Milk and Milk Products	628.85
Edible oils	2581.80
Vegetables	4670.98
Sugar, salt, Fresh and dry fruits	2084.34
Spices and Beverages	4437.52
Fuel and Light	2561.03
Clothing	5521.32

All are highly significant.

F-statistics:** $\frac{(\boldsymbol{Restricted\ RSS - unrestricted\ RSS})/\boldsymbol{q}}{\boldsymbol{Unrestricted\ RSS}/(\boldsymbol{n-k})}$, ***q*:** number of restrictions, ***k: number of parameters.

TableC7: Estimates of Price elasticities (at mean budget share) of EASI System (Parameters: Table A5): All India, All Households, Rural Sector

Item	Cereal & Cereal substitutes	Pulses & Pulse Products	Milk and Milk Products	Edible oils	Vegetables	Sugar, salt, Fresh and dry	Spices and Beverages	Fuel and Light	Clothing	Footwear
Cereal & Cereal substitutes	**-0.442**	0.008	-0.402	0.020	0.004	-0.104	-0.034	-0.026	0.021	-0.045
Pulses & Pulse Products	0.038	**-0.854**	-0.108	-0.198	0.064	0.155	0.079	-0.013	-0.104	-0.059
Milk and Milk Products	-0.934	-0.055	**-0.276**	0.006	0.094	-0.008	-0.025	0.103	0.004	0.091
Edible oils	0.115	-0.254	0.015	**-0.865**	0.115	0.116	0.016	-0.009	-0.150	-0.099
Vegetables	0.016	0.052	0.149	0.072	**-1.291**	-0.148	0.289	-0.005	-0.082	-0.052
Sugar, salt, Fresh and dry fruits	-0.850	0.278	-0.029	0.162	-0.328	**-0.244**	0.019	-0.031	-0.022	0.046
Spices and Beverages	-0.192	0.099	-0.061	0.015	0.447	0.013	**-1.215**	-0.032	-0.113	0.040
Fuel and Light	-0.092	-0.010	0.155	-0.006	-0.005	-0.013	-0.020	**-0.980**	-0.017	-0.012
Clothing	0.115	-0.124	0.010	-0.139	-0.121	-0.015	-0.108	-0.026	**-0.604**	0.012
Footwear	-0.728	-0.211	0.638	-0.275	-0.228	0.091	0.113	-0.055	0.037	**-0.382**

Table C8: Share of 5 items as percentage of total expenditure (on 10 items considered earlier)

State	% of total expenditure covered by 5 items
Andhra Pradesh	72.8
Assam	72.0
Bihar	76.0
Chattisgarh	68.3
Gujarat	74.0
Haryana	74.2
Jharkhand	69.0
Karnataka	68.5
Kerala	61.7
Madhya Pradesh	70.3
Maharastra	67.4
Orissa	67.3
Punjab	74.6
Rajasthan	72.3
Tamil Nadu	67.4
Uttar Pradesh	75.4
Uttaranchal	67.2
West Bengal	71.1

Appendix D: The Deaton procedure for calculating Spatial Prices

Let *c* denote 'cluster', i.e. village in our case, and *i* denote household. The principal equations are:

$$w_{ic} = \alpha_1 + \beta_1 \ln x_{ic} + \gamma_1 z_{ic} + \theta_1 \ln p_c + f_c + u_{1ic} \quad \text{(C1)}$$

$$\ln v_{ic} = \alpha_2 + \beta_2 \ln x_{ic} + \gamma_2 z_{ic} + \theta_2 \ln p_c + u_{2ic} \quad \text{(C2)}$$

w_{ic} is the share of the budget devoted to the good (including both actual purchases and imputed expenditures), x_{ic} is the total budget, v_{ic} is the calculated unit value, and z_{ic} is a vector of observed household characteristics. Since the cluster price, p_c is not observed, we use the following three step procedure (as suggested in Deaton (1988)) to estimate the cluster price,p_c and from that the price in a district based on the prices in the clusters constituting a district.

Step 1:

From (C1) and (C2) we have (by taking deviation from the means):

$$w_{it} - \overline{w_i} = \beta_i (\ln x_{ic} - \overline{\ln x_i}) + \gamma_i (z_{ic} - \overline{z_i}) + (u_{1ic} - \overline{u_{1i}}) \quad \text{(C3)}$$

$$\ln v_{ic} - \overline{\ln v_i} = \beta_2 (\ln x_{ic} - \overline{\ln x_i}) + \gamma_2 (z_{ic} - \overline{z_i}) + (u_{2ic} - \overline{u_{2i}}) \quad \text{(C4)}$$

We estimate β_1, β_2 , γ_1, $\gamma_2$from (C3) and (C4). The estimates are denoted by a tilde appearing over the corresponding parameter symbol.

Step 2:

Next, we define and compute

$$\tilde{y}_{1ic} = w_{ic} - \tilde{\beta}_1 \ln x_{ic} - \tilde{\gamma}_1 z_{ic} \quad \text{(C5)}$$

$$\tilde{y}_{2ic} = \ln v_{ic} - \tilde{\beta}_2 \ln x_{ic} - \tilde{\gamma}_2 z_{ic} \quad \text{(C6)}$$

Then, we compute the means, $\tilde{\bar{y}}_{1c}$, $\tilde{\bar{y}}_{2c}$

The population counterparts of these magnitudes y_{1c} , y_{2c} satisfy (from (C1) & (C2))

$$y_{1c} = \alpha_1 + \theta_1 \ln p_c + f_c + u_{1c} \quad \text{(C7)}$$

$$y_{2c} = \alpha_2 + \theta_2 \ln p_c + u_{2c} \quad \text{(C8)}$$

Step 3:

Let us observe that in equation (C8) above, the right hand side is basically a linear function of the logarithm of the actual price series p_c at the cluster level. So, $\tilde{\tilde{y}}_{2c}$ is the estimate of a linear function of the logarithm of the actual price series, p_c (unobservable) at the cluster level.