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Preferences, Spatial Prices and Inequality[1]

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Abstract

Much of the recent welfare analysis in the development literature has focussed attention on poverty. This is especially true for India which has seen a large proliferation in the poverty literature. This study departs from this tradition and focuses on inequality. It is based on the premise that as a country develops and experiences high growth rates, the focus should shift from poverty to inequality. Rising inequality leads to increasing marginalisation and greater social tension even while there may have been a general decline in poverty rates. The study examines the effect of prices on inequality. It does so in the heterogeneous country context of rural India during the recent period of economic reforms and beyond. It proposes a framework for calculating preference based "exact" price indices and shows its usefulness by consistently calculating spatial prices and regionally varying temporal prices that take into account both differences in preferences between states and changing preferences over time. The "exact" price indices are based on the recent "Exact Affine Stone Index" (EASI) demand system. This paper provides evidence on the usefulness of the proposed procedures by finding that the nature of inflation has been regressive during the first half (1999/2000 – 2004/5) and progressive during the second half (2004/5- 2009/10).

The study also provides evidence based on panel estimation that suggests that while temporal price inflation has a positive effect on inequality, the effect of spatial prices on inequality is qualitatively quite different. The study also documents the positive role that rural developmental spending can play in reducing inequality. In contrast, an increase in non-farm labour productivity increases inequality. The sharp rise in inequality during the second half of our time period when India recorded high growth rates and falling poverty rates highlights the need for a closer look at inequality and its determinants as in this study.

Key words: Exact Affine Stone Index, Expenditure Inequality, Spatial Prices, Exact Price Index.
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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), Eswaran, Kotwal, Ramaswami and Wadhwa (2007), 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[2]. This feature stands out against the fact, documented in, for example, Kotwal, Ramaswami and Wadhwa (2011) , that in India, while on a fixed poverty line the poverty rates generally record a decline during the period of economic reforms in the 1990s and 2000s[3], the evidence on inequality suggests the reverse [Mishra and Ray (2011)]. The inequality literature does not suffer from the controversy in the recent poverty debates in India that stem from the subjectivity involved in the definition of a poverty line. Rising inequality marginalises increasing number of people causing social tensions and all this can occur even when a country grows and there is a general improvement in living standards. While stark inequality is ethically repugnant to some, it also has adverse functional consequences by preventing many from realising their full potential and contributing effectively to society. Though economists have coined the phrase "growth with equity", and there is an extensive discussion of this in the literature, an equitable growth in a high growth context is generally conspicuous by its absence. Following the logic of Kuznets, as newly emerging economies embark on economic reforms and try to accelerate their growth rates, this is likely to unleash forces that will tend to increase inequality, even while lifting millions of people out of poverty. The recent evidence in India suggesting a sharply rising

[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] A good example of this is Kotwal, Ramaswami and Wadhwa (2011) which devotes a section to poverty rates but inequality hardly gets a mention.

[3] This is not to suggest, however, that poverty has become less of an issue in the Indian context. For example, a recent study based on the 66th round of the National Sample Survey (2009/10) shows that if one adopts the average monthly expenditure, rather than the Planning Commission's definition, as the poverty line, then nearly two thirds of the population is poor- see http://articles.timesofindia.indiatimes.com/2012-04-29/india/31475601_1_poverty-line-population-expenditure.

inequality amidst a matching decline in poverty points to the need to move the focus from poverty to inequality. 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 is in such a spirit.

This paper is devoted to the subject of inequality or, more precisely, expenditure inequality in rural India during the first decade of the current millennium, namely, the period, 1999/2000 to 2009/2010. This period is of considerable significance for, principally, two reasons. First, for much of this period, India recorded impressive growth rates on the back of significant economic reforms that started in the previous decade. Second, this period also includes the global financial crisis that slowed down the reforms and the growth rates. While growth rates, trade and investment flows in India have received much attention, the distributive consequences of India's economic performance during this period have received less attention. 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, as in this study, has been justified by Blundell and Preston (1998) and is consistent with the practice adopted in the economics literature[4].

The present study is much more than a study of expenditure inequality. It provides evidence on a set of largely unexplored issues. These, listed as follows, provide the distinctive features and motivation of this study.

First, and quite crucially, this study examines the distributive consequences of inflation via the change in relative prices. It provides a methodology for evaluating whether a change in prices has been progressive or regressive. Central to this role is the argument that inflation that is accompanied by a significant change in the relative prices of the principal items of consumption affects household groups differently owing to differences in their expenditure patterns reflecting differences in their preferences, demographic and economic circumstances. In his pioneering study of the redistributive role of UK inflation, Muellbauer

[4] See Barrett, Crossley and Worswick (2000), Blacklow and Ray (2000) for examples of recent studies using consumption inequality as an inequality measure.

(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, and 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 still further by using a recently proposed demand system, namely, the `Exact Affine Stone Index' (EASI) demand system due to Lewbel and Pendakur (2009) that is more general than QAIDS and "can have any rank and its Engel curves can have any shape over real expenditures" (p. 827).

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 once one recognises and incorporates the large heterogeneity in expenditure patterns amongst the constituent states of the Indian union. In a similar spirit, the study also records large spatial differences in the temporal movement in the 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), and extends that study in principally two respects, namely, by using the more general EASI preference framework, and by introducing spatial differences in prices and preferences inside the country. As the present study demonstrates, such an approach allows the incorporation of price induced substitution effects between items. The incorporation of regional differences in preferences and price movements via the estimation of state specific demand systems and the use of the estimated preference

parameters in the calculation of the state specific "exact" price indices highlights the usefulness of the proposed methodology.

Fourth, the study proposes a methodology for constructing prices from unit values of various items from the expenditure and quantity information on purchases of various items found in household expenditure surveys. The unit value of an item is the ratio of the value of household expenditure on that item and the corresponding quantity of purchase. Examples of some recent studies that use unit values to construct spatial prices include Aten and Menezes (2002), Coondoo, Majumder and Ray (2004), O'Donnell and Rao (2007), Hoang (2009), Deaton and Tarozzi (2000) and McKelvey (2011). However, one cannot use unit values as prices due to (a) measurement errors, (b) quality effects, and (c) household compositional effects on expenditure patterns. This paper proposes a methodology that adjusts unit values to correct for quality and demographically induced taste differences for use as prices. It builds on the procedures proposed by Cox and Wohlgenant (1986) and Hoang (2009) for constructing prices from unit values.

Finally, and most significantly, the paper uses the price information to provide evidence on the redistributive effects of inflation by comparing the nominal and real expenditure inequalities by state and in each time-period. Moreover, in keeping with the focus of this study on inequality, this paper provides evidence on the movement in expenditure inequality both between states and over time. In this context, the study provides evidence on some of the determinants of the variation of inequality between states. 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 study in this respect resembles the earlier literature on the cross-country variation in inequality. However, as Ravallion and Datt (2002) note, while cross-country data pose comparability problems, they are largely avoided in the case of cross section of Indian states that share a common heritage, history and culture.

The rest of the paper is organised as follows. Section 2 describes the EASI demand system and presents the methodology for calculating the "exact" spatial and temporal price indices

based on the preferences underlying the EASI demand model. Section 3 describes the quality and demographic adjustment procedure for constructing the prices from the unit values. Section 4 describes the data and presents the constructed prices by states and over time. Section 5 presents the estimated spatial and temporal prices using the "exact" price indices corresponding to the EASI demand system. Section 6 focuses on inequality and consists of two subsections. Section 6.1 presents the nominal and real expenditure inequalities, and Section 6.2 presents the results of the cross-state inequality regressions. Section 7 concludes the paper.

2. The Demand System, the Exact Price Indices and The Distributive Impact of Inflation

The 'Exact Affine Stone Index' (EASI) Demand System, proposed by Lewbel and Pendakur (2009), is derived from the following expenditure function in logarithmic form[5]:

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

p denotes the vector of prices, **z** ={z_1,...., z_T} denotes the vector of demographic characteristics of the household, u is the utility level, **ε** = { ε^1, ..., ε^J } is a vector of unobserved preference heterogeneity parameters for the consumer, and we assume that E{**ε**} **=** 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). Following Lewbel and Pendakur (2009), we consider a 5thorder polynomial in u, which is given in observable form, y, by

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

The budget shares, $w^j = w^j(\mathbf{p}, u)$are observable in the data, *x* is per capita household expenditure, with the OECD equivalence scale, defined as the square root of household size, used as the expenditure deflator.

[5] This exposition follows, quite literally, that in Pendakur (2009) which was a companion piece to Lewbel and Pendakur (2009).

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

$$w^j = m^j (y, \mathbf{z}) + \sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p^k + \varepsilon^j, \quad (3)$$

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

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

$$m^j (y, \mathbf{z}) = \sum_{r=1}^{R} b_r^j y^r + \sum_{t=1}^{T} g_t^j z_t. \quad (4)$$

As suggested in Lebwel and Pendakur (2009), Pendakur (2009), a polynomial in y of order 5, ie. *R=5*, is considered in the present exercise. The household is the unit of behaviour. The vector of demographic variables, **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[6].

Estimation of (3) 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 ln x, z_t and $\ln p^j$ (as well as endogenous w^j). Pendakur (2009) has provided the computer algorithm for the estimation of the EASI demand system.

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, $\mathbf{p}_1$ and $\mathbf{p}_0$. 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:

$$\ln P(\mathbf{p}_1, \mathbf{p}_0, u^*) = \sum_{j=1}^{J} m^j (u^*, \mathbf{z}) (\ln p_1^j - \ln p_0^j) + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p_1^j \ln p_1^k - \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha^{jk}(\mathbf{z}) \ln p_0^j \ln p_0^k + \sum_{j=1}^{J} \varepsilon^j (\ln p_1^j - \ln p_0^j). \quad (5)$$

We can obtain an observable expression for the TCLI by substituting the unobservable, u*, by the expression of the right hand side of equation (3).The resulting expression is as follows:

[6]As described later, 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. The latter exercise provides the time dimension in this study.

$$\ln P(\mathbf{p}_1, \mathbf{p}_0, u^*) = \sum_{j=1}^{J} w_0^j \left(\ln p_1^j - \ln p_0^j \right) + \frac{1}{2} \sum_{j=1}^{J} \sum_{k=1}^{J} \alpha^{jk} \left(\ln p_1^j - \ln p_0^j \right) \left(\ln p_1^k - \ln p_0^k \right); \quad (6)$$

u*, the reference utility level, corresponds to that in the base year with price vector, $\mathbf{p_0}$, and $\mathbf{w_0}$ is the vector of budget shares (w_0^j) in the base year.

The expression on the right hand side of equation (6) 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, besides 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 Procedure for Constructing Prices from Unit Values

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. In other words, we need information on how much each household has paid for each item and how that varies over time. Such information is missing in most data sets. We use as proxies for prices the unit values for food items obtained by dividing expenditure values by

quantities. However, the raw unit values need adjustment for quality and demographic effects. To do so, we adopt the following procedure.

The unit values, v_i, are adjusted for quality and demographic factors following Cox and Wohlgenant (1986) and Hoang (2009), through the following regression equation:

$$v_i^{hsjd} - \left(v_i^{sjd}\right)_{median} = \alpha_i D_s + \beta_i D_j + \gamma_i \sum_j \sum_d D_j D_d + \varphi_i x^{hsjd} + \sum_k \omega_{ik} f_{ik}^{hsjd} + \sum_m b_{im} z_{im}^{hsjd} + \varepsilon_i^{hsjd} \quad (7)$$

v_i^{hsjd} is the unit value paid by household *h* for item *i* in state/province *j*, district *d* and sector *s*, $(v_i^{sjd})_{median}$ is the median unit value for the district in which the household resides, x is the household total expenditure per capita, *z* denotes the set of demographic variables such as household size and composition that may have an impact on the unit values by altering the household's preferences and its purchases, f is the set of other relevant variables like `household type' and D_s, D_j and D_d are dummies for sector, state/province and district, respectively. While Hoang estimates equation (7) using *mean* unit prices and then adds the predicted residual ($\widehat{\varepsilon_i}$) to the district mean to get the quality adjusted price for each good, the present paper uses deviation of household level unit prices from *median* unit prices, which are not affected by extreme values, to represent quality effect. The quality adjusted unit prices are calculated by, first, estimating equation (7), which, for each commodity i, regresses the deviation of household's unit price from the median price in the district d, of state/province *j*, in each sector *s* (rural or urban), $\left(v_i^{sd}\right)_{median}$, on household characteristics.

Next, the district wise quality adjusted price for each item p_i is generated by adding the district median unit value for this item to the estimated residual from equation (7).

$$(p_i^{sd})_{median} = \left(v_i^{sd}\right)_{median} + (\widehat{\varepsilon_i^{sd}})_{median}. \quad (8)$$

The district wise median of the prices calculated in equation (8) is used to represent the district wise quality adjusted price for each food item$i$. In other words, each household is

assumed to face the vector of quality adjusted median values, using equations (7) and (8), of the items in the district where the household resides.

The quality adjustment to the unit values represented by equation (7) may not be adequate since the unit value will also vary with district prices, so that in districts with higher prices the quality chosen will be lower[7]. The quality adjustment procedure described by (8) can be easily extended to accommodate this possibility.

$$v_i^{hsjd} - \left(v_i^{sjd}\right)_{median} = \alpha_i D_s + \beta_i D_j + \gamma_i \sum_j \sum_d D_j D_d + \delta_{i2}\ D_{id2}^M + \delta_{i3} D_{id3}^M + \varphi_i x^{hsjd} + \sum_k \omega_{ik} f_{ik}^{hsjd} + \sum_m b_{im} Z_{im}^{hsjd} + \varepsilon_i^{hsjd}. \quad (9)$$

The dummy variables, D_{id2}^M and D_{id3}^M , in equation (9) capture the effect of higher district level prices on the quality of food item $i$purchased. For each item in each district, a categorical variable *M* is constructed based on the deviation of the district level median unit values from the All India median unit values. That is, for each food item,i, the variable *M* takes the value 1 if the median unit value of each district is less than $Median - SD$ of the All India unit value, 2 if it is in the range $(Median - SD)$ to $(Median + SD)$ of the All India unit value, and 3 if the district's median unit value is in the district is greater than (Median + SD) of the All India unit value. The district price dummies for item i are then defined as follows: D_{id2}^M =1, if *M*=2, and D_{id3}^M =1, if *M*=3. The default category is *M*=1 with equation (9) specialising to equation (7) for all districts for whom *M*=1 for item$i$. Note that equation (9) denotes a much greater correction of the unit values for a range of quality, demographic and community/district level effects than has been attempted before.

4. The Data and the Quality Adjusted Unit Values

This study uses the detailed rural information on household purchases on food and non-food items in both quantity and value terms, along with that on household size, composition

[7] See McKelvey (2011).

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 of India's National Sample Surveys. As this study used only the rural samples, the sector dummy variable is omitted. India maintained a high growth rate throughout this period that included the global financial crisis. The 10 items used in the demand estimation along with the unit of their prices are listed in the Appendix Table A1. The 15 major states considered in this study, along with the number of districts in each state in each round, have been listed in Appendix Table A2.

Following the procedure described above, and using equations (8) and (9), the quality adjusted unit values in the three rounds at median have been presented[8] in Tables 1-3. 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). There was a moderate increase in the prices of most of the items in the first half, and in case of cereals and cereal substitutes there was a small decline. This contrasts with a large rise in prices of all the items during the latter half, 2004/5- 2009/10. Second, the price increase in the second half has been quite uneven between the 10 items with the three non-food items, namely, Fuel, Clothing and Footwear recording much higher inflation than the food items. Fuel stands out in this respect recording a doubling or trebling in prices in several states. The consequent increase in relative prices of the non-food items vis-à-vis the food items explains the redistributive nature of the price increase during the period, 2004/5 – 2009/10, that we report below. Third, and quite significant from the spatial aspect that we focus on in this study, there is large spatial variation in the unit values, and the inflation has been quite uneven between the principal states of India. We have not reported the prices faced by households in the four expenditure quartiles to save space. These show that they increase 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

[8] See Appendix Tables A3-A5 for the corresponding regression estimates of equation (9) underlining Tables 1-3, respectively. For space reasons, only a selected list of estimated coefficients has been presented in these Appendix Tables. The quality effect of rising household affluence is captured by the significantly positive estimated coefficient of monthly per capita expenditure for all items in all rounds. The large and significant coefficient estimates of "District Dummy 2" and "District Dummy 3", especially the latter, for Clothing and Footwear suggest that in the more expensive districts consumers trade off quality for price, as suggested by the Indonesian evidence of McKelvey (2011). The effect is less pronounced for the food items.

the top two quartiles than between the others and this adds to the redistributive nature of inflation over this period[9].

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

Table 4 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[10]. 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. 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 4 is presented in Appendix Table A6 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

[9] 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 in equation (9), there is still considerable heterogeneity in preferences that is driving this result.

[10] These have been calculated using equation (6). The reference point corresponds to the all India median budget shares and All-India prices (calculated from the pooled sample over all the states).

exception and reversal occur for the top two quartiles in Kerala in NSS Round 66. One should qualify these observations by noting that, due to data limitations, we have been restricted to (mainly) non-durable items, and, consequently, Table 4 presents only a partial picture of the comparative costs of living in the principal states in India.

Table 5 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. Consistent with our earlier discussion and Tables 1-3, Table 5 shows that 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. Table 5 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, Andhra Pradesh recording a doubling of prices over the period in contrast to Karnataka and Kerala which recorded a much lower rate of inflation. Table 6 presents the disaggregated picture underlying Table 5 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. This has implications for, for example, the International Comparison Project (ICP) of the United Nations that assumes that the PPP of a country's currency is the same everywhere inside the country. Clearly, such an assumption is untrue for large countries such as India, and this 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. These are reported in Appendix Table A7. The estimates support the extension of EASI over its linear and quadratic specialisations [AIDS, QAIDS] by reporting strong statistical significance of the higher order terms in log of Stone index deflated nominal expenditure. Almost all the price coefficients are significant as well.

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

This section is subdivided into 2 subsections. Subsection 6.1 presents the two sets of expenditure inequalities distinguishing between the nominal and real expenditure inequalities. Let us recall that 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. Subsection 6.2 tries to correlate 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 7 presents the Gini measure of the nominal and real expenditure inequalities 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, and most significantly, 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. This result is consistent with the Canadian evidence presented in Pendakur (2002), who, using a different methodology, showed that the level and trend in inequality is sensitive to the incorporation of price changes in the measurement of inequality. Note, however, that the qualitative result on the sharp increase in nominal expenditure inequality between rounds 61 and 66 is generally robust between states. Finally, table 7 contains evidence on the distributive impact of the 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 been 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[11], 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 panel of households at the state level 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. The final model that emerged is:

$$lnG_{it} = \alpha + \beta^{NFP} lnNFP_{it} + \beta^{GOV} lnGOV_{it} + \beta^{TI} lnTI_{it} + \beta^{SI} lnSI_{it} + \eta_i + \varepsilon_{it}, \qquad (10)$$

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 5), SI is the spatial index (Table 4), 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 effects model/ panel random

[11] 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.

effects model) were arrived at. The results are presented in Tables 8(a) and 8(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 8(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 8(b) is based on the second set of spatial prices, reported under Set 2 in table 4 (last three columns), i.e., spatial indices, which are evaluated using parameters of state-specific EASI demand system.

The model adequacies are evident from the LR tests. In Table 8(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 8(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 8(a) contain state specific variation only in prices, those in Table 8(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, namely, 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. In Table 8(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 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 8(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). Coming to the price elasticities, 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

Much of welfare analysis in the development literature has focussed on poverty rates and their movement over time. This is especially true in the case of India which has witnessed a large proliferation in studies on poverty. There has been relatively less attention paid to inequality. Yet, as a country develops, especially at the high growth rates that India has experienced in recent years, the focus ought to shift from poverty to inequality. It is possible for poverty rates to go down as a country develops, but if this is accompanied by rising inequality, then social tensions increase due to the marginalisation of large sections of society. This requires improved methods for the quantification of inequality and analysis of their underlying determinants. The principal motivation of this paper has been to provide such an analysis. It does so using Indian data over the recent period, 1999/2000 – 2009/10. The significant features of this study are described as follows.

First, the paper focuses attention on the role of prices in inequality movements. There is a parallel here with the poverty literature where the prices are needed for updating the poverty line over time. However, the role that prices play in the poverty calculations is quite different from their role in the inequality literature. This study draws a distinction between real and nominal expenditure inequalities. The distinction rests on the fact that households at different points in the expenditure distribution may face different prices due to differences in preferences, in their household characteristics and in their economic circumstances. Such price differences and in their movement over time will draw a wedge

between real and nominal expenditure inequalities. An examination of the differences between the two inequalities will tell us whether the prices, or more precisely, the structure of relative prices facing the different households, have 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. The preference based methodology for calculating "exact" price indices is used consistently for calculating both spatial and regionally varying temporal prices. On the way, the study extends the methodology of Cox and Wohlgenant (1986) for generating prices from unit values. The spatial prices (at a point in time) and regionally varying temporal price indices (over time) are both needed for examining the effect of price movement on inequality.

Third, the study turns to the key question of the effect of prices on inequality. It does so based on the estimation of a panel of households that is created at the state level over the chosen period. Here, 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 study documents strong evidence that suggests that per capita real state expenditure reduces both nominal and real expenditure inequality. There is a strong policy message here. The inequality increase due to price inflation can be moderated through an increase in rural developmental spending. In contrast, an increase in non-farm productivity shifts 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 than has been the case. That is the principal message of this study.

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Table 1: Quality Adjusted Unit Values in NSS 55thRound: 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	9.990	27.710	8.834	38.151	6.623	9.011	57.584	0.638	40.644	42.506
Assam	11.911	27.026	11.905	45.760	5.931	9.423	77.992	0.734	54.309	50.790
Bihar	9.469	22.147	11.276	41.698	4.220	9.135	61.472	1.034	41.449	37.411
Gujarat	8.236	26.381	12.714	43.448	8.030	13.313	93.498	0.873	42.069	48.196
Haryana	6.729	23.416	10.009	38.323	6.311	14.514	83.358	0.952	61.052	71.347
Karnataka	9.612	25.073	9.088	40.587	6.317	11.999	70.497	0.745	40.433	53.330
Kerala	12.040	28.546	12.457	50.330	9.261	11.931	67.874	1.177	49.935	50.193
Maharashtra	7.922	20.906	10.067	35.356	5.245	9.289	72.417	0.815	39.487	38.378
Madhya Pradesh	8.408	24.460	10.983	37.817	7.385	14.567	81.396	0.905	40.664	46.809
Orissa	9.730	24.964	9.485	42.191	4.976	6.496	59.654	0.601	44.198	33.583
Punjab	6.812	24.202	10.320	38.607	5.522	15.190	86.783	1.370	60.303	80.205
Rajasthan	7.006	21.951	10.098	42.879	6.882	12.781	77.638	0.879	48.196	63.401
Tamil Nadu	10.853	29.141	10.061	39.634	8.306	6.118	64.556	0.956	39.160	37.230
Uttar Pradesh	7.247	22.916	9.921	38.623	4.319	10.292	70.605	0.871	47.333	47.941
West Bengal	10.711	27.795	10.069	43.936	5.024	8.649	66.425	0.966	43.076	39.346
ALL INDIA (Rural)	9.086	24.748	10.399	40.748	5.926	10.259	70.584	0.879	44.669	46.132

*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 2: 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	10.508	28.375	10.303	51.350	7.681	12.760	56.929	0.576	46.320	49.506
Assam	10.889	30.352	15.200	59.162	7.307	13.340	74.390	0.743	66.791	77.607
Bihar	8.670	24.648	12.337	57.794	5.264	13.904	55.852	1.353	48.154	48.851
Gujarat	8.268	26.729	14.234	53.603	9.784	16.339	78.936	0.882	42.902	56.755
Haryana	6.732	27.647	12.514	50.103	7.310	16.859	80.076	1.087	44.693	77.836
Karnataka	9.338	26.816	10.134	52.651	6.638	15.030	66.149	0.630	42.150	64.156
Kerala	12.203	30.822	13.556	66.026	9.936	15.586	59.872	1.088	58.037	72.759
Maharashtra	7.063	23.885	10.564	48.897	6.450	13.613	68.584	0.772	42.328	48.415
Madhya Pradesh	8.475	26.238	12.028	51.333	8.574	18.053	72.208	0.874	42.948	56.471
Orissa	8.323	25.344	9.976	59.082	6.600	12.545	58.568	0.665	56.520	49.273
Punjab	7.013	27.073	11.440	50.649	6.856	17.339	84.165	1.461	56.805	82.683
Rajasthan	6.788	24.794	10.609	53.256	8.272	15.106	71.164	0.680	44.986	66.494
Tamil Nadu	11.835	29.767	10.426	55.755	9.224	9.842	57.984	0.791	46.411	42.980
Uttar Pradesh	7.142	25.315	10.673	51.793	5.813	14.452	65.488	1.001	45.729	54.012
West Bengal	10.368	30.101	11.814	57.969	6.001	13.537	64.712	0.935	50.522	53.225
ALL INDIA (Rural)	8.829	26.824	11.471	54.071	7.335	14.540	66.825	0.859	47.747	58.204

*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 3: 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	20.466	68.205	20.132	54.260	14.422	10.844	87.874	1.616	84.805	88.677
Assam	17.717	61.101	21.205	68.454	11.510	9.272	99.598	1.531	87.839	115.133
Bihar	14.221	49.749	19.951	67.227	9.810	9.509	104.022	2.666	77.693	77.217
Gujarat	14.275	61.476	21.704	60.799	15.001	9.569	120.430	1.393	62.779	83.586
Haryana	12.524	54.244	22.562	59.904	13.225	12.878	132.618	3.592	78.632	128.463
Karnataka	16.455	59.311	15.268	57.462	13.013	11.150	92.740	0.765	69.048	102.353
Kerala	20.421	64.396	20.106	56.039	17.392	8.369	97.976	1.174	98.347	125.617
Maharashtra	12.734	55.902	18.070	53.557	11.814	9.312	112.888	1.565	64.991	81.692
Madhya Pradesh	15.291	60.738	20.458	55.244	16.372	22.586	115.394	2.086	62.880	91.394
Orissa	14.661	61.945	14.959	64.867	12.579	8.229	98.470	0.945	82.124	77.569
Punjab	12.924	55.594	21.254	60.429	13.613	11.031	123.904	9.245	103.013	126.843
Rajasthan	12.593	53.006	17.358	64.309	14.031	8.293	110.628	1.500	63.174	88.346
Tamil Nadu	21.263	55.502	17.866	58.553	16.061	7.142	101.392	3.108	71.056	74.927
Uttar Pradesh	12.078	50.324	17.967	62.078	10.766	9.268	117.777	2.034	62.290	76.363
West Bengal	16.796	62.490	16.604	68.057	10.465	8.757	101.863	1.602	81.376	86.225
ALL INDIA (Rural)	15.717	57.873	18.720	61.046	13.069	10.396	107.985	2.039	76.059	91.589

*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 4: 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 5: State specific and All India Temporal Price Indices: Rural sector

State	NSS Rounds		
	55th	61st	66th
Andhra Pradesh	1.000	1.092	2.010
Assam	1.000	1.049	1.616
Bihar	1.000	1.056	1.727
Gujarat	1.000	1.071	1.703
Haryana	1.000	1.125	1.862
Karnataka	1.000	1.036	1.631
Kerala	1.000	1.058	1.545
Madhya Pradesh	1.000	1.034	1.718
Maharashtra	1.000	1.072	1.844
Orissa	1.000	1.011	1.666
Punjab	1.000	1.098	1.975
Rajasthan	1.000	1.021	1.665
Tamil Nadu	1.000	1.070	1.888
Uttar Pradesh	1.000	1.097	1.755
West Bengal	1.000	1.062	1.671
ALL INDIA (Rural)	1.000	1.076	1.790

Table 6: 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 7: 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 8(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 8(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

Table A1: 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

Table A2: 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 A3: Unit Value Regression Parameters: NSS 55th Round, Rural Sector

Variables	Items									
	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	Footwear
District Dummy 2 (D_{id2}^{M})	- 0.481* (0.000)	-0.674 (0.537)	-1.023* (0.000)	-2.796* (0.004)	-0.153 (0.214)	-1.044* (0.004)	-508.229* (0.000)	0.078 (0.242)	-3.897*** (0.050)	-3.562*** (0.079)
District Dummy 3 (D_{id3}^{M})	-0.775* (0.000)	Omitted	-2.359* (0.000)	-5.032* (0.000)	0.094 (0.648)	-1.599** (0.029)	Omitted	-0.501* (0.000)	-11.690** (0.025)	-14.396* (0.005)
Monthly Per Capita Expenditure (x)	0.002* (0.000)	0.002* (0.000)	0.001* (0.000)	0.002* (0.000)	0.001* (0.000)	0.005* (0.000)	1.454* (0.000)	0.001* (0.000)	0.022* (0.000)	0.033* (0.000)
Number of adults (z_1)	0.008*** (0.088)	-0.001 (0.746)	0.025** (0.012)	-0.012 (0.563)	-0.00002 (0.996)	0.138* (0.000)	7.603* (0.000)	0.019* (0.000)	0.955* (0.000)	3.010* (0.000)
Number of Children (z_2)	0.020 * (0.000)	-0.030 (0.452)	-0.018*** (0.080)	0.026 (0.209)	-0.009*** (0.058)	0.068* (0.000)	34.343* (0.000)	0.006** (0.013)	0.935* (0.000)	-0.356* (0.000)
$\overline{R}^2$	0.074	-0.004	0.084	0.047	0.027	0.051	0.433	0.079	0.073	0.151

1. Figures in parentheses are the p-values. [*p<0.01, ** p<0.05, ***p<0.10 are level of significance.]
2. All dummy variables corresponding to household types (f) are significant. The household types considered here are (i) Self-employed in agriculture, (ii) Self-employed in non-agriculture, (iii) Agricultural and other labourers and (iv) Others.
3. A negative value of $\overline{R}^2$ means that the value of R^2 is very low.

Table A4: Unit Value Regression Parameters: NSS 61st Round, Rural Sector

Variables	Items									
	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	Footwear
District Dummy 2 (D_{id2}^{M})	-0.789** (0.015)	0.285 (0.535)	-0.178 (0.439)	0.996 (0.336)	-0.411** (0.043)	-4.255* (0.000)	-0.869 (0.643)	-0.152 (0.480)	-21.712* (0.000)	-36.097* (0.000)
District Dummy 3 (D_{id3}^{M})	-1.344* (0.006)	-0.393 (0.604)	-0.342 (0.362)	-0.570 (0.724)	-0.219 (0.512)	-5.096* (0.000)	-11.775* (0.000)	-1.065 (0.643)	-12.483** (0.015)	-37.932* (0.000)
Monthly Per Capita Expenditure (x)	0.003* (0.000)	0.001* (0.000)	0.001* (0.000)	0.002* (0.000)	0.001* (0.000)	0.008 * (0.000)	0.020* (0.000)	0.001* (0.000)	0.036* (0.000)	0.067* (0.000)
Number of adults (z_1)	0.011 (0.190)	-0.051* (0.000)	-0.010*** (0.071)	-0.072* (0.005)	0.009*** (0.078)	0.120* (0.000)	0.353* (0.000)	0.040* (0.000)	1.054* (0.000)	3.269* (0.000)
Number of Children (z_2)	0.053* (0.000)	-0.068* (0.000)	0.017* (0.000)	-0.017 (0.534)	0.009*** (0.078)	0.120* (0.000)	0.154* (0.000)	0.033* (0.000)	1.486* (0.000)	0.158*** (0.085)
$\overline{R}^2$	0.041	0.043	0.117	0.022	0.023	0.086	0.059	0.120	0.072	0.173

1. Figures in parentheses are the p-values. [*p<0.01, ** p<0.05, ***p<0.10 are level of significance.]
2. All dummy variables corresponding to household types (f) are significant. The household types considered here are (i) Self-employed in agriculture, (ii) Self-employed in non-agriculture, (iii) Agricultural and other labourers and (iv) Others.

Table A5: Unit Value Regression Parameters: NSS 66thRound, Rural Sector

Variables	Items									
	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	Footwear
District Dummy 2 (D_{id2}^{M})	-0.162 (0.642)	-3.768* (0.003)	-1.280 * (0.001)	1.570 (0.155)	-0.266 (0.484)	-7.072* (0.000)	3.544 (0.212)	2.024* (0.000)	-37.471* (0.000)	-48.763* (0.000)
District Dummy 3 (D_{id3}^{M})	-1.004 (0.150)	-3.464*** (0.107)	-1.009*** (0.089)	-5.862* (0.002)	-1.016 (0.181)	-12.847* (0.000)	12.602** (0.012)	-11.586* (0.000)	-43.606* (0.000)	-86.316* (0.000)
Monthly Per Capita Expenditure (x)	0.001* (0.000)	0.002 * (0.000)	0 .0004* (0.000)	0.002* (0.000)	0.0006* (0.000)	0.007* (0.000)	0.003* (0.000)	0.002* (0.000)	0.020* (0.000)	0.029* (0.000)
Number of adults (z_1)	-0.016 (0.184)	0.105* (0.016)	-0.047 * (0.001)	-0.084** (0.030)	-0.025*** (0.059)	0.359* (0.000)	-0.170*** (0.087)	0.146* (0.000)	1.352 * (0.000)	3.650* (0.000)
Number of Children (z_2)	0.011 (0.473)	-0.180 * (0.001)	-0.003 (0.859)	0.089*** (0.069)	0.048* (0.005)	0.145* (0.004)	-0.588* (0.000)	-0.049*** (0.057)	1.813* (0.000)	0.106 (0.598)
$\overline{R}^2$	0.121	0.077	0.128	0.078	0.058	0.203	0.053	0.256	0.135	0.229

1. Figures in parentheses are the p-values. [*p<0.01, ** p<0.05, ***p<0.10 are level of significance.]
2. All dummy variables corresponding to household types (f) are significant. The household types considered here are (i) Self-employed in agriculture, (ii) Self-employed in non-agriculture, (iii) Agricultural and other labourers and (iv) Others.

Table A6: 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
Maharashtra	0.823	0.843	0.808	0.824	0.773	0.770	0.749	0.727	0.870	0.853	0.750	0.610
Madhya Pradesh	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 A7: 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)
Const	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.