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ARTICLES

SPATIAL COMPARISONS OF PRICES AND EXPENDITURE IN A HETEROGENEOUS COUNTRY: METHODOLOGY WITH APPLICATION TO INDIA

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This study addresses two significant limitations in the literature on cross-country expenditure comparisons: (a) treatment of all countries, large and small, as single entities with no spatial differences inside the countries, and (b) use of Divisia price indices, rather than Rank 3 preference-based "exact price" indices, in the expenditure comparisons. This paper compares alternative preference consistent methods for estimating spatial price differences in a large heterogeneous country, namely India, that are benchmarked against the spatial prices generated by the Laspyeres and Tornqvist price indices. Unlike the use of conventional price indices, the use of demand-systems-based methods allows the incorporation of price-induced substitution effects between items. The paper illustrates the usefulness of the methodology by using the "exact" spatial price indices, in conjunction with the inequality-sensitive welfare measure due to Sen, to rank the Indian states and examine changes in ranking during one of the most significant periods in independent India. The results have methodological and empirical implications that extend far beyond India.

Keywords: True Cost of Living Index, Inequality-Sensitive Real Expenditure Comparisons, Spatial Price Indices, Hasse Diagrams, Unit Values

1. INTRODUCTION

There is now a large literature on the comparison of real incomes of countries across time and space. Much of it is based on the Penn World Tables, from the

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TABLE 1. Coefficient of variation (CV) (%) of the different price indices (11 food items) across states: NSS 50th–66th rounds (rural and urban)

	CV (rural India)				CV (urban India)			
Indices (1)	50th round (2)	55th round (3)	61st round (4)	66th round (5)	50th round (6)	55th round (7)	61st round (8)	66th round (9)
Coondoo et al. (2011) index	17.3	17.9	20.3	19.7	10.0	11.9	14.3	12.6
QAIDS-based index	26.9	15.1	21.7	26.5	35.5	18.5	15.7	23.4
Tornqvist GEKS index	7.2	7.3	8.1	12.9	10.4	6.5	5.7	11.4
Laspeyres index	12.6	11.6	9.8	7.5	8.2	8.9	9.3	6.9

Note: The coefficient of variation (%) of the PPPs among the following OECD small countries (with area less than 1.5 million kilometers square) during 2009/2010 turned out to be 8.8: Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, and Euro area. *Data source:* OECD.Stat *Extracts.*

International Comparison Program (ICP) of the United Nations, which regularly publishes estimates of real GDP for a large panel of countries. Although such comparisons are routinely done from the World Development Indicators published by the World Bank,[1] there have been some recent attempts to make these international comparisons consistent across space and over time. Recent examples of international comparisons of real income or real expenditure include Hill (2004), Neary (2004), and Feenstra et al. (2009). Oulton (2012) sets out a preference-based algorithm for comparing living standards across countries.

Most of these international income comparisons treat a whole country as a single entity, and ignore the spatial dimension within the country.[2] They ignore the fact that in large countries, such as Brazil and India, there is much greater variation in prices and consumer preferences between states or provinces than there is between several of the smaller countries that figure in the ICP real income or inequality comparisons. As reported in Table 1, the order of magnitude of the Coefficient of Variation of the PPPs between the states in India is larger than that between several of the smaller countries in the European Union.

The variation in the PPP of a currency inside a large country can be attributed to three related but conceptually different factors: (a) intranational spatial heterogeneity in preferences, (b) differences in prices, and (c) spatial differences in household size and composition. In countries such as India and Brazil, the combined impact of these three factors may lead to high spatial heterogeneity in the PPP of the country's currency. The assumption of a single PPP restricts the usefulness of the methodology adopted in such countries. For example, the international statistical agencies have spent much resources on calculating PPPs between nations [Asian

Development Bank (2008); Rao et al. (2010)], but not much attention has been paid to calculating PPPs within nations. Nor are these cross-country comparisons usually made on preference-consistent expenditure systems that take into account substitution between items over time or the spatial differences in the magnitude of such substitution effects driven by corresponding spatial differences in prices and preferences. Yet the considerations of preference heterogeneity and differing relative prices between nations that drive the cross-country PPP calculations also underline the importance of spatial prices in the context of large federal countries such as Brazil and India. In the words of Oulton (2012, p. 425), "though much work has been done on estimating systems of consumer demand or producers' cost functions, the results of these studies are not typically employed by other economists in empirical work . . . when macro economists study inflation empirically they do not usually employ their micro colleagues' estimates of expenditure functions." The recent study by Feenstra et al. (2009), although continuing the tradition of treating all countries, large and small, as homogenous, marks a departure and proposes a framework for expenditure comparisons between countries based on estimated preference parameters.[3] The present study, which is in this recent tradition, is motivated by an attempt to take consumer preferences and price-induced substitution into account in calculating spatial price indices, unlike much of the earlier literature, as exemplified by the earlier quotation from Oulton (2012). In doing so, this paper pays major attention to regional heterogeneity in prices and in household size and composition as the principal reasons for the spatial heterogeneity in a country's PPP, namely, those identified as (b) and (c). We also take into account regional variation in preferences, namely (a), by calculating the intranational PPPs using spatially different preference parameters obtained by estimating the demand systems separately for each of the constituent states. However, the paper's contribution on this is limited by the fact that we use the same demand functional form for all the constituent states.

The recent evidence of Aten and Menezes (2002), Coondoo et al. (2004, 2011), Deaton and Dupriez (2011), and Majumder et al. (2011, 2012) suggests that the assumption of spatial homogeneity is unlikely to be valid in the case of large heterogeneous countries with diverse preferences such as Brazil, India, and Indonesia. The lack of spatial prices in large countries prevents real income comparisons between provinces, because the calculation of provincial real income is dependent on the availability of regional price deflators. The heterogeneity in regional preferences over items and in regional price movements in large countries implies that there is much greater variation between individual provinces and states in such countries than exists between several of the smaller countries in, for example, the European Union[4] or, more generally, the list of countries that figure in the ICP project. This paper extends the cross-country framework of the ICP to a within-country framework and contributes to the literature by providing the first preference-consistent measurement of spatial price variation within a country. In a different context, namely, of monetary aggregation, Barnett (2007) has proposed a Divisia-based methodology for aggregating monetary service flows aggregated over the smaller nations of the European Union. Many of the smaller countries in Barnett (2007)'s framework are analogous to the constituent states of the Indian union considered in this study.

The present study uses the methodology proposed in Majumder et al. (2012), which provides a preference-consistent framework for estimating spatial differences in prices. This paper extends Majumder et al. (2012) in moving from urban–rural heterogeneity in that study to regional heterogeneity between the principal states of the Indian union. The present study uses the estimated spatial prices in expenditure comparisons between regions in the context of a large heterogeneous country, namely India. Our earlier study [Majumder et al. (2012)] was in the recent expenditure function-based tradition of Feenstra et al. (2009). The present study extends our earlier one in three significant respects: (a) it introduces spatial differences in preferences and price movements within a country and moves from the multicountry context of that study to the multiregion context of a single federal country, (b) it shows that the utility-based "true cost of living index" used recently in intertemporal price comparisons can also be used in constructing spatial price indices within a country for a single time period, and (c) the expenditure function adopted is the rank three functional form introduced by Banks et al. (1997) rather than its restricted rank-two specialization, which yields the almost ideal demand system.[5] The paper compares alternative methodologies for estimating spatial prices. The comparison is not only between the traditional approach based on Divisia price indices[6] and the approach based on the preference parameters estimated from complete demand systems but, within the latter approach, between that using the innovative procedure of Coondoo et al. (2011), which uses Engel curve analysis without requiring any price information, and that which uses prices constructed from unit values in the household expenditure surveys. The latter is preferable in the context of long time series, where it is important to take into account price-induced substitution between items and the regional heterogeneity in such substitution. As is the case with Majumder et al. (2012), the principal contribution of this paper is empirical in comparing the results of different methodologies in calculating spatial prices within a large federal country. Whereas our earlier study compared rural–urban price indices calculated using different methodologies, the emphasis in the present study is on differences in price indices between the principal states constituting the Indian union.

Although this study should, therefore, be seen as a natural continuation of our earlier exercise, it is important to point out the key point of departure from Majumder et al. (2012) and put the contribution of this paper in proper perspective.[7] In the words of a referee, "the novel contribution of this paper is instead to demonstrate the relevance of the methodological differences between the Coondoo et al. (2011), QAIDS, and Divisia indices in a new empirical context. Whereas Majumder, Ray, and Sinha (2012) asks whether substitution effects matter for the measurement of rural–urban price differences, the current paper asks whether these effects matter for the measurement of interregional price indices (and, therefore, real incomes). Interestingly, the two papers reach quite different conclusions.

Whereas Majumder, Ray, and Sinha (2012) find that a Divisia price index that ignores price-induced substitution effects entirely (namely, the Laspeyres) yields a similar estimate of the national rural–urban price gap in India, the current paper shows that two different Divisia price indices (the Laspeyres and the Tornqvist, which accounts for some substitution) both yield downward-biased estimates of interregional price differences." It is worth stressing that the use of the Tornqvist GEKS index in this study demonstrates that even a superlative Divisia index can lead to a significant substitution bias in relation to the QAIDS index.

Other distinguishing features of the present study include the fact that we propose formal tests of the hypothesis of no spatial differences in prices. Moreover, the paper uses the distribution-sensitive welfare measure, proposed by Sen (1976), to rank states in India and examines whether the welfare rankings have changed over the chosen period. This was a period of considerable economic significance for India because it coincided with "second generation reforms" that helped to make India one of the fastest-growing countries in the world. Yet not all states in India have shared equally in the progress, and this puts the focus on regional expenditure, price, and welfare differences within the country, as is done in this study. As Datt and Ravallion (1998) have shown, there has been considerable unevenness in economic progress among the constituent states in the Indian Union. Whereas Datt and Ravallion (1998)'s study was based on poverty rates and covered the prereforms period, the present study ranks states based on the welfare of the entire population (not just the poor) and covers the more recent period of economic reforms in India. It may be noted that the expenditure-based welfare comparison between different regions in a large country is analogous to that between countries in international comparisons, but the former does not usually suffer from the problems posed by inconsistent data definitions in various countries faced in the latter. Moreover, the prevalence of similar institutional and cultural features in various regions in a country, along with a shared historical experience, unlike in various countries, makes the intracountry welfare comparisons more meaningful than the cross-country comparisons, as noted by Datt and Ravallion (1998).

The rest of the paper is organized as follows. Section 2 presents the alternative methodologies for estimating and testing for spatial differences in prices. The data set is briefly described in Section 3, which also presents and discusses the quality- and demography-adjusted unit values that are used as proxies for prices. Section 4 presents the results, and Section 5 concludes the paper.

2. PROCEDURES FOR ESTIMATING SPATIAL PRICES

The methodology is based on the fact that a spatial price index can be viewed as a true cost of living index, which is defined later.[8] The general cost function underlying the rank-three quadratic logarithmic (QL) systems [e.g., the quadratic almost ideal demand system (QAIDS) of Banks et al. (1997) and the generalized almost ideal demand system (GAIDS) of Lancaster and Ray(1998)] is of the form

$$C(u, p) = a(p).\exp\left[\frac{b(p)}{(1/\ln u) - \lambda(p)}\right], \quad \textbf{(1)}$$

where p is the price vector, $a(p)$ is a homogeneous function of degree one in prices, $b(p)$ and $\lambda(p)$ are homogeneous functions of degree zero in prices, and u denotes the level of utility. The budget share functions corresponding to the cost function (1) are of the form

$$w_i = a_i(p) + b_i(p)\ln\left[\frac{x}{a(p)}\right] + \frac{\lambda_i(p)}{b(p)}\left[\ln\frac{x}{a(p)}\right]^2, \quad \textbf{(2)}$$

where x denotes nominal per capita expenditure and i denotes item of expenditure.

The corresponding true cost of living index (TCLI) in logarithmic form comparing price situation p^1 with price situation p^0 is given by

$$\ln P(p^1, p^0, u^*) = [\ln a(p^1) - \ln a(p^0)] + \left[\frac{b(p^1)}{\frac{1}{\ln u^*} - \lambda(p^1)} - \frac{b(p^0)}{\frac{1}{\ln u^*} - \lambda(p^0)}\right], \quad \textbf{(3)}$$

where u^* is the reference utility level. Note that whereas "price situation" refers to the prices in a given year in temporal comparisons of prices and welfare, it refers to the prices prevailing in a particular region, i.e., state, in the spatial context of this study. The first term on the R.H.S. of (3) is the logarithm of the basic index (measuring the cost of living index at some minimum benchmark utility level) and the second term is the logarithm of the marginal index. Note that for $p^1 = \theta p^0$, $\theta > 0$, $a(p^1) = \theta a(p^0)$, so that the basic index takes a value θ and hence may be interpreted as the component of the TCLI that captures the effect of uniform or average inflation on the cost of living. On the other hand, for $p^1 = \theta p^0$, $\theta > 0$, $b(p^1) = b(p^0)$, and $\lambda(p^1) = \lambda(p^0)$, the marginal index takes a value of unity. Hence, the marginal index may be interpreted as the other component of the TCLI, which captures the effect of changes in the relative price structure.

The following discussion of the spatial price estimation procedure can be divided into four parts. The first part (Section 2.1) describes the three-step procedure due to Coondoo et al. (2011) that calculates the spatial prices based on Engel curve analysis obtained from the rank-three demand system described earlier. This procedure requires neither any price data nor any algebraic functional form for the cost function. The convenience of this procedure stems from the fact that many countries do not have any price information, let alone spatial prices. However, this convenience comes at the cost of ignoring substitution effects of price changes that may bias the estimates of spatial prices/PPP.[9] The second part (Section 2.2) describes an extension of this procedure by estimating a rank-three demand system using price information. These two procedures are benchmarked against the spatial prices generated by the Tornqvist GEKS Index,[10] which is "exact" under the rank-two transcendental logarithmic (translog) demand system [Diewert (1976)], and the Laspyeres price index. They are briefly described in Sections 2.3 and 2.4, respectively. The latter three procedures require price information that is lacking in most data sets. Section 2.5 shows how unit values obtained from expenditure and quantity information on purchases can be used to provide the necessary price information after adjusting for quality and demographic characteristics, and describes the procedure of generating quality-adjusted unit values as prices. The usefulness of the estimated spatial prices is shown by making spatial-price-corrected expenditure comparisons of the various regions, namely, the Indian states in the present study. The framework and measures used for such comparisons are described in Section 2.6.

2.1. The Coondoo et al. (2011) Procedure for Calculating Spatial Prices (Engel Curve Analysis)

The procedure for estimating TCLIs (spatial prices) for R regions, taking region 0 as base,[11] involves three stages.

In the first stage, a set of item-specific Engel curves relating budget shares to the logarithm of income are estimated for each region $r = 0, 1, 2, \ldots, R$ as follows:

$$w_{ij}^r = a_i^r + b_i^r \ln x_j^r + c_i^r (\ln x_j^r)^2 + \varepsilon_{ij}^r, \tag{4}$$

where i denotes item, j denotes household, ε_{ij}^r is a random disturbance term, and a_i^r, b_i^r, c_i^r are parameters that contain the price information on item i in region r.

In the second stage, $a(p^r)$, $r = 0, 1, 2, \ldots, R$, is estimated from the following equation obtained by equating equations (2) and (4):

$$\hat{b}_i^r - \hat{b}_i^0 = \ln a\left(p^0\right)\left(2\hat{c}_i^0\right) - \ln a\left(p^r\right)\left(2\hat{c}_i^r\right) + e_i^r;\ r = 1, 2, \ldots, R. \tag{5}$$

Here e_i^r is a composite error term, which is a linear combination of the individual errors of estimation of the parameters a_i^r, b_i^r, c_i^r, and p^0 denotes the price vector of the base region.

In the third stage, $b(p^r)$ and $\lambda(p^r)$, $r = 1, 2, \ldots, R$, are estimated, using the normalization $b(p^0) = \lambda(p^0) = 1$ for the base region, from the following regression equation:[12]

$$\frac{1}{\ln\left[\frac{x_j^r}{\widehat{a(p^r)}}\right]} = \frac{1}{b\left(p^r\right)}\left[\frac{1}{\ln\frac{x_j^0}{\widehat{a\left(p^0\right)}}} + 1\right] - \frac{\lambda\left(p^r\right)}{b\left(p^r\right)} + \text{error}. \tag{6}$$

The money metric utility u_j^0 of a household of the base region that has nominal per capita income $x_j^0[= C(u_j^0, p^0)]$ is given by

$$\frac{1}{\ln u_j^0} = \frac{1}{\ln\frac{x_j^0}{a(p^0)}} + 1. \tag{7}$$

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Using these, the TCLIs are estimated for a given reference level of utility of the base region. It may be emphasized that $a(p^r)$, $b(p^r)$, and $\lambda(p^r)$ are estimated as composite variables and no explicit algebraic forms for these functions are assumed. However, as already noted, because they are based on single-equation Engel curves, the issue of price-induced substitution effects among commodities is ignored. To incorporate such substitution among the items into the calculation of spatial prices, we need to estimate complete demand systems, which require specification of functional forms for $a(p^r)$, $b(p^r)$, and $\lambda(p^r)$, which in turn require prices for estimation. This methodology can be extended to allow the calculation of spatial prices incorporating substitution using constructed prices, as described in the following.

2.2. Extending the Coondoo et al. (2011) Procedure to Calculate Spatial Prices Incorporating Price-Induced Substitution (Demand Systems Estimation)

We now extend the procedure described in the preceding section by specifying explicit forms of $a(p^r)$, $b(p^r)$, and $\lambda(p^r)$. The specific functional forms of $a(p^r)$, $b(p^r)$, and $\lambda(p^r)$ for QAIDS in (1) are as follows:

$$\ln a\left(p^r\right) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln\ p_i^r + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \ln\ p_i^r \ln\ p_j^r;$$

$$b\left(p^r\right) = \prod\nolimits_{i=1}^{n} p_i^{r\beta_i},\ \lambda\left(p^r\right) = \sum_{i=1}^{n} \lambda_i \ln p_i^r,$$

where p_i^r is the price of item i in region r.

The resulting budget share equations are given by

$$w_i^r = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j^r + \beta_i \ln\left(x/a(p^r)\right) + \lambda_i [\ln\left(x/a(p^r)\right)]^2. \tag{8}$$

Given a reference utility level, the spatial prices can be calculated from equation (3) using the estimated parameters and information on prices.

Based on the level of regional disaggregation considered, estimation of the demand system [equation (8)] would yield estimates of $a(p^r)$, $b(p^r)$, and $\lambda(p^r)$, where superscript r denotes the province/region, r, and there are R such provinces. Substitution in (3) and taking the exponential function yields the spatial prices between provinces, conditional on a prespecified reference utility, u^*, in each situation. In the empirical work, we have used the utility level corresponding to per capita median expenditure in the whole country, India, as the reference utility level,[13] u^*, to calculate the spatial price of each state/province. Note that as we have calculated the spatial prices separately for rural and urban areas, the reference utility is that corresponding to the all-India median in the rural and urban areas.

2.3. The Tornqvist GEKS Index of Spatial Prices

The Tornqvist GEKS Index, given by $\prod_{i=1}^{n} (p_i^r/p_i^0)^{v_i}$, where $v_i = \frac{w_i^r + w_i^0}{2}$, is estimated using the following regression equation [Clements and Izan (1981); Hill and Timmer (2004)]:

$$\ln\left(\frac{p_i^r}{p_i^0}\right) = \alpha_{r0} + \varepsilon_{ir0}. \qquad \mathbf{(9)}$$

Assuming $E(\varepsilon_{ir0}) = 0$ and $\mathrm{Var}(\varepsilon_{ir0}) = \sigma_{r0}^2/nv_i$, the generalized least squares estimator $\widehat{\alpha_{r0}} = \sum_{i=1}^{n} [v_i \ln(p_i^r/p_i^0)]$ yields the logarithm of the Tornqvist GEKS index, along with its standard error. The index is "exact" under the Translog demand system,[14] which is obtained from the following rank-two QL indirect utility function [Christensen et al. (1975)]:

$$\ln\Psi(p,x) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln(p_i/x) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij}\ln(p_i/x), \qquad \mathbf{(10)}$$

with $\sum_i \alpha_i = -1$.

2.4. The Laspeyres Index of Spatial Prices

The Laspeyres index is computed using Selvanathan's (1991) procedure, based on the regression equation

$$\frac{p_i^{\mathrm{r}} q_i^0}{\sqrt{p_i^0 q_i^0}} = \gamma\sqrt{p_i^0 q_{\mathrm{i}}^0} + \varepsilon_{i,} \qquad \mathbf{(11)}$$

where r denotes the comparison state (namely, each of the 15 states in India) and 0 denotes the reference region (All India in this study), p_i and q_i are the price and quantity of the ith commodity, and ε_i is the disturbance term. The ordinary least squares estimator $\hat{\gamma}$ yields the Laspeyres index, along with its standard error. In the calculations of the Laspeyres spatial price index reported in the following, we fixed the reference bundle at the All India median of quantities (separately for rural and urban areas) at the corresponding round of India's National Sample Surveys (NSS). The equation has been estimated on percentile-level income-group-wise sector-region-level data corresponding to the respective rounds.

2.5. The Procedure for Generating Quality-Adjusted Unit Values as Prices (Food Items)

Whereas the Coondoo et al. (2011) procedure for calculating spatial prices described in Section 2.1 does not require prices of the individual items for calculating the spatial price indices, the demand-systems-based procedure described in Section 2.2 and the Laspeyres and Tornqvist indices of spatial prices described in

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Sections 2.3 and 2.4 require item prices in each round. Because such prices are rarely available even in developed countries, we use as prices the unit values obtained by dividing the household expenditure by the quantity purchased of the individual items, obtained from the NSS unit records. Note, however, that unadjusted unit values cannot be used as prices because of (a) measurement errors, (b) quality effects, and (c) household compositional effects on expenditure patterns. The presence of quality effects prevents the use of raw unit values as prices, as discussed by Prais and Houthakker (1971), who refrained from using them in the estimation of price elasticities on budget data. For example, the unit value of an item, say cereals, that is consumed in the urban areas may be higher than its rural counterpart simply because cereals consumed in urban areas are of superior quality. A large part of rural consumption is out of home-produced items, which are lower priced than urban consumption items that are mostly bought in the market. Also, one should note that part of the spatial differences in prices may be attributed to state-specific food subsidies rather than reflecting genuine price variation. However, the rationing system, which is the main source providing subsidized cereals, which are the dominant item in our study, is fairly uniform between the states in India.

Comparison of raw unit values will therefore exaggerate the rural–urban differential in prices. Similarly, a larger household enjoys discounted prices that a smaller household does not. This paper follows a recent and expanding literature that uses adjusted unit values as prices in welfare analysis—see, for example, Gibson and Rozelle (2005), Deaton and Dupriez (2011), and McKelvey (2011). Cox and Wohlgenant (1986) and Deaton (1988) proposed alternative methodologies for constructing price series from unit values in the household expenditure records.[15] In this paper, we extend the procedure, due to Cox and Wohlgenant (1986), that adjusts unit values obtained from budget surveys to correct for quality effects before they are used as prices in cross-sectional demand estimation. This methodology has been extended in two recent studies based on Vietnamese data by Hoang (2009) and on Indian data by Majumder et al. (2012). The present study used the Cox and Wohlgenant (1986) methodology over the Deaton (1988) procedure because the latter is more intensive in the calculations required. Hoang (2009) contains a useful comparative discussion of the two procedures. Gibson and Rozelle (2005) and McKelvey (2011) argue that even the adjusted unit values lead to substantial biases when used as prices. They suggest combined use of market prices and adjusted unit values, rather than reliance on any one of them. Unfortunately, the former are rarely available in developing countries and, even when they are, they also suffer from biases.

The information on spatial prices needed to estimate complete demand systems is missing in most data sets. We use as proxies for prices[16] the unit values for food items, which can be obtained by dividing expenditure values by quantities. However, the raw unit values need to be adjusted for quality and demographic effects. To do so, following our previous papers [Majumder et al. (2011, 2012)], 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:

$$\nu_i^{hsjd} - \left(\nu_i^{sjd}\right)_{\text{median}} = \alpha_i D_s + \beta_i D_j + \gamma_i \sum_j \sum_d D_j D_d + \varphi_i x^{hsjd}$$

$$+\omega_i f_i^{hsjd} + \sum_m b_i Z_{im}^{hsjd} + \varepsilon_i^{hsjd}; \quad \textbf{(12)}$$

where ν_i^{hsjd} is the unit value paid by household h for item i in state/province j, district d, and sector s, $(v_i^{sjd})_{\text{median}}$ is the median unit value for the district in which the household resides x is the household food expenditure per capita, f is the proportion of times meals are consumed outside by that household, and D_s, D_j, and D_d are dummies for sector, state/province, and district, respectively. Z denotes the set of demographic variables such as household size and composition that have an impact on the unit values by altering the household's preferences and its purchases. Whereas Hoang estimates equation (12) using the mean (in place of the median being used here) unit prices and then adds the predicted residual $(\widehat{\varepsilon_i})$ to the district mean to get the quality-adjusted price for each good, in our papers, including the present paper, we use the deviation of household level unit prices from median unit prices, which are not affected by extreme values, to represent a quality effect. The quality-adjusted unit prices are calculated by, first, estimating equation (12), which, for each commodity i, regresses the deviation of the household's unit price from the median price in the district d, of state/province j, in each sector s (rural or urban), $(\nu_i^{sjd})_{\text{median}}$, on household characteristics. In other words, each household is assumed to face the vector of quality-adjusted median values of the items in the district where the household resides. It may be noted that, ideally, consumers with different nominal expenditures should face different prices. But because the main emphasis of this study is on interstate price variation, we have ignored the intradistrict variation in prices. Details on the estimation of quality-corrected unit prices are presented in Majumder et al. (2012).

2.6. Spatial-Price-Deflated Real Expenditure Comparisons between Regions

The methodology proposed by Sen (1976) for real income comparisons between countries, and illustrated in that paper by applying it to studying regional differences in the rural standard of living in India,[17] is used in the present study to compare real expenditure among the constituent states of the Indian union. Following Sen (1976), we consider, as a welfare measure, the inequality-corrected nominal expenditure, $w_n^r = \mu_n^r(1 - G_n^r)$, where μ_n^r is the mean of the nominal expenditures (x_h^r) in state r, and G_n^r is the Gini inequality measure of nominal expenditures in that state. The spatial price of state r can be used to convert the welfare measure from nominal to real terms by defining $w_R^r = \mu_R^r(1-G_R^r)$, where μ_R^r is the mean of the real expenditures (x_h^r/S^r), G_R^r is the corresponding spatially corrected real expenditure inequality, and S^r is the spatial price of state r with respect to the All India figure, which is normalized at 1.[18]

An alternative way of incorporating spatial differences in prices into the expenditure comparisons has been proposed by Sen (1976). The welfare measure in nominal terms, w_n^r, for region r is calculated not only at that region's prices (p^r), but also at other regions' prices, (p^s); i.e., $w_n^{s,r} = \mu_n^r(p^s)(1-G_n^r(p^s))$. Sen's methodology consists of constructing the matrix W from these spatially corrected welfare values, with the diagonal elements W_{ii} being the values of the measure, w_n^r, in the various states evaluated at that state's prices, i.e., $w_n^r(p^r)$, and the off-diagonal elements denoting the corresponding values evaluated at other states' prices; i.e., the (s,r)th element denotes $w_n^r(p^s)$. We adopt Sen's recommendation to rank states from the values of the W matrix as follows: "If the value of the diagonal element for any state 1 is larger than the value in the same row for another state 2, then we conclude that in terms of consumption state 1 has a higher rural standard of welfare" [Sen (1976, p. 35)]. This gives us a "partial ordering of a complete welfare indicator rather than a complete ordering of a partial welfare indictor" (p. 32).These pairwise comparisons may not yield unambiguous rankings—for example, state i may have a higher welfare than state j with both states' expenditures evaluated at state i's price, whereas state j may have a higher welfare than state i with both expenditures evaluated at state j's price.

The Hasse diagrams are quite convenient in pictorially presenting the rankings and are reported in the following section. A point of interest in this study is whether there are rural–urban differences in the spatially corrected state rankings that are shown in the Hasse diagrams. Unfortunately, it is not always readily apparent from the Hasse diagrams if there are rural–urban differences. We provide evidence on rural–urban differences by constructing a distance matrix, D, whose (i,j)th element, D_{ij}, is given by the absolute value of the distance between the spatially corrected welfare measures of states i and j, i.e., ${D_{ij}}^R = w_R^i - w_R^j$ for the rural sector and ${D_{ij}}^U = w_U^i - w_U^j$ for the urban sector. Each D matrix is, therefore, a symmetric matrix whose diagonal elements are all 0. The Mantel test [Mantel (1967)], which has been widely used on genetic data by evolutionists, allows linear or monotonic comparisons between the elements of two distance matrices [see Legendre and Fortin (2010)], and is used here to test for rural–urban differences in the expenditure-based state rankings depicted in the Hasse diagrams.[19]

3. DATA DESCRIPTION AND THE QUALITY-ADJUSTED UNIT VALUES

This study uses the detailed information on household expenditures on food and nonfood items, household size, composition, and other household characteristics contained in the unit records from the 50th (July 1993–June 1994), 55th (July 1999–June 2000), 61st (July 2004–June 2005), and 66th (July 2009–June 2010) rounds of India's NSS. All these rounds are "thick" rounds, and based on large samples. The period covered by these four "thick rounds" of the NSS, 1993/1994–2009/2010, is of much interest, both in India and abroad, because it saw India transformed from a slow-growing economy facing a serious balance of payments crisis in 1991/19922 to one of the fastest-growing economies of the world. Moreover, the NSS 66th round, the latest available that we have considered here, covered the period immediately following the global financial crisis.

The spatial price calculations were done for 11 principal food items[20] on which the NSS contained information on both expenditures and quantities, allowing the calculation of unit values. The list of the 15 major states for which the spatial prices were calculated, along with the number of districts in each state, is given in Table A.2. Table A.3 provides further details on the data by reporting the number of households considered in each state and broken down by rural and urban areas.

The methods for calculating the price indices were based on (a) the Coondoo et al. (2011) procedure described in Section 2.1; (b) the QAIDS demand system-based procedure described in Section 2.2; (c) the Tornqvist formula described in Section 2.3; and (d) the Laspeyres index described in Section 2.4. As mentioned earlier, procedure (a) avoids the requirement of price information; the latter three procedures use the quality-adjusted unit values as prices. A comparison of the calculated spatial price indices between (a) and (b) shows the effect of disregarding price-based substitution in (a), but not in (b); a comparison between (b) and (c) shows the effect of using Rank 3 versus Rank 2 demand systems; and comparison between (b)/(c) and (d) establishes the robustness of the evidence to the adoption of the approach of "exact price" indices versus that of Divisia price indices.

The coefficient estimates of the quality adjustment regressions of the unit values of the 11 food items are presented in Table A.4.[21] Several of the coefficient estimates are highly significant. The sectoral dummy (urban = 1, rural = 0) is significant for eight items (nonsignificant for fruits, sugar, and spices). with positive values for all except milk and milk products and pan/tobacco, thereby generally implying higher urban prices.[22] With the exception of milk and milk products, the more affluent households consume superior-quality food items, as evident from the positive and significant coefficient estimate of the per capita expenditure variable for most items. Household size generally goes the other way, with larger households consuming inferior-quality food items. The coefficient estimates of the district price effects, D^M_{id2} and D^M_{id3}, are mostly significant, providing some support to the suggestion of McKelvey (2011) that in districts with higher prices the quality chosen will be lower.[23] All the PPPs were calculated with these controls included in the unit value regressions. Note, however, that these additional controls have very little policy significance because, as a comparison of Tables A.8 (inclusive of these effects) and A.9 (exclusive of them) shows, the two sets of quality-adjusted unit values in the 66th round are nearly identical.

The quality- and demography-adjusted unit values of the 11 food items in each of the 15 major states and for the whole country for the four NSS rounds, 50th, 55th, 61st, and 66th, are presented in the Appendix (Tables A.5–A.9). Two features

A

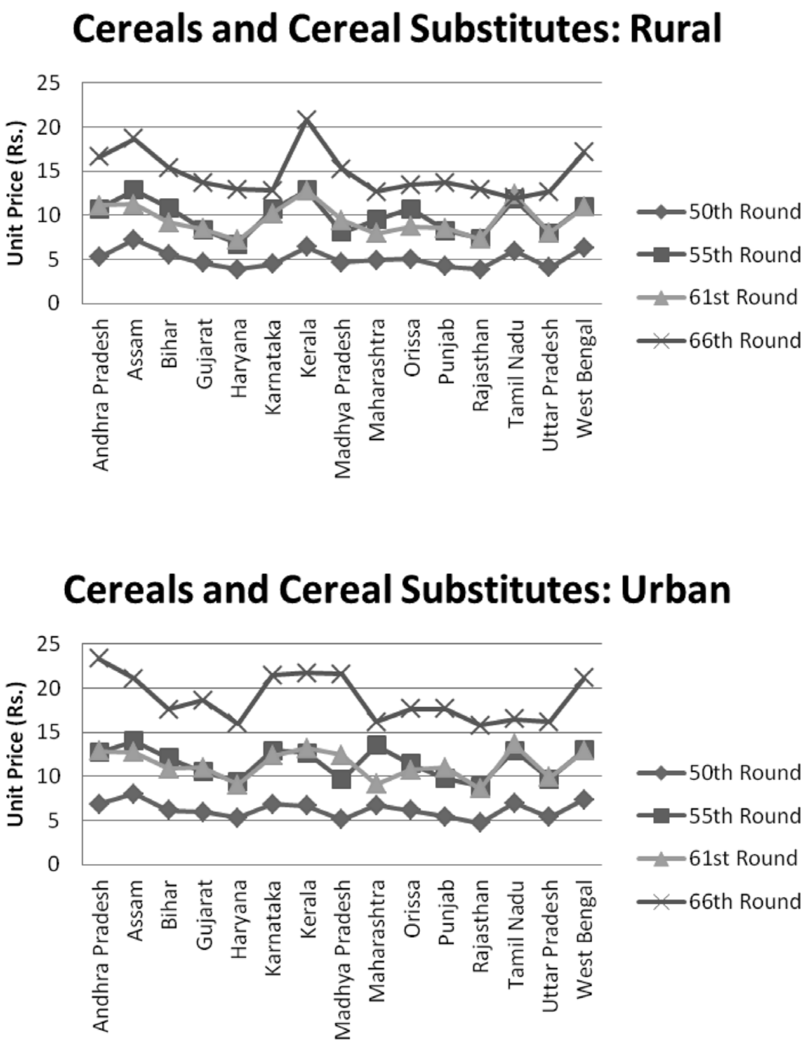

FIGURE 1. Movement of statewise unit prices for selected items over the NSS rounds.

are worth noting: (a) There was an increase in the unit values of most of the items, with much of the increase taking place between rounds 61 and 66, i.e., the most recent period, 2004/2005–2009/2010. In contrast, the period between NSS rounds 55 and 61, i.e., 1999/2000–2004/2005, saw relatively mild increases for most items, with even a decline in the case of cereal and cereal substitutes. (b) The structure of spatial prices varies sharply between rural and urban areas, and over

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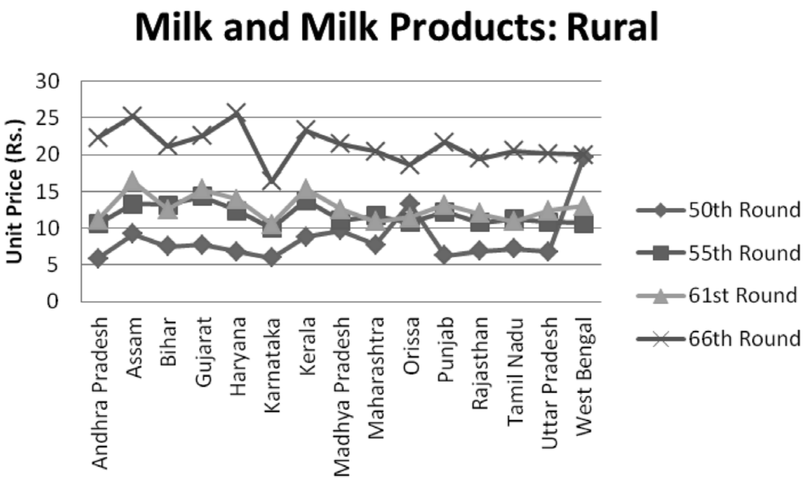
B



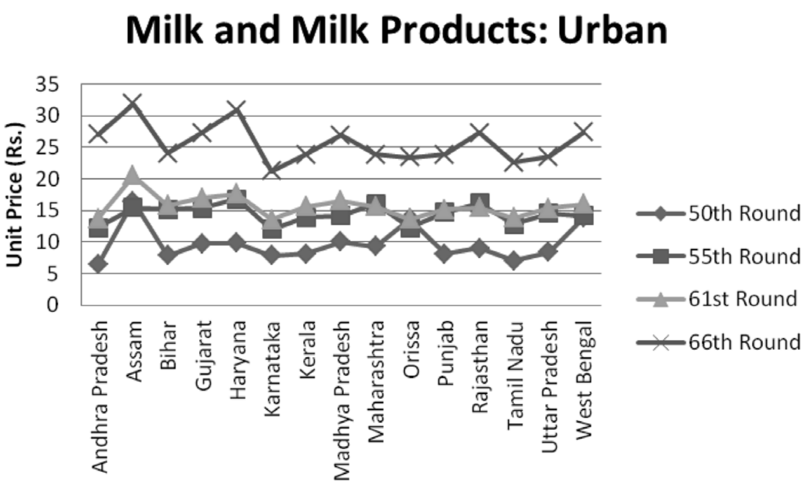


FIGURE 1. (Continued.)

the rounds. These features are clearly evident from the graphs of the unit value movement of some selected items that have been presented in Figures 1A–1C. As already noted, a comparison of Tables A.8 and A.9 establishes robustness of the estimated quality–adjusted unit values to the presence/absence of the district price dummies, suggested by McKelvey (2011).

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C

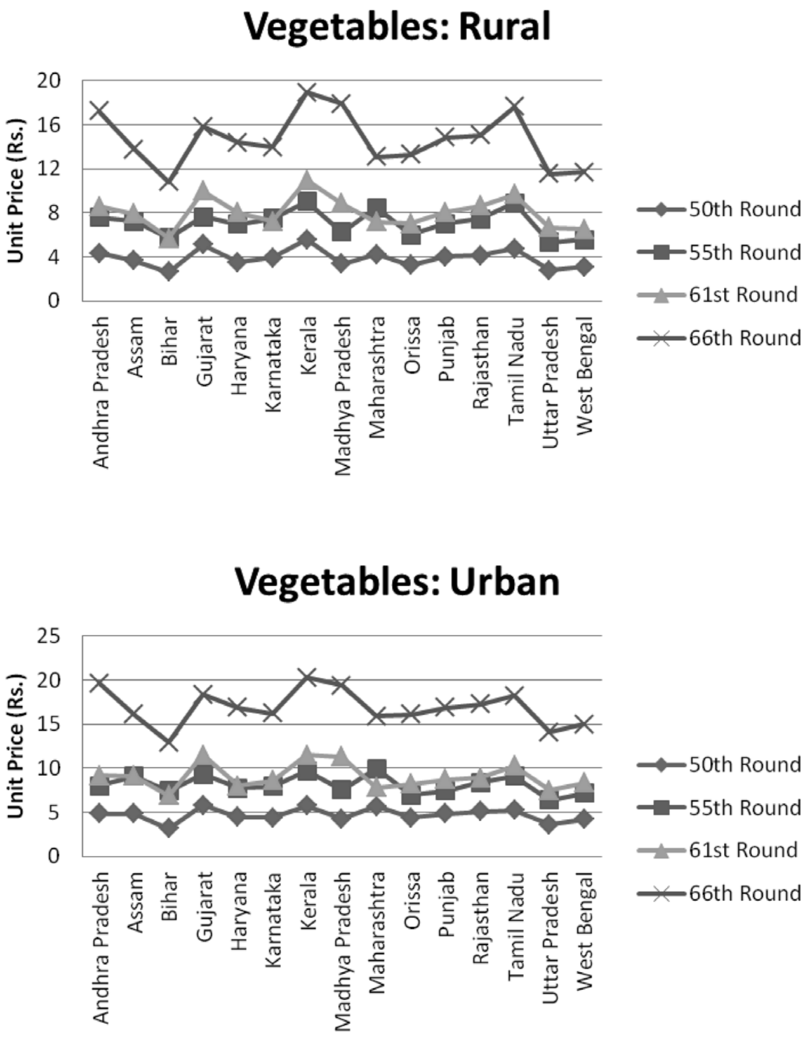

FIGURE 1. (Continued.)

4. RESULTS

Table 2 presents the coefficients of variation of the statewise quality-adjusted unit values of the items for the four rounds considered here. Although the formal evidence on spatial price variation will be presented later, this table contains prima facie evidence of the large variation in spatial prices that motivated this study.

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The estimates of the spatial price indices obtained using the four alternative procedures for calculating spatial price indices, described in Sections 2.1–2.3, are presented in Tables A.10–A.13. An estimate of spatial price for a state that is significantly greater than one implies that the state is more expensive than the country as a whole, and vice versa if the estimate is less than one. Although a comparison between the tables provides evidence of the sensitivity of the estimated spatial prices to the method used, each table allows a further comparison between the rural and urban spatial price estimates and how they have changed over the period between NSS rounds 50 (1993/1994) and 66 (2009/2010). The tables also report below each spatial price estimate the value of the *t*-statistic against the null hypothesis of no regional price difference, i.e., that all the spatial prices are unity.[24] The reported *t*-statistics may not be perfectly accurate because, as a referee pointed out, further adjustments are required in the three procedures (Engel curve, QAIDS, and Tornqvist) that use the estimates of quality-adjusted prices as regressors. Although such additional calculations are best left for a future exercise, the high significances reported in the tables make it unlikely that the picture will change much from that reported here. The qualitative similarity between the results from different methodologies is evident from the graphical representation of the indices in Figures 2A and 2B, for the rural and urban sectors, respectively.

The following features are worth noting:

(a) The estimates are mostly, but not always, plausible. A few exceptions occur in case of the QAIDS-based estimates[25] presented in Table A.11. The estimates are generally well determined.

(b) These tables contain widespread evidence of spatially different prices in India in each round and in each sector. Clearly, the treatment of India as a single entity in international comparisons of PPP and real expenditure is based on a false premise of spatial homogeneity.

(c) Notwithstanding wide differences in methodology, the qualitative picture of the spatial differences between the states in Tables A.10–A.13 seems remarkably robust, though the quantitative magnitudes do vary. The rank-three demand-system-based estimated spatial price indices generally show greater variation between states and in the magnitude of their deviation from 1 than the other two procedures. The coefficients of variation (CV) of the different price indices across states presented in Table 1 corroborate this observation. Clearly, the QAIDS-based estimates show the largest variation. The QAIDS is a rank-three system and allows substitution between items in response to price changes. In contrast, among the others, although the Tornqvist index allows substitution between items, it is based on a rank-two system [see Diewert (1976)], and the rest do not allow substitution between items. This points to the usefulness of the rank-three demand-systems-based approach in calculating the "exact" price indices.

(d) In particular, as observed in Table 1, the Laspeyres and Tornqvist spatial price indices pick up only the weakest evidence of spatially different prices. This reflects the fact that these Divisia price indices admit limited (and biased) price-induced substitution effects and overlook their heterogeneity between the various states enforcing a spatial

TABLE 2. Coefficients of variation of quality-adjusted statewise unit values for 11 food items across NSS rounds

Round (sector)	Cereal and cereal substitutes	Pulses and products	Milk and milk products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, intoxicants	Beverages
50th (rural)	0.201	0.104	0.416	0.075	0.184	0.214	0.280	0.056	0.444	0.826	0.700
50th (urban)	0.150	0.067	0.289	0.060	0.160	0.162	0.220	0.069	1.085	0.500	0.609
55th (rural)	0.200	0.098	0.113	0.076	0.236	0.165	0.285	0.055	0.260	0.524	0.338
55th (urban)	0.149	0.070	0.106	0.088	0.166	0.130	0.251	0.054	0.331	0.352	0.402
61st (rural)	0.187	0.095	0.140	0.081	0.283	0.177	0.318	0.040	0.268	0.937	0.362
61st (urban)	0.146	0.062	0.116	0.080	0.219	0.162	0.246	0.044	0.167	0.529	0.278
66th (rural)	0.176	0.093	0.114	0.085	0.220	0.168	0.294	0.152	0.561	0.831	0.442
66th (urban)	0.138	0.079	0.119	0.060	0.170	0.122	0.253	0.114	0.419	0.570	0.351

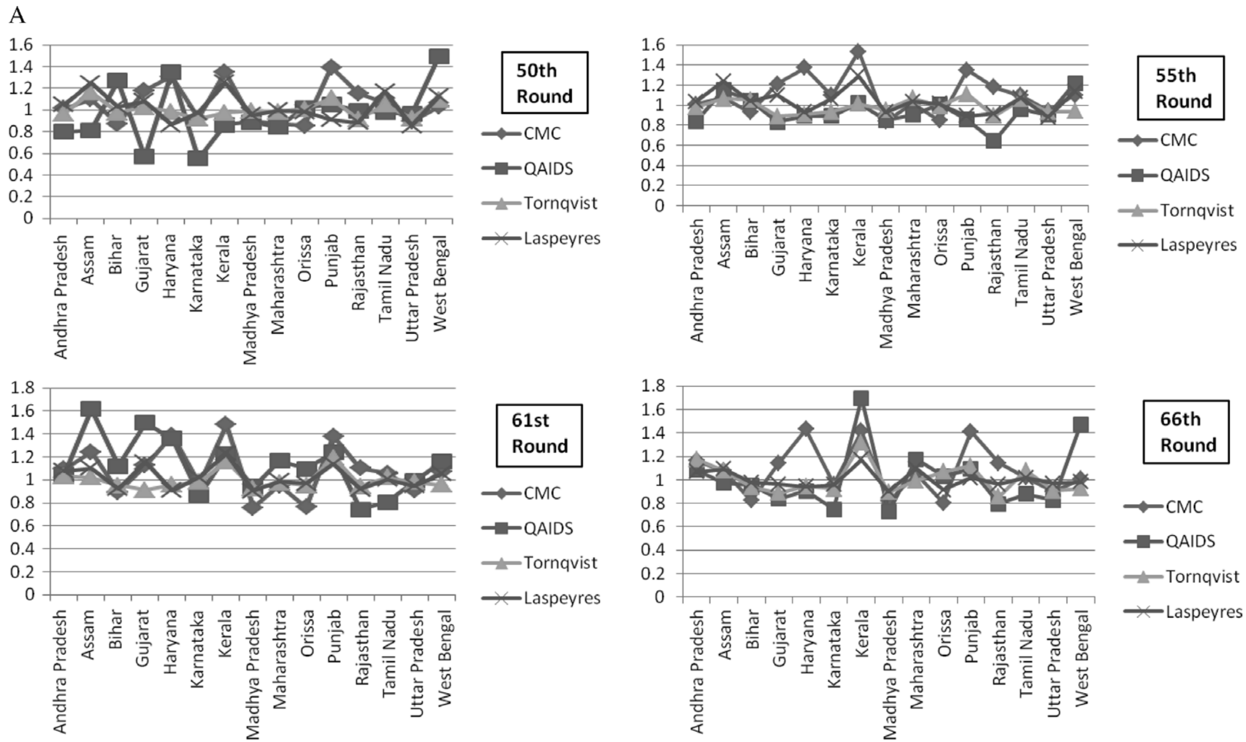

FIGURE 2. Comparison of price indices from different methodologies: Coondoo et al. (2011) (CMC), QAIDS, Tornqvist, and Laspeyres NSS rounds 50–66: (A) rural and (B) urban.

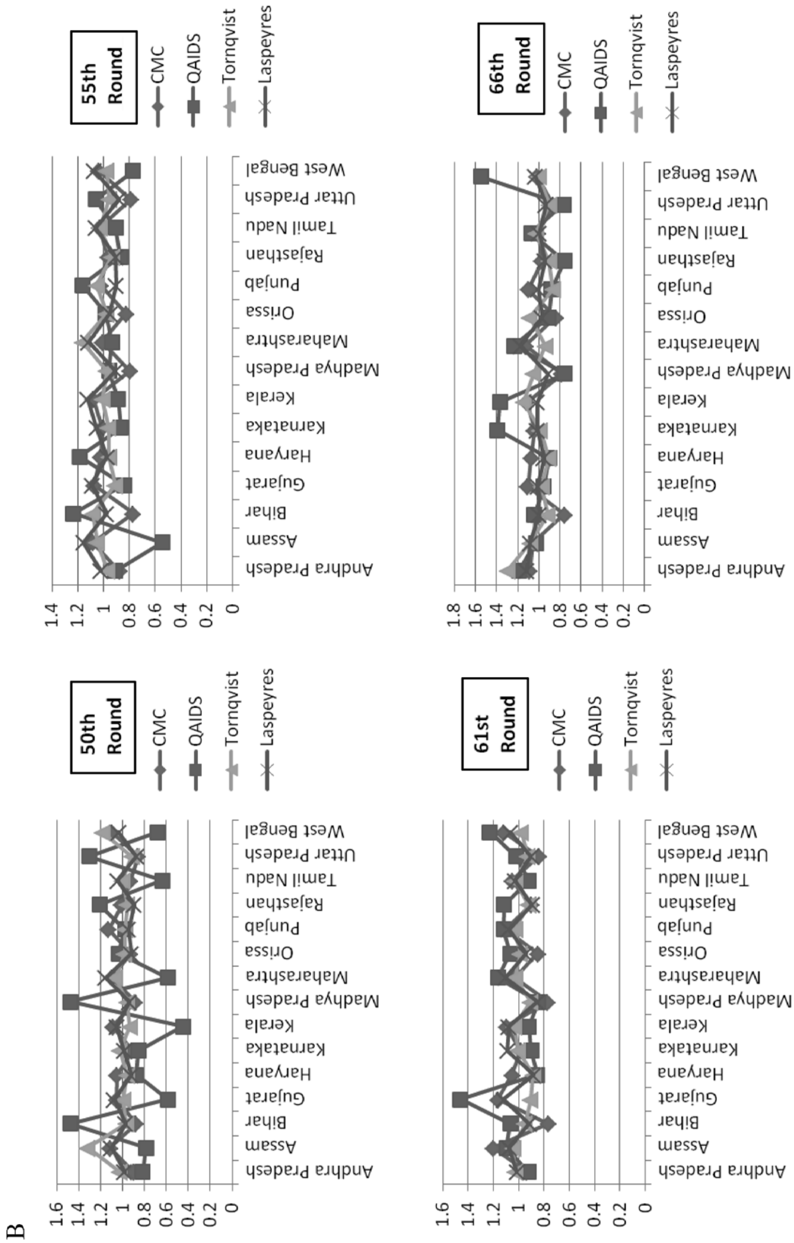

FIGURE 2. (Continued.)

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homogeneity that is clearly unrealistic in the federal context of India. Because much of the literature on cross-country comparisons of PPP and real expenditure are based on Divisia price indices, these results have much wider significance that extends beyond the immediate context of India. Note, however, that even in the case of these two spatial price indices, the hypothesis of spatial homogeneity is strongly rejected in several states (Tables A.10–A.13).

To test for uniformity of spatial variation across price indices computed using different methods, a nonparametric Levene test was performed pairwise between indices for the different rounds.[26] Table 3 presents the results. The principal features that emerge from the table are as follows: (a) when the two rank-three system-based methods [Coondoo et al. (2011) and QAIDS-based] are compared, except for the 50th NSS round, the hypothesis of equality of variation in spatial prices is not rejected; (b) the hypothesis is rejected in all cases when the QAIDS-based index and the Tornqvist index are compared; and (c) for the 66th round in the rural sector, the Laspeyres index shows significant difference in variation from all other indices, and in the urban sector this difference is observed with two indices, the QAIDS-based index and the Tornqvist index. Although (a) and (b) point to the usefulness of the rank-three demand systems-based approach to calculating the "exact" price indices, (c), along with the fact that the Laspeyres index shows the minimum CV in the 66th round (Table 1), indicates the usefulness of a demand-system-based approach. Thus, the Laspeyres methodology leads to a downward biased estimate of the level of spatial heterogeneity in prices, at least in the 66th round.

This discussion raises the following question: Does the incorporation of spatial prices have any impact on the expenditure comparisons in relation to the nominal expenditures that assume no spatial price differences? Tables A.14–A.17 provide evidence on this issue by reporting, for each state, the spatial price-deflated real income, the real income being the state income in relation to the All-India income, for NSS rounds 50, 55, 61, and 66, respectively [these comparisons are along the lines suggested by Feenstra et al. (2009)]. The quality of the unit value information in the 50th NSS round is again reflected in some of the implausible estimates of real expenditure indices reported by the QAIDS-based figures in Table A.14. These tables show considerable sensitivity of the expenditure indices to (a) the deflation of nominal indices by the spatial price deflator and (b) the spatial price estimation procedure adopted. In case of the latest NSS round available to us, namely, NSS round 66, for example, the poorer states of Bihar and Uttar Pradesh do much better on the spatially price deflated expenditure comparisons than in the nominal real expenditure comparisons that assume spatial price homogeneity. These tables also show considerable movement in the state rankings over the period spanned by the four large NSS rounds considered in this study.

Further evidence on the sensitivity of the state rankings to the incorporation of regional price differentials via the use of spatial price deflators in the real expenditure comparisons, and to the spatial price used in the comparison, is provided in Table 4, which reports the Spearman rank correlations between the

TABLE 3. Testing for spatial homogeneity: Pairwise nonparametric Levene test: NSS 50th–66th rounds (rural and urban)

	F-statistic							
	Rural				Urban			
Levene test between (1)	50th round (2)	55th round (3)	61st round (4)	66th round (5)	50th round (6)	55th round (7)	61st round (8)	66th round (9)
Coondoo et al. (2011) index and Laspeyres index	1.012	1.268	3.192***	5.162**	2.953***	0.061	2.053	2.465
	(0.323)	(0.270)	(0.085)	(0.031)	(0.097)	(0.806)	(0.163)	(0.128)
Coondoo et al. (2011) index and Tornqvist index	11.103*	3.876***	9.021*	1.070	10.859*	1.731	17.617*	0.646
	(0.002)	(0.059)	(0.006)	(0.310)	(0.003)	(0.199)	(0.000)	(0.428)
Coondoo et al. (2011) index and QAIDS Index	0.919	0.063	0.101	0.410	13.266*	0.001	0.010	2.678
	(0.346)	(0.804)	(0.753)	(0.527)	(0.001)	(1.000)	(0.920)	(0.113)
Laspeyres index and Tornqvist index	4.402**	1.366	2.356	7.548**	1.684	4.821**	11.452*	3.656***
	(0.045)	(0.252)	(0.136)	(0.010)	(0.205)	(0.037)	(0.002)	(0.066)
Laspeyres index and QAIDS index	2.723	0.709	3.931***	12.007*	15.291*	2.195	1.712	21.254***
	(0.110)	(0.407)	(0.057)	(0.002)	(0.001)	(0.150)	(0.201)	(0.000)
Tornqvist index and QAIDS index	8.607*	3.118***	4.876**	4.633**	16.760*	8.235*	15.157*	5.311**
	(0.007)	(0.088)	(0.036)	(0.040)	(0.000)	(0.008)	(0.001)	(0.029)

Note: Figures in parentheses are p-values. $^{*}p < 0.01$, $^{**}p < 0.05$, $^{***}p < 0.10$ are levels of significance for testing equality of variance.

TABLE 4. Rank correlation coefficient (Spearman's rho) among statewise nominal and spatial price deflated real incomes: NSS 66th round (2009/2010): Rural and urban, 11 food items

	Urban				
Rural	Nominal	Deflated by Coondoo et al. (2011) index	Deflated by QAIDS index	Deflated by Tornqvist index	Deflated by Laspeyres index
Nominal		0.750** (0.001)	0.204 (0.467)	0.847** (0.000)	0.904** (0.000)
Deflated by Coondoo et al. (2011) index	0.725** (0.002)		0.207 (0.459)	0.617* (0.014)	0.793** (0.000)
Deflated by QAIDS index	0.607* (0.016)	0.542* (0.037)		0.393 (0.147)	0.389 (0.152)
Deflated by Tornqvist index	0.868** (0.000)	0.665** (0.007)	0.771** (0.001)		0.860** (0.000)
Deflated by Laspeyres index	0.932** (0.000)	0.758** (0.001)	0.800** (0.000)	0.929** (0.000)	

Note: Figures in parentheses are p-values. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

state rankings in the 66th NSS round under alternative spatial price deflators used to capture movements in spatial prices. These also include the case where no deflator is used, namely, what has been referred to as "nominal" in the table. For reasons of space, we have reported only the correlation estimates in the latest round, the 66th NSS round, but the picture is not very different in the earlier rounds. The off-diagonal elements in the first row and the first column show the sensitivity of the state rankings to the incorporation of spatial prices in comparison with nominal ranking. The use of the spatial price deflators, via application of the Laspeyres index, seems to have the least impact on the nominal state rankings in both rural and urban areas, with correlation magnitudes upward of 0.9. The state rankings are sensitive to the use of the other spatial price deflators. However, the variation in ranking is much more pronounced in the urban sector than in the rural sector. The overall message from Table 4 is that it is important not only to incorporate regional differences in prices and preferences into the expenditure comparisons, but also to do so through the use of preference-consistent true cost of living indices based on rank-three demand systems.

Let us recall that the main difference between the procedures is in the treatment of price-induced substitution effects between the food items. Whereas the Coondoo et al. (2011) procedure ignores price-induced substitution and concentrates exclusively on expenditure effects via the Engel curves, those using Divisia indices based on Laspeyres and Tornqvist price indices are limited by the fact that they are evaluated for a fixed "reference bundle." The QAIDS-based procedure is the most general because it admits rank-three demand systems and allows realistic substitution possibilities, though none above rank-three preferences. Hence, for long time series data, the QAIDS-based procedure will be preferable, but for data sets covering limited time periods where the cross-sectional variation is much larger, and price information is scarce, the Coondoo et al. (2011) is possibly a better procedure to employ.

The state rankings and changes in the rankings are brought out clearly by the Hasse diagrams for the different rounds presented in Figures 3A (rural) and 3B (urban). The diagrams are based on the W matrix (constructed from the Laspeyres index) and the rule suggested by Sen (1976) for ranking states using the values of the distribution-sensitive mean expenditure of a state evaluated at all the states' prices, including its own prices. The use of the Laspeyres price index to calculate the welfare index suggested by Sen (1976) was motivated by (i) a desire to stick closely to Sen's study, which was based on a fixed reference consumption bundle and did not use preference-based methods to calculate the price indices, and (ii) a desire to illustrate that even using this index, which has the least impact on the nominal state rankings, there is considerable change in state rankings. This raises the issue of how sensitive the state rankings that we report here are to the use of preference-based methods that allow price substitution, an issue that is best left for future study. The Hasse diagram provides a clear representation of 210 pairwise comparisons of the states' welfare levels, "with a downward path indicating superiority in the standard of welfare" [Sen (1976)] under the assumption that all states have the same welfare function, as given in Section 2.5. A comparison of Figure 3 of Sen (1976) with Figure 3A of our paper brings out several similarities and some sharp differences. Kerala was ranked near the bottom in Sen's rankings, based on NSS rounds 16 (1960/1961) and 17 (1961/1962), but it has moved up sharply to be at or near the top in Figure 3A in this paper. Punjab has slipped slightly from its preeminent position in Sen's study, with its top ranking taken by Haryana, which was carved out of the erstwhile state of Punjab. Note, incidentally, that the differences in the state rankings between those that we have reported in Figures 3A and 3B and those in Sen (1976) are the result of a combination of (i) temporal changes in the period between the two studies and (ii) methodological differences. It would be useful to find out how much of this is due to temporal changes between the period considered in Sen (1976) and ours, and how much is due to methodological differences. That requires a separate study and is best left for a future exercise. Figures 3A and 3B in our paper reveal several cases of changes in state rankings over the period spanned by the four NSS surveys. They also reveal several rural–urban differences in the

A

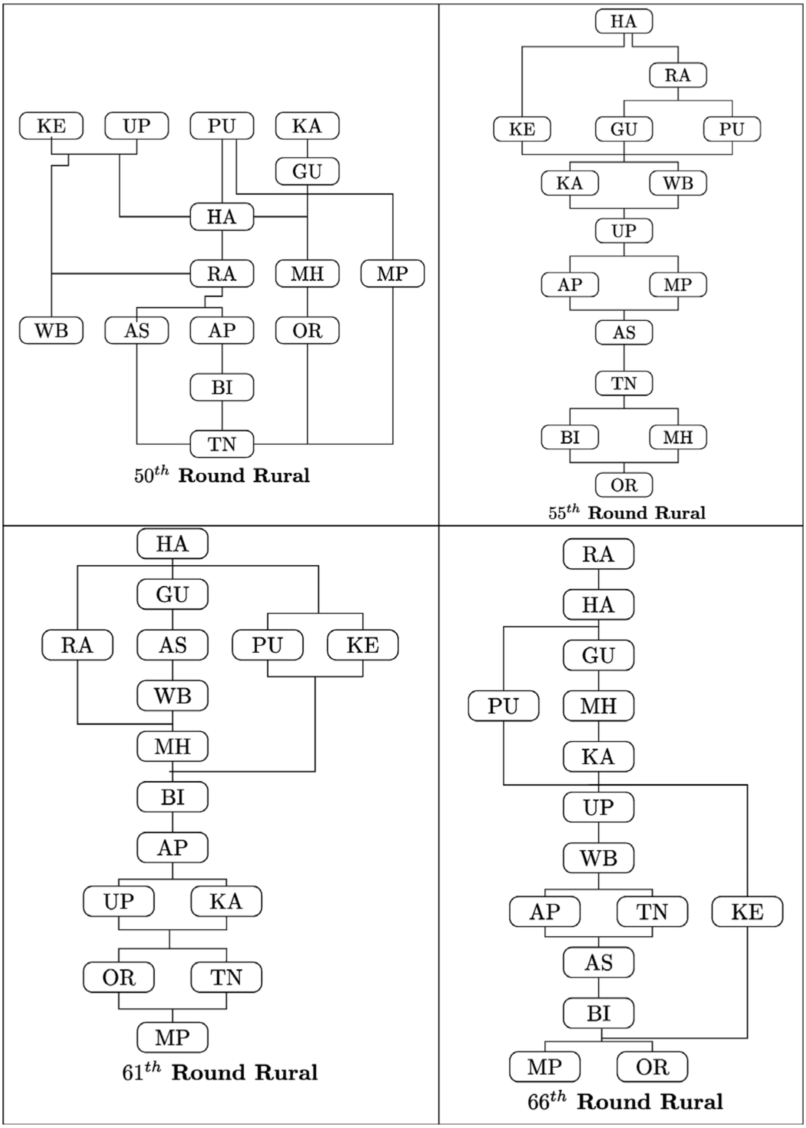

FIGURE 3. Hasse diagrams for various NSS rounds: (A) rural India and (B) urban India. For state names corresponding to the abbreviations in these diagrams, see Appendix Table A.2.

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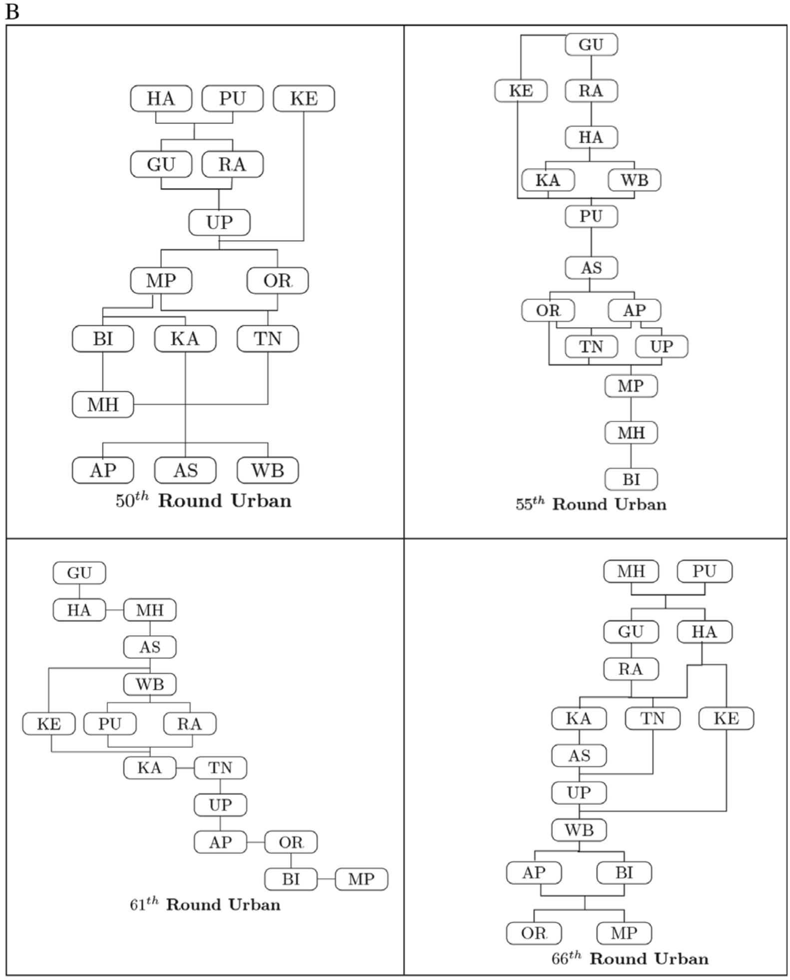

FIGURE 3. (Continued.)

Hasse pictures. For example, in the 61st round, Punjab is ranked quite high among the rural states, but slips down several steps in the corresponding urban rankings. Overall, however, there are no major changes in the rankings over the period 1993/1994–2009/1200, though the structure of the Hasse pictures has changed during this period. The Hasse diagrams for NSS round 66 are consistent with a priori expectations in both sectors because the economically advanced states in Western India, such as Punjab, Gujarat, and Maharashtra, are ranked quite highly, whereas the economically backward states in Eastern India, such as Bihar and Orissa, are ranked at the bottom. Note, also, that the most populous state in India,

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TABLE 5. Mantel test of no association between distances in states' welfare levels in rural and urban areas: 11 food items

Rural v/s urban	Mantel stat(r)[a]	Significance
NSS 50th round	0.8956*	< 0.001
NSS 55th round	0.8482*	< 0.001
NSS 61st round	0.8864*	< 0.001
NSS 66th round	0.9235*	< 0.001

[a]Mantel statistic based on Pearson's product–moment correlation. Estimates based on 1,000 permutations.
*Statistically significant at 1% level of significance.

which is also one of the poorest states, namely, Uttar Pradesh, does much better than its economic status leads us to expect.

Though the Hasse diagrams provide vivid representations of the state rankings, they do not constitute a formal test of pairwise differences between the alternative price situations. Such a test of differences is provided by the Mantel test, described earlier, which is based on the symmetric distance matrix consisting of pairwise distances between the states' spatially corrected welfare values using the Sen (1976) welfare function. Table 5 provides the results of the Mantel (1967) test of the hypothesis of no correlation between the rural and urban distance matrices. This table provides the Mantel test statistic in all four rounds. The values of the test statistic lead to a decisive rejection of the hypothesis. The message is intuitively clear—food being an item of necessity, there is greater closeness between the welfare distances between states in the rural and urban areas based on food items only than between distances based on food and nonfood items. This is because prices and preferences vary much more in the case of nonfood items than in that of food items. In other words, the rural–urban differences in the welfare-based state rankings in India, with some states moving ahead of the others during this period of economic reforms and beyond, possibly show up mainly in the expenditure on nonfood items.

5. CONCLUSION

This study addresses two significant limitations in the current literature on cross-country expenditure comparisons: (a) the treatment of all countries, large and small, as single entities with no spatial differences inside the countries, and (b) the use of Divisia price indices, rather than rank-three preference-based "exact price" indices, in the expenditure comparisons. The assumption of identical prices and preferences across all regions in a country is unlikely to be valid in countries such as Brazil and India. The paper uses alternative preference-consistent methods for estimating spatial price differences in India. Unlike the conventional price indices, the use of demand-systems-based methods allows the incorporation of price-induced substitution effects between items. The paper applies the demand-systems-based methodology to estimate "exact" spatial price indices in a large federal country.

The paper provides empirical evidence on the spatial differences in prices and their effect on real expenditure comparisons, and provides formal tests of the hypothesis of no spatial price differences within the country. The study makes the expenditure comparisons distribution-sensitive by using the inequality-inclusive welfare measure due to Sen (1976) in ranking the states. The study provides overwhelming evidence that rejects the assumption of spatial price homogeneity. The Hasse diagrams show the state rankings, the variation in the rankings between sectors (rural–urban), and how these rankings have changed over a period that is one of the most significant for independent India. The results of this study have implications for international comparisons such as the ICP project. Such projects need to focus as much on spatial price and expenditure comparisons within countries as they do on comparisons between countries. One needs an integrated approach that incorporates the former into the latter. The approach of Barnett (2007) in the context of monetary service flows to small, heterogeneous countries in Europe can provide a basis for adopting such an integrated approach in the context of cross-country PPP calculations as performed in the ICP exercises.

NOTES

1. See, for example, the latest World Development Report [World Bank (2011)].
2. There is also a long tradition of international inequality comparisons that treat a whole country as a single entity; examples include Hill (2000) and Almas (2012).
3. See O'Donnell and Rao (2007) for an expenditure-function-based approach to the estimation of price indices and a comparison with those based on the conventional PPP methodology of Divisia price indices.
4. Table 1 reports supporting evidence.
5. Whereas the use of the rank two AIDS framework by Feenstra et al. (2009) was necessitated by the fact that their analytical results are conditional on such a functional form, there is now extensive empirical evidence that rejects rank-two demand models in favor of more general expenditure patterns.
6. See Hulten (1973) and Hill (2000). Feenstra and Reinsdorf (2000) have shown equivalence between the Divisia approach and the "exact approach" of the "true cost of living indices" in case of the "Almost Ideal Demand System." It is not readily apparent if such equivalence extends to rank-three preferences such as the one considered here.
7. We are grateful to the referee for highlighting this distinction and the contribution of the present paper.
8. In the cross-country study of Majumder et al. (2011), a similar framework was adopted.
9. The argument is similar to that in Hill (2000), who shows that in the context of international income comparisons "additive purchasing power parity (PPP) methods, such as Geary–Khamis, are subject to substitution bias."
10. As a referee pointed out, the Tornqvist GEKS Divisia price index has been used in the calculation of the most recent round of Penn World Tables [see Feenstra et al. (2012)].
11. In the calculations reported later, we take All India as the base region, 0.
12. The regression setup arises because $\widehat{a(p^r)}$ and $\widehat{a(p^0)}$ are estimated values.
13. The QAIDS expenditure function [equation (1)] is inverted to obtain the reference utility level, u^*, required in (3), from the reference per capita household expenditure using equation (7).

14. Diewert (1976) has shown that the Tornqvist index is also "superlative," which he defines as being "exact," i.e., consistent with a flexible functional form, namely, the translog form of Christensen et al. (1975).

15. See Atkin and Donaldson (2012) for an alternative methodology that uses intranational price data, which does not require the additional unit value adjustment and the consequent bias to the indices. We are grateful to the referee for drawing this study to our attention.

16. See Atella et al. (2004) for an alternative methodology for constructing spatial prices in cross sections using the variability of budget shares that do not require quantity information.

17. See the Appendix of Sen (1976).

18. The nominal and real expenditure Gini coefficients are the same, for the following reason. Because the comparison is across states, the price deflator used was the state-level spatial price indices (that is, everyone within a state faces the same price), which would result in the Gini coefficient being the same in nominal and real terms. The variation is therefore due solely to putting expenditures into real terms.

19. See, however, Legendre and Fortin (2010) for words of caution on the use of the Mantel test, especially their observation that "the Mantel test does not correctly estimate the proportion of the original data variation explained by spatial structures" (p. 831).

20. See Table A.1 for description of the 11 groups of food items and the number of the smaller items over which they were aggregated.

21. To save space, we have presented the regressions for the (latest) NSS round 66. Those for other rounds are available on request.

22. Although a negative value indicates a lower value for the urban sector, this may not be reflected in the overall value of unit price when the combined effects of state and district dummies are considered, as is evident from Table 4.

23. This is, however, not fully apparent from Table A.4 because several of the coefficient estimates either are insignificant or have the "wrong" sign.

24. Whereas the standard errors for the Laspeyres and Tornqvist indices are obtained from regression equations (9) and (10), respectively, those for the Coondoo et al. (2011) and QAIDS-based price indices have been estimated using the Delta method.

25. The few implausible estimates that are reported in case of QAIDS are restricted to the NSS 50th round, and may reflect the quality of the data in the earlier rounds.

26. As the overall test for equality of variations would not detect the nonhomogeneous index, if any, pairwise tests were performed. It may be noted that whereas the original Levene test [Levene (1960)] of equality of variances based on means is founded on the assumption of symmetric distributions, the nonparametric Levene test, which utilizes the *method of ranks* [Nordstokke and Zumbo (2010)], avoids the assumption of normality implicit in the analysis of variance.

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APPENDIX

TABLE A.1. Eleven food items

Item group	No. of items items aggregated	Item group	No. of items aggregated
1. Cereals and cereal substitutes	22	7. Fruits	17
2. Pulses and products	13	8. Sugar	5
3. Milk and milk products	8	9. Spices	8
4. Edible oil	5	10. Beverages, etc.	17
5. Meat, egg, and fish	7	11. Betel leaf, tobacco, intoxicants	17
6. Vegetables	30		

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TABLE A.2. Number of districts in each state

State	NSS 50th round[a]		NSS 55th round		NSS 61st round		NSS 66th round	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh (AP)	35	7	22	23	22	23	23	23
Assam (AS)	23	3	23	20	23	23	27	27
Bihar (BI)	59	5	52	47	55	55	38	37
Gujarat (GU)	27	9	18	18	25	24	25	25
Haryana (HA)	14	5	16	16	19	19	20	20
Karnataka (KA)	23	7	20	20	27	27	27	27
Kerala (KE)	17	5	14	13	14	14	14	14
Madhya Pradesh (MP)	48	7	44	44	61	61	48	48
Maharashtra (MH)	36	9	29	29	33	34	35	35
Orissa (OR)	20	5	30	23	30	30	30	30
Punjab (PU)	12	7	14	13	17	17	18	18
Rajasthan (RA)	29	7	30	28	32	32	32	32
Tamil Nadu (TN)	28	7	22	23	29	30	31	31
Uttar Pradesh (UP)	92	9	71	62	83	83	70	70
West Bengal (WB)	36	7	16	17	17	18	19	19

[a]NSS 50th round does not report district-level data. For this round the analysis is done at the stratum level.

TABLE A.3. Number of households in each state

State	NSS 50th Round[a]		NSS 55th Round		NSS 61st Round		NSS 66th Round	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh (AP)	4,908	3,644	5,166	3,782	5,532	2,858	3,917	2,933
Assam (AS)	3,199	880	3,438	849	3,350	900	2,616	830
Bihar (BI)	6,979	2,155	7,261	2,257	6,733	2,438	5,049	2,237
Gujarat (GU)	2,219	2,372	2,478	2,763	2,313	1,949	1,718	1,697
Haryana (HA)	1,040	697	1,132	758	1,680	1,040	1,440	1,179
Karnataka (KA)	2,617	2,469	2,748	2,465	2,879	2,222	2,035	2,014
Kerala (KE)	2,555	1,830	2,603	2,011	3,295	1,933	2,596	1,825
Madhya Pradesh (MP)	5,313	3,233	5,118	3,142	5,835	2,871	4,220	2,697
Maharashtra (MH)	4,440	5,528	4,103	5,226	5,007	4,989	4,008	3,970
Orissa (OR)	3,338	1,037	3,379	1,037	3,833	1,185	2,967	1,050
Punjab (PU)	2,046	1,947	2,138	1,869	2,433	1,852	1,556	1,555
Rajasthan (RA)	3,097	1,799	3,228	1,938	3,540	3,580	2,574	1,545
Tamil Nadu (TN)	3,901	4,042	4,130	4,120	4,152	4,125	3,319	3,309
Uttar Pradesh (UP)	9,010	4,451	9,313	4,626	9,333	4,093	6,953	3,815
West Bengal (WB)	4,480	3,338	4,497	3,385	4,988	2,887	3,575	2,747

[a]NSS 50th round does not report district-level data. For this round the analysis is done at the stratum level.

TABLE A.4. Unit value regressions: NSS 66th round

Food item[a]	Variable[b]	Coefficient	Std. err	t-stat	p-value	R^2
Cereals and substitutes ($N = 98{,}859$)	D_s (urban = 1, rural = 0)	0.570*	0.051	11.070	0.000	
	D^M_{id2}	−3.717*	1.129	−3.29	0.001	0.189
	D^M_{id3}	−2.796*	0.316	−8.86	0.000	
	Per capita food exp. 30 days	0.003*	0.000	139.77	0.000	
	Proportion meals outside	1.509*	0.184	8.18	0.000	
	Head age	−0.009*	0.001	−7.91	0.000	
	Male household head	−0.638*	0.047	−13.54	0.000	
	Household size	−0.178*	0.011	−16.99	0.000	
	Adult females	0.065*	0.022	3.03	0.002	
	Adult males	−0.038**	0.019	−2.03	0.042	
Pulses and substitutes ($N = 97{,}049$)	D_s (urban = 1, rural = 0)	0.721*	0.081	8.850	0.000	
	D^M_{id2}	−11.447*	2.010	−5.69	0.000	0.045
	D^M_{id3}	−12.462*	3.144	−3.96	0.000	
	Per capita food exp. 30 days	0.002*	0.000	47.48	0.000	
	Proportion meals outside	−2.789*	0.568	−4.91	0.000	
	Head age	0.000	0.003	−0.12	0.902	
	Male household head	−0.367*	0.127	−2.90	0.004	
	Household size	−0.503*	0.028	−17.77	0.000	
	Adult females	0.115**	0.058	1.98	0.047	
	Adult males	0.193*	0.050	3.85	0.000	
Milk and milk products ($N = 84{,}619$)	D_s (urban = 1, rural = 0)	−1.327**	0.601	−2.21	0.027	
	D^M_{id2}	0.956	17.086	0.06	0.955	0.032
	D^M_{id3}	5.221	7.086	0.74	0.461	
	Per capita food exp. 30 days	−0.002*	0.000	−5.70	0.000	
	Proportion meals outside	10.067*	3.431	2.93	0.003	

Table A.4. (Continued.)

Food item[a]	Variable[b]	Coefficient	Std. err	t-stat	p-value	R^2
	Head age	−0.031	0.024	−1.32	0.185	
	Male household head	1.093	0.955	1.14	0.253	
	Household size	−0.023	0.209	−0.11	0.914	
	Adult females	−0.646	0.427	−1.51	0.130	
	Adult males	0.457	0.369	1.24	0.216	
Edible oils ($N = 97{,}921$)	D_s (urban = 1, rural = 0)	0.504*	0.079	6.390	0.000	
	D^M_{id2}	−4.414*	1.688	−2.61	0.009	0.0577
	D^M_{id3}	−5.024	4.288	−1.17	0.241	
	Per capita food exp. 30 days	0.002*	0.000	46.36	0.000	
	Proportion meals outside	−1.936*	0.549	−3.53	0.000	
	Head age	0.003	0.003	0.98	0.328	
	Male household head	−0.525*	0.122	−4.29	0.000	
	Household size	−0.250*	0.027	−9.13	0.000	
	Adult females	−0.062	0.056	−1.12	0.264	
	Adult males	−0.193*	0.049	−3.97	0.000	
Meat, eggs, and fish ($N = 59{,}691$)	D_s (urban = 1, rural = 0)	2.145*	0.324	6.620	0.000	
	D^M_{id2}	−9.718	10.472	−0.93	0.353	0.111
	D^M_{id3}	−74.596***	41.195	−1.81	0.070	
	Per capita food exp. 30 days	0.012*	0.000	63.14	0.000	
	Proportion meals outside	−20.461*	2.192	−9.33	0.000	
	Head age	0.041*	0.013	3.09	0.002	
	Male household head	−3.056*	0.497	−6.15	0.000	
	Household size	−0.284**	0.114	−2.50	0.013	
	Adult females	0.549**	0.225	2.44	0.015	
	Adult males	−0.177	0.196	−0.90	0.366	

TABLE A.4. (Continued.)

Food item[a]	Variable[b]	Coefficient	Std. err	t-stat	p-value	R^2
Vegetables ($N = 98{,}654$)	D_s (urban = 1, rural = 0)	0.263*	0.026	10.120	0.000	
	D_{id2}^M	−0.690	0.597	−1.16	0.248	0.051
	D_{id3}^M	−0.666	2.504	−0.27	0.790	
	Per capita food exp. 30 days	0.001*	0.000	53.59	0.000	
	Proportion meals outside	0.515*	0.176	2.92	0.003	
	Head age	0.001	0.001	0.82	0.412	
	Male household head	0.045	0.040	1.13	0.260	
	Household size	−0.102*	0.009	−11.30	0.000	
	Adult females	−0.019	0.018	−1.06	0.291	
	Adult males	−0.018	0.016	−1.13	0.258	
Fruits ($N = 70{,}837$)	D_s (urban = 1, rural = 0)	0.330	0.24	1.41	0.160	0.038
	D_{id2}^M	−7.656	5.326	−1.440	0.151	
	D_{id3}^M	−9.116	8.087	−1.130	0.260	
	Per capita food exp. 30 days	0.004*	0.000	28.430	0.000	
	Proportion meals outside	1.439	0.883	1.630	0.103	
	Head age	0.001	0.009	0.060	0.950	
	Male household head	0.160	0.370	0.430	0.666	
	Household size	−0.426*	0.084	−5.090	0.000	
	Adult females	0.312***	0.168	1.850	0.064	
	Adult males	−0.218	0.146	−1.490	0.136	
	D_s (urban = 1, rural = 0)	0.332	0.236	1.41	0.159	
Sugar ($N = 96{,}809$)	D_{id2}^M	10.27*	2.134	4.810	0.000	0.058
	D_{id3}^M	−0.800	1.092	−0.730	0.464	
	Per capita food exp. 30 days	0.001*	0.000	45.840	0.000	
	Proportion meals outside	0.386	0.311	1.240	0.214	

Table A.4. (Continued.)

Food item[a]	Variable[b]	Coefficient	Std. err	t-stat	p-value	R^2
	Head age	−0.024*	0.002	−11.75	0.000	
	Male household head	−0.367*	0.081	−4.510	0.000	
	Household size	−0.106*	0.018	−5.880	0.000	
	Adult females	0.043	0.037	1.170	0.241	
	Adult males	0.052	0.032	1.620	0.105	
Spices[c] ($N = 98{,}233$)	D_s (urban = 1, rural = 0)	0.002	0.001	1.160	0.246	0.029
	D^M_{id2}	−0.009	0.036	−0.260	0.792	
	Per capita food exp. 30 days	0.000*	0.000	3.720	0.000	
	Proportion meals outside	−0.002	0.010	−0.200	0.839	
	Head age	0.000	0.000	0.070	0.946	
	Male household head	0.003	0.002	1.400	0.161	
	Household size	−0.001	0.001	−1.320	0.188	
	Adult females	0.000	0.001	−0.300	0.764	
	Adult males	−0.001	0.001	−0.750	0.453	
Pan/tobacco ($N = 59{,}095$)	D_s (urban = 1, rural = 0)	−2.0477*	0.536	−3.82	0.000	
	D^M_{id2}	43.451***	25.541	1.700	0.089	0.120
	D^M_{id3}	46.371*	12.355	3.750	0.000	
	Per capita food exp. 30 days	0.009*	0.000	27.78	0.000	
	Proportion meals outside	−7.254*	2.269	−3.200	0.001	
	Head age	−0.071*	0.021	−3.350	0.001	
	Male household head	−2.173**	1.003	−2.170	0.030	
	Household size	−0.287	0.170	−1.680	0.093	
	Adult females	−0.400	0.359	−1.120	0.265	
	Adult males	−0.848	0.309	−2.740	0.006	

TABLE A.4. (Continued.)

Food item[a]	Variable[b]	Coefficient	Std. err	t-stat	p-value	R^2
Beverages[c] ($N = 98{,}388$)	D_s (urban = 1, rural = 0)	1.932*	0.595	3.250	0.001	
	D_{id2}^{M}	−29.907*	6.546	−4.570	0.000	0.014
	Per capita food exp. 30 days	0.011*	0.000	31.510	0.000	
	Proportion meals outside	−0.999	2.071	−0.480	0.630	
	Head age	−0.045***	0.023	−1.930	0.054	
	Male household head	2.163**	0.927	2.330	0.020	
	Household size	0.369***	0.205	1.800	0.072	
	Adult females	−1.521*	0.423	−3.600	0.000	
	Adult males	−1.276*	0.365	−3.490	0.000	

[a] These regressions were done for all 11 food items in each of the NSS rounds.
[b] Coefficients for the state and interaction dummies have not been reported.
[c] D_{id3}^{M} was dropped because of collinearity.
*$p < 0.01$, ** $p < 0.05$, ***$p < 0.10$ are levels of significance.

TABLE A.5. Quality-adjusted unit values in NSS 50th round[a]

State	Cereal and cereal substitutes	Pulses and pulse products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Rural						
Andhra Pradesh	5.21	15.91	5.84	35.82	37.29	4.31	4.93	10.30	0.07	0.26	0.14
Assam	7.24	13.19	9.22	30.85	28.36	3.67	5.05	10.68	0.22	0.10	0.31
Bihar	5.50	12.23	7.48	32.67	33.94	2.63	6.11	9.95	0.10	0.18	0.10
Gujarat	4.56	16.05	7.72	38.47	29.12	5.11	8.05	11.18	0.20	0.01	0.13
Haryana	3.82	14.80	6.81	33.14	33.49	3.47	8.00	11.19	0.16	0.16	0.11
Karnataka	4.44	15.69	5.93	34.92	31.90	3.92	4.68	10.67	0.05	0.00	0.02
Kerala	6.34	16.06	8.82	38.51	21.56	5.56	4.48	11.01	0.08	0.19	0.01
Madhya Pradesh	4.65	12.09	9.70	31.72	33.92	3.34	5.57	10.71	0.24	0.00	0.17
Maharashtra	4.88	16.05	7.70	36.02	38.42	4.21	6.04	11.31	0.09	0.03	0.05
Orissa	5.02	13.69	13.27	34.73	26.26	3.26	4.75	10.52	0.24	0.03	0.19
Punjab	4.19	15.80	6.23	36.16	42.52	4.01	9.27	11.80	0.16	0.11	0.12
Rajasthan	3.84	14.46	6.84	32.85	39.17	4.14	9.27	11.84	0.13	0.30	0.08
Tamil Nadu	5.90	17.18	7.16	34.79	34.88	4.71	3.84	9.88	0.18	0.09	0.22
Uttar Pradesh	4.07	13.80	6.81	30.07	36.57	2.78	6.30	10.21	0.19	0.09	0.00
West Bengal	6.32	14.07	19.60	32.04	23.09	3.09	6.90	10.35	0.08	0.24	0.21
Coefficient of variation	0.201	0.104	0.416	0.075	0.184	0.214	0.280	0.056	0.444	0.826	0.700
All India	5.19	14.25	7.46	33.81	34.91	3.71	5.98	10.42	0.16	0.09	0.01

TABLE A.5. (Continued.)

State	Cereal and cereal substitutes	Pulses and pulse products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Urban						
Andhra Pradesh	6.82	16.80	6.42	36.07	37.59	4.82	5.77	10.41	0.12	0.46	0.32
Assam	8.01	14.71	16.41	32.48	35.53	4.84	6.66	11.82	0.51	0.60	0.68
Bihar	6.13	14.04	7.81	34.08	34.15	3.17	6.42	10.32	0.10	0.40	0.23
Gujarat	5.93	16.58	9.72	37.92	29.34	5.82	8.39	11.78	0.07	0.34	0.15
Haryana	5.24	15.57	9.83	35.01	33.67	4.46	8.21	11.77	0.05	0.05	0.14
Karnataka	6.81	18.11	7.86	35.45	32.20	4.39	5.78	10.94	0.15	0.25	0.25
Kerala	6.61	16.19	8.07	38.64	21.82	5.71	5.03	11.24	0.05	0.35	0.16
Madhya Pradesh	5.10	15.82	10.01	33.50	34.17	4.24	6.38	11.58	0.06	0.36	0.15
Maharashtra	6.68	17.26	9.27	38.12	37.92	5.66	6.68	12.12	0.08	0.79	0.40
Orissa	6.10	15.98	13.67	35.57	24.31	4.38	5.43	10.09	0.04	0.25	0.22
Punjab	5.40	16.44	8.11	37.37	40.79	4.83	9.41	12.19	0.08	0.30	0.20
Rajasthan	4.71	15.29	9.03	35.09	39.41	5.11	8.45	12.01	0.04	0.67	0.16
Tamil Nadu	6.97	17.52	7.05	35.83	35.06	5.23	4.38	10.12	0.09	0.14	0.31
Uttar Pradesh	5.32	15.53	8.36	31.49	35.54	3.56	5.93	10.29	0.04	0.55	0.08
West Bengal	7.35	15.51	13.82	33.31	28.74	4.15	8.54	11.50	0.35	0.59	0.51
Coefficient of variation	0.150	0.067	0.289	0.060	0.160	0.162	0.220	0.069	1.085	0.500	0.609
All India	6.43	16.10	8.83	35.53	35.54	4.83	6.43	11.22	0.08	0.35	0.25

[a] All values are in Indian rupees per kilogram. All units were converted to kilograms where possible. For items where consumption is reported in numbers the following conversions have been used: 1 egg = 58 g, 1 liter milk = 1 kg, 10 bananas = 1 kg, 1 orange = 150 g, 1 pineapple = 1.5 kg, 1 coconut = 1 kg. Lemons and ginger not included.

TABLE A.6. Quality adjusted unit values in NSS 55th round[a]

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Rural						
Andhra Pradesh	10.69	28.69	10.56	40.34	51.44	7.59	9.46	16.56	1.07	1.12	0.95
Assam	12.86	28.66	13.29	46.06	49.35	7.24	6.31	18.76	1.48	1.94	1.15
Bihar	10.86	23.25	13.13	42.97	41.16	5.71	8.72	18.68	2.18	1.70	1.92
Gujarat	8.37	26.37	14.35	44.19	53.65	7.64	11.36	16.29	0.98	0.50	0.54
Haryana	6.71	24.64	12.36	38.75	39.24	6.95	13.20	16.70	1.29	0.84	0.83
Karnataka	10.66	25.48	10.00	40.63	49.87	7.46	8.49	15.70	1.12	0.76	0.80
Kerala	12.83	29.44	13.79	49.23	31.29	9.04	6.84	16.84	1.33	1.17	1.18
Madhya Pradesh	8.05	21.76	11.08	36.10	44.65	6.22	7.72	16.54	1.30	1.31	1.02
Maharashtra	9.50	25.82	11.65	40.24	60.92	8.46	13.84	16.54	1.50	3.14	1.16
Orissa	10.67	25.49	10.77	42.15	35.89	5.98	7.65	17.40	1.13	1.59	1.03
Punjab	8.25	26.17	12.19	40.71	52.43	7.02	15.37	18.08	2.03	1.60	1.60
Rajasthan	7.31	22.62	10.76	40.84	78.41	7.44	10.73	16.65	1.05	0.65	0.63
Tamil Nadu	11.80	29.67	11.18	40.85	51.71	8.89	6.32	16.64	1.36	1.52	1.60
Uttar Pradesh	7.99	24.14	10.83	39.94	46.78	5.28	9.42	15.94	1.31	1.01	1.05
West Bengal	10.95	28.86	10.68	44.58	38.55	5.56	10.67	17.87	1.02	0.55	1.02
Coefficient of variation	0.200	0.098	0.113	0.076	0.236	0.165	0.285	0.055	0.260	0.524	0.338
All India	10.49	25.94	11.32	41.53	45.94	7.02	9.20	16.84	1.33	1.36	1.10

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TABLE A.6. (Continued.)

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Urban						
Andhra Pradesh	12.68	28.41	12.30	39.57	53.48	8.00	10.36	16.58	1.07	1.34	0.87
Assam	14.01	28.78	15.48	48.17	55.99	9.07	13.83	19.01	1.68	1.05	1.53
Bihar	12.06	25.27	15.20	44.75	49.86	7.43	11.65	19.07	2.58	1.06	2.40
Gujarat	10.54	27.62	15.38	43.35	51.41	9.27	15.68	16.31	1.05	0.53	0.66
Haryana	9.44	25.75	16.79	40.74	51.73	7.74	15.50	16.69	1.38	0.96	0.93
Karnataka	12.91	29.05	11.97	40.54	60.61	7.92	10.48	16.45	1.11	1.18	0.87
Kerala	12.65	29.85	13.93	51.77	33.05	9.68	6.93	16.61	1.41	1.90	1.25
Madhya Pradesh	9.58	26.14	14.13	37.59	49.26	7.52	11.22	16.84	1.40	1.42	1.15
Maharashtra	13.46	28.69	16.05	44.46	56.54	9.92	16.54	17.67	2.67	1.26	2.38
Orissa	11.39	27.56	12.25	41.84	46.17	6.98	9.47	17.54	1.20	1.68	1.14
Punjab	9.75	26.29	14.75	40.29	52.60	7.42	17.16	18.14	1.78	1.99	1.51
Rajasthan	8.86	24.53	16.17	40.63	68.73	8.39	13.88	16.59	1.12	0.64	0.80
Tamil Nadu	12.90	30.90	12.81	41.20	52.82	9.10	7.90	16.66	1.70	1.11	1.62
Uttar Pradesh	9.70	26.66	14.53	39.29	38.87	6.39	12.26	16.81	1.45	0.93	1.26
West Bengal	12.99	30.54	14.14	45.30	45.38	7.13	14.61	18.16	1.24	0.86	1.13
Coefficient of variation	0.149	0.070	0.106	0.088	0.166	0.130	0.251	0.054	0.331	0.352	0.402
All India	12.03	28.07	14.15	41.84	52.05	8.58	12.26	17.12	1.51	1.03	1.31

[a] All values are in Indian rupees per kilogram. All units were converted to kilograms where possible. For items where consumption is reported in numbers the following conversions have been used: 1 egg = 58 g, 1 liter milk = 1 kg, 10 bananas = 1 kg, 1 orange = 150 g, 1 pineapple = 1.5 kg, 1 coconut = 1 kg. Lemons and ginger not included.

TABLE A.7. Quality-adjusted unit values in NSS 61st round[a]

State	Cereal and cereal substitutes	Pulses and pluse products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Rural						
Andhra Pradesh	11.07	28.92	11.15	50.89	54.58	8.54	10.77	18.80	1.24	1.14	1.06
Assam	11.25	30.42	16.37	60.18	58.88	7.91	8.85	20.72	1.28	0.72	0.84
Bihar	9.16	24.84	12.56	58.27	45.21	5.66	9.38	19.35	0.92	0.67	1.05
Gujarat	8.45	26.69	15.21	53.86	64.16	9.96	14.86	19.24	0.83	0.27	0.36
Haryana	7.12	28.08	13.96	50.41	49.85	8.00	17.22	18.43	1.20	0.56	0.65
Karnataka	10.17	27.08	10.50	53.11	56.63	7.24	8.83	18.64	1.08	0.91	0.82
Kerala	12.75	31.83	15.31	64.96	31.45	10.92	8.27	19.36	1.76	2.33	1.62
Maharashtra	9.44	26.65	12.53	51.20	74.31	8.83	16.63	18.47	1.06	0.58	0.74
Madhya Pradesh	7.95	22.14	10.87	50.25	48.50	7.15	10.08	18.50	1.05	0.55	0.73
Orissa	8.73	26.31	11.42	60.10	40.22	7.00	8.48	20.14	1.05	0.60	1.05
Punjab	8.50	28.67	13.19	51.55	64.86	8.07	19.62	19.25	2.03	3.82	1.49
Rajasthan	7.27	25.32	11.99	55.18	98.25	8.60	12.82	18.70	0.97	0.52	0.60
Tamil Nadu	12.33	30.27	10.93	55.72	56.08	9.67	7.23	18.08	1.04	0.92	1.39
Uttar Pradesh	8.01	25.72	12.38	53.15	60.33	6.64	12.36	18.55	1.19	0.73	1.01
West Bengal	10.88	30.93	12.97	59.83	41.95	6.47	11.51	20.16	1.03	0.41	0.86
Coefficient of variation	0.187	0.095	0.140	0.081	0.283	0.177	0.318	0.040	0.268	0.937	0.362
All India	9.95	27.69	12.55	55.89	54.60	8.02	10.78	19.16	1.14	0.78	1.03

TABLE A. 7. (Continued.)

State	Cereal and cereal substitutes	Pulses and pluse products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Urban						
Andhra Pradesh	12.84	29.96	13.74	52.79	57.16	9.12	12.14	18.62	1.35	1.77	1.33
Assam	12.71	31.61	20.52	60.53	68.35	9.07	13.52	20.98	1.58	1.64	1.22
Bihar	10.82	27.30	15.77	58.52	50.96	6.91	13.87	20.32	1.30	0.71	1.22
Gujarat	10.95	27.82	17.01	54.19	73.35	11.50	18.28	19.18	1.03	0.17	0.63
Haryana	9.02	28.55	17.62	50.38	50.05	7.97	17.92	18.19	1.05	0.39	0.59
Karnataka	12.34	29.12	13.53	55.40	56.60	8.56	11.90	18.83	1.43	1.44	1.31
Kerala	13.13	31.70	15.62	67.19	33.48	11.51	8.77	19.56	1.52	2.25	1.42
Maharashtra	12.38	29.38	16.52	56.29	67.28	11.28	19.27	19.40	1.06	1.07	1.47
Madhya Pradesh	9.08	26.80	15.62	50.28	49.73	7.81	13.77	18.67	1.10	0.65	0.89
Orissa	10.68	28.71	13.59	60.42	50.67	8.20	10.62	20.02	1.46	1.31	1.49
Punjab	10.93	29.41	15.17	52.17	65.45	8.70	19.27	19.56	1.76	1.74	1.36
Rajasthan	8.56	26.30	15.43	55.19	88.32	8.89	15.41	18.98	1.07	0.73	0.78
Tamil Nadu	13.58	30.76	13.83	57.23	59.20	10.27	8.38	18.08	1.40	1.21	1.70
Uttar Pradesh	9.85	28.27	15.31	53.32	55.55	7.49	15.25	18.70	1.38	0.63	1.04
West Bengal	12.84	32.20	16.01	59.27	50.52	8.32	14.27	20.50	1.34	0.87	1.19
Coefficient of variation	0.146	0.062	0.116	0.080	0.219	0.162	0.246	0.044	0.167	0.529	0.278
All India	11.96	29.67	15.65	56.61	58.80	9.50	14.33	19.31	1.32	1.09	1.33

[a] All values are in Indian rupees per kilogram. All units were converted to kilograms where possible. For items where consumption is reported in numbers the following conversions have been used: 1 egg = 58 g, 1 liter milk = 1 kg, 10 bananas = 1 kg, 1 orange = 150 g, 1 pineapple = 1.5 kg, 1 coconut = 1 kg. Lemons and ginger not included.

TABLE A. 8. Quality adjusted unit values in NSS 66th round[a]

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Rural						
Andhra Pradesh	16.61	69.53	22.30	52.50	85.25	17.22	20.42	32.56	2.02	3.95	2.41
Assam	18.66	61.73	25.27	70.52	94.72	13.72	18.79	26.83	1.62	1.96	2.03
Bihar	15.35	51.21	21.15	70.34	81.07	10.80	17.62	36.77	0.95	1.18	1.47
Gujarat	13.67	60.79	22.56	60.65	100.49	15.79	20.78	34.14	0.51	1.54	0.86
Haryana	12.87	55.35	25.68	60.50	99.71	14.37	25.79	35.17	0.88	1.14	1.13
Karnataka	12.77	60.61	16.32	59.22	79.91	13.94	12.51	30.59	1.04	1.36	1.20
Kerala	20.77	68.65	23.28	59.52	58.24	18.89	11.87	35.47	3.17	5.25	3.40
Maharashtra	15.25	62.69	21.44	55.34	102.67	17.86	18.53	33.90	1.19	1.55	1.44
Madhya Pradesh	12.61	54.64	20.42	60.05	72.45	13.07	14.74	32.44	0.72	1.47	1.27
Orissa	13.43	59.85	18.60	65.09	72.61	13.27	12.89	36.88	1.70	2.79	2.26
Punjab	13.68	56.14	21.69	61.58	86.92	14.80	30.55	36.87	1.11	8.21	1.19
Rajasthan	12.92	53.68	19.42	64.46	142.50	15.01	21.26	35.22	0.49	0.89	0.70
Tamil Nadu	11.91	56.51	20.55	61.17	89.23	17.60	10.85	17.55	1.62	2.71	2.51
Uttar Pradesh	12.61	53.19	20.10	63.59	82.29	11.52	17.40	34.58	0.86	1.10	1.28
West Bengal	17.08	63.59	19.97	70.60	73.56	11.65	19.09	35.20	0.78	1.20	1.61
Coefficient of variation	0.176	0.093	0.114	0.085	0.220	0.168	0.294	0.152	0.561	0.831	0.442
All India	14.63	58.82	21.22	63.62	85.94	14.86	17.58	34.40	1.25	1.66	1.70

Table A. 8. (Continued.)

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Urban						
Andhra Pradesh	23.28	72.79	27.01	64.65	101.87	19.60	24.09	36.63	4.34	8.30	4.63
Assam	21.02	67.38	31.92	72.02	107.42	16.08	27.68	34.82	2.69	3.04	3.16
Bihar	17.56	56.38	23.99	69.40	87.00	12.90	26.40	37.22	1.43	2.11	2.15
Gujarat	18.60	64.79	27.27	66.21	93.47	18.33	27.63	35.43	1.76	2.91	2.15
Haryana	15.91	57.64	30.89	62.34	82.89	16.83	29.06	35.84	1.36	1.18	2.02
Karnataka	21.44	66.72	21.19	61.98	88.34	16.22	17.09	34.04	2.17	1.85	2.40
Kerala	21.70	66.45	23.81	60.93	65.86	20.29	12.81	35.80	3.29	5.30	3.57
Maharashtra	21.58	70.40	26.95	61.17	107.82	19.35	28.84	36.62	2.28	2.91	2.89
Madhya Pradesh	16.16	61.87	23.88	57.96	84.01	15.85	20.18	34.67	1.76	2.29	1.94
Orissa	17.61	68.18	23.36	66.39	87.58	16.05	17.67	38.02	2.81	3.87	3.52
Punjab	17.65	60.14	23.84	64.00	95.88	16.82	32.02	36.62	0.87	3.55	1.06
Rajasthan	15.75	58.50	27.31	63.24	136.86	17.25	26.24	35.60	1.35	1.63	1.69
Tamil Nadu	16.44	61.63	22.54	63.22	96.10	18.19	13.48	21.06	2.16	4.28	3.12
Uttar Pradesh	16.16	60.46	23.49	64.22	81.50	14.05	22.18	35.22	1.48	1.71	1.83
West Bengal	21.10	69.61	27.37	71.15	91.21	14.98	25.22	35.94	1.99	2.48	2.79
Coefficient of variation	0.138	0.079	0.119	0.060	0.170	0.122	0.253	0.114	0.419	0.570	0.351
All India	18.83	63.61	25.58	66.40	96.10	17.29	23.77	35.38	1.99	2.92	2.55

[a] All values are in Indian rupees per kilogram. All units were converted to kilograms where possible. For items where consumption is reported in numbers the following conversions have been used: 1 egg = 58 g, 1 liter milk = 1 kg, 10 bananas = 1 kg, 1 orange = 150 g, 1 pineapple = 1.5 kg, 1 coconut = 1 kg. Lemons and ginger not included.

TABLE A. 9. Quality-adjusted unit values in NSS 66th round (district price effects excluded)

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Rural						
Andhra Pradesh	16.62	69.53	22.30	52.67	85.20	16.81	20.37	32.38	1.84	3.89	2.31
Assam	18.61	61.73	25.11	70.34	94.69	13.73	18.68	26.79	1.50	1.85	2.03
Bihar	15.22	51.12	21.09	70.30	81.03	10.80	17.48	36.64	0.90	1.06	1.47
Gujarat	13.68	60.72	22.56	60.59	100.42	15.80	20.72	34.08	0.52	1.49	0.85
Haryana	12.87	55.36	25.68	60.50	99.71	14.33	25.79	35.17	0.88	1.14	1.13
Karnataka	12.89	60.21	16.32	59.16	79.86	13.89	12.39	30.60	0.99	1.24	1.14
Kerala	20.41	68.58	23.15	59.11	57.84	20.22	11.81	35.45	2.96	5.19	3.20
Maharashtra	15.19	62.20	21.41	55.31	102.62	17.87	18.44	33.91	1.20	1.54	1.39
Madhya Pradesh	12.61	54.64	20.42	60.02	72.45	13.01	14.74	32.42	0.73	1.40	1.24
Orissa	13.43	59.79	18.59	65.09	72.61	13.21	12.87	36.88	1.70	2.78	2.22
Punjab	13.68	56.15	21.69	61.57	86.92	14.77	30.55	36.88	1.09	8.21	1.17
Rajasthan	12.84	53.69	19.29	64.38	147.02	14.93	21.18	35.20	0.36	0.81	0.56
Tamil Nadu	11.77	56.46	20.50	61.12	89.17	17.91	10.75	18.19	1.56	2.52	2.39
Uttar Pradesh	12.55	53.12	20.11	63.60	82.24	11.47	17.40	34.54	0.83	1.01	1.20
West Bengal	17.02	63.59	19.98	70.61	73.50	11.59	19.11	35.20	0.72	1.15	1.61
All India	14.61	58.78	21.16	63.58	85.58	14.85	17.52	34.34	1.17	1.54	1.61

TABLE A. 9. (Continued.)

State	Cereal and cereal substitutes	Pulses and products	Milk and milk Products	Edible oil	Meat, fish, and eggs	Vegetables	Fruits	Sugar	Spices	Pan, tobacco, and intoxicants	Beverages
					Urban						
Andhra Pradesh	23.55	73.60	27.01	64.65	101.69	19.49	23.99	36.57	3.90	8.24	4.22
Assam	20.96	67.10	31.70	71.87	107.42	16.05	27.49	34.73	2.59	2.89	3.13
Bihar	17.45	56.36	23.99	69.30	86.93	12.89	26.40	37.16	1.43	2.04	2.08
Gujarat	18.53	64.72	27.26	66.21	93.40	18.33	27.62	35.36	1.69	2.84	2.08
Haryana	15.90	57.63	30.89	62.30	82.89	16.83	29.05	35.84	1.36	1.18	2.02
Karnataka	21.44	66.67	20.78	61.98	88.34	16.16	17.08	34.04	2.08	1.78	2.40
Kerala	21.70	66.36	23.43	60.62	65.80	20.94	12.75	35.68	3.02	4.91	3.45
Maharashtra	21.81	70.41	26.92	61.16	107.04	19.46	28.85	36.58	2.24	2.71	2.89
Madhya Pradesh	16.09	61.86	23.88	57.90	84.01	15.85	20.12	34.66	1.75	2.27	1.94
Orissa	17.61	68.17	23.36	66.32	87.65	15.91	17.66	37.96	2.77	3.79	3.53
Punjab	17.53	60.12	23.86	64.00	95.76	16.82	32.02	36.62	0.85	3.54	1.05
Rajasthan	15.65	58.40	27.31	63.23	141.38	17.20	26.13	35.59	1.29	1.48	1.63
Tamil Nadu	16.33	61.52	22.42	62.79	95.66	18.93	13.41	21.70	2.05	4.22	3.07
Uttar Pradesh	16.16	60.42	23.49	64.10	81.49	14.05	22.18	35.15	1.48	1.71	1.78
West Bengal	21.10	69.60	27.37	71.14	91.21	14.98	25.21	35.86	1.90	2.47	2.71
All India	18.78	63.36	25.47	66.21	95.74	17.20	23.36	35.28	1.90	2.77	2.43

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TABLE A. 10. Testing for statewise variation in prices with respect to all-India (S^{State}) in various NSS rounds for 15 major states: Rural and urban

State	Rural price indices				Urban price indices			
	50th round	55th round	61st round	66th round	50th round	55th round	61st round	66th round
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	1.011	1.008	1.094	1.161	0.898	0.876	0.935	1.088
	(0.20)	(0.14)	(1.27)	(0.31)	(−2.80)*	(−1.81)	(−1.11)	(0.11)
Assam	1.097	1.078	1.242	1.077	1.115	1.081	1.202	1.061
	(0.72)	(1.23)	(1.73)	(0.14)	(0.89)	(0.53)	(1.82)	(0.09)
Bihar	0.871	0.930	0.897	0.823	0.876	0.769	0.765	0.758
	(−3.45)*	(−1.36)	(−2.56)*	(−1.21)	(−2.77)*	(−2.32)*	(−4.92)*	(−0.63)
Gujarat	1.181	1.213	1.127	1.142	1.056	1.074	1.164	1.103
	(0.74)	(2.65)*	(0.92)	(0.40)	(0.61)	(0.70)	(2.20)*	(0.19)
Haryana	1.310	1.374	1.389	1.432	1.051	1.022	1.053	1.073
	(2.50)*	(3.46)*	(3.93)*	(0.57)	(0.47)	(0.10)	(0.35)	(0.13)
Karnataka	0.925	1.095	0.962	0.960	0.912	1.009	0.985	1.041
	(−1.39)	(1.27)	(−1.14)	(−0.10)	(−1.05)	(0.12)	(−0.12)	(0.06)
Kerala	1.351	1.533	1.481	1.416	1.089	1.079	1.097	1.115
	(3.39)*	(2.34)*	(2.50)*	(0.53)	(1.56)	(0.68)	(0.51)	(0.30)
Madhya Pradesh	0.898	0.836	0.759	0.814	0.886	0.797	0.768	0.782
	(−2.06)*	(−3.61)*	(−7.40)*	(−0.69)	(−5.37)*	(−5.84)*	(−3.48)*	(−0.64)
Maharashtra	0.874	1.019	0.950	1.050	1.097	1.008	1.029	1.128
	(−0.90)	(0.55)	(−0.87)	(0.14)	(1.70)	(0.09)	(0.45)	(0.22)
Orissa	0.855	0.846	0.761	0.802	0.929	0.825	0.848	0.839
	(−5.69)*	(−4.71)*	(−2.85)*	(−0.77)	(−0.71)	(−2.80)*	(−3.82)*	(−0.68)

TABLE A. 10. (Continued.)

State (1)	Rural price indices: 50th round (2)	Rural: 55th round (3)	Rural: 61st round (4)	Rural: 66th round (5)	Urban price indices: 50th round (6)	Urban: 55th round (7)	Urban: 61st round (8)	Urban: 66th round (9)
Punjab	1.395	1.351	1.379	1.412	1.127	1.023	1.106	1.101
	(5.49)*	(3.94)*	(3.72)*	(0.71)	(1.28)	(0.21)	(1.81)	(0.20)
Rajasthan	1.156	1.179	1.103	1.142	1.007	0.966	0.903	0.971
	(2.45)*	(2.62)*	(0.78)	(0.51)	(0.15)	(−0.55)	(−1.00)	(−0.09)
Tamil Nadu	1.059	1.096	1.058	1.019	0.928	1.030	1.053	1.004
	(1.03)	(0.66)	(0.74)	(0.03)	(−0.86)	(0.15)	(0.43)	(0.01)
Uttar Pradesh	0.895	0.942	0.910	0.899	0.861	0.790	0.841	0.866
	(−2.51)*	(−1.19)	(−1.86)	(−0.38)	(−1.87)	(−5.97)*	(−1.92)	(−0.76)
West Bengal	1.029	1.101	1.072	1.004	1.097	1.034	1.120	1.013
	(0.25)	(4.26)*	(2.61)*	(0.01)	(2.26)*	(0.73)	(0.99)	(0.05)
All India								
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: Method: Coondoo et al. (2011); 11 food items. Figures in parentheses are the *t*-statistics given by $S^{\text{State}} - 1/se(S^{\text{State}})$. *Significant at 5% level.

TABLE A. 11. Testing for statewise variation in prices with respect to all-India (S^{State}) in various NSS rounds for 15 major states: Rural and urban

State	Rural price indices				Urban price indices			
	50th round	55th round	61st round	66th round	50th round	55th round	61st round	66th round
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	0.797	0.841	1.048	1.083	0.815	0.911	0.923	1.190
	(−13.04)*	(−10.91)*	(2.13)**	(5.47)*	(−3.03)*	(−3.34)*	(−3.17)*	(7.67)*
Assam	0.812	1.150	1.619	0.972	0.786	0.545	1.097	1.029
	(−4.77)*	(5.60)*	(5.76)*	(−1.03)	(−2.74)*	(−17.56)*	(1.05)	(0.58)
Bihar	1.268	1.046	1.122	0.955	1.476	1.232	1.068	1.040
	(14.20)*	(7.10)*	(4.99)*	(−1.95)***	(8.69)*	(13.98)*	(1.49)	(0.83)
Gujarat	0.567	0.831	1.498	0.840	0.588	0.839	1.461	0.950
	(−10.74)*	(−5.05)*	(3.16)*	(−10.91)*	(−9.13)*	(−5.91)*	(2.45)**	(−1.58)
Haryana	1.345	0.891	1.360	0.907	0.876	1.185	0.851	0.902
	(9.13)*	(−4.29)*	(2.02)**	(−3.59)*	(−1.22)	(5.03)*	(−2.01)**	(−1.56)
Karnataka	0.549	0.893	0.868	0.748	0.857	0.864	0.902	1.390
	(−34.07)*	(−6.92)*	(−3.81)*	(−16.14)*	(−4.43)*	(−8.12)*	(−3.34)*	(5.41)*
Kerala	0.862	1.024	1.222	1.697	0.449	0.887	0.921	1.368
	(−2.28)**	(0.51)	(2.18)**	(11.54)*	(−11.86)*	(−2.17)*	(−1.47)	(4.91)*
Madhya Pradesh	0.887	0.851	0.939	0.729	1.478	0.958	0.844	0.753
	(−6.61)*	(−12.51)*	(−1.92)***	(−20.64)*	(7.89)*	(−3.03)*	(−4.32)*	(−14.49)*
Maharashtra	0.840	0.901	1.165	1.174	0.586	0.936	1.162	1.236
	(−8.54)*	(−8.20)*	(3.81)*	(5.39)*	(−31.89)*	(−6.42)*	(5.30)*	(5.82)*
Orissa	1.018	1.010	1.098	1.031	1.035	0.982	1.066	0.907
	(0.62)	(0.77)	(2.02)**	(1.45)	(0.44)	(−0.43)	(0.76)	(−2.90)*

TABLE A. 11. (Continued.)

State (1)	Rural price indices: 50th round (2)	55th round (3)	61st round (4)	66th round (5)	Urban price indices: 50th round (6)	55th round (7)	61st round (8)	66th round (9)
Punjab	1.050	0.858	1.240	1.093	0.976	1.162	1.120	0.881
	(2.35)**	(−6.74)*	(5.77)*	(6.10)*	(−0.40)	(3.98)*	(1.99)**	(−7.79)*
Rajasthan	0.993	0.642	0.741	0.796	1.209	0.868	1.114	0.757
	(−0.40)	(−36.40)*	(−3.37)*	(−10.95)*	(3.08)*	(−6.87)*	(0.98)	(−9.40)*
Tamil Nadu	0.977	0.963	0.808	0.880	0.640	0.908	0.919	1.074
	(−0.94)	(−1.89)***	(−3.43)*	(−6.51)*	(−9.85)*	(−4.38)*	(−2.36)**	(1.64)***
Uttar Pradesh	0.962	0.901	0.990	0.826	1.303	1.060	1.020	0.769
	(−3.78)*	(−13.17)*	(−0.36)	(−16.09)*	(8.68)*	(4.65)*	(0.56)	(−16.98)*
West Bengal	1.490	1.219	1.156	1.471	0.677	0.769	1.226	1.546
	(10.17)*	(7.29)*	(3.95)*	(11.53)*	(−5.06)*	(−8.04)*	(5.02)*	(6.46)*
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: Method: QAIDS index: 11 food items. Figures in parentheses are the t-statistic given by $S^{\text{State}} - 1/se(S^{\text{State}})$. $^{*}p < 0.01$, $^{**}\ p < 0.05$, $^{***}p < 0.10$ are levels of significance for testing PPP = 1.

TABLE A. 12. Testing for statewise variation in prices with respect to all-India (S^{State}) in various NSS rounds for 15 major states: Rural and urban

State	Rural price indices				Urban price indices			
	50th round	55th round	61st round	66th round	50th round	55th round	61st round	66th round
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	0.965	0.979	1.032	1.176	1.025	0.968	1.028	1.295
	(−1.72)***	(−4.24)*	(4.72)*	(13.74)*	(2.78)*	(−2.78)*	(3.27)*	(16.66)*
Assam	1.164	1.064	1.021	1.077	1.320	1.048	1.045	1.081
	(13.32)*	(10.28)*	(2.87)*	(14.52)*	(10.46)*	(19.66)*	(5.44)*	(10.48)*
Bihar	0.974	1.056	0.950	0.937	0.968	1.082	0.951	0.915
	(−2.11)*	(4.95)*	(−10.45)*	(−8.43)*	(−5.53)*	(5.31)*	(−7.84)*	(−11.59)*
Gujarat	1.025	0.890	0.912	0.885	0.993	0.910	0.905	0.975
	(2.35)**	(−5.37)*	(−3.83)*	(−4.14)*	(−0.89)	(−5.53)*	(−3.14)*	(−5.62)*
Haryana	0.983	0.907	0.956	0.944	0.958	0.959	0.886	0.905
	(−1.51)	(−8.61)*	(−3.79)*	(−4.69)*	(−4.26)*	(−4.26)*	(−5.99)*	(−7.38)*
Karnataka	0.920	0.935	0.979	0.923	1.023	0.960	1.004	0.987
	(−3.18)*	(−5.67)*	(−3.58)*	(−23.93)*	(3.01)*	(−3.65)*	(0.77)	(−1.41)
Kerala	0.976	1.013	1.162	1.317	0.935	1.008	1.036	1.145
	(−1.10)	(1.46)	(8.83)*	(13.07)*	(−6.21)*	(0.69)	(2.59)*	(9.65)*
Madhya Pradesh	0.992	0.955	0.927	0.895	0.957	0.976	0.905	1.048
	(−0.59)	(−8.13)*	(−15.66)*	(−7.96)*	(−5.02)*	(−3.32)*	(−12.27)*	(19.01)*
Maharashtra	0.982	1.070	0.977	0.994	1.066	1.162	1.028	0.938
	(−1.26)	(3.86)*	(−2.84)*	(−1.44)	(9.80)*	(13.01)*	(8.51)*	(−21.12)*

TABLE A. 12. (Continued.)

State (1)	Rural price indices 50th round (2)	55th round (3)	61st round (4)	66th round (5)	Urban price indices 50th round (6)	55th round (7)	61st round (8)	66th round (9)
Orissa	1.009	0.989	0.953	1.070	0.979	0.977	0.986	1.085
	(0.57)	(−2.16)**	(−10.50)*	(5.97)*	(−1.67)***	(−2.62)*	(−2.25)**	(7.57)*
Punjab	1.106	1.109	1.192	1.120	0.975	1.052	1.029	0.868
	(4.85)*	(6.37)*	(6.25)*	(3.88)*	(−4.04)*	(4.24)*	(3.36)*	(−4.61)*
Rajasthan	0.915	0.891	0.942	0.853	0.953	0.934	0.924	0.904
	(−9.53)*	(−7.54)*	(−4.36)*	(−5.48)*	(−4.04)*	(−4.96)*	(−6.09)*	(−8.36)*
Tamil Nadu	1.047	1.060	1.022	1.080	1.004	1.026	1.026	1.029
	(7.97)*	(9.30)*	(2.54)*	(7.38)*	(0.65)	(4.19)*	(3.65)*	(4.30)*
Uttar Pradesh	0.922	0.933	0.980	0.905	0.915	0.956	0.929	0.898
	(−7.52)*	(−11.27)*	(−3.44)*	(−12.57)*	(−7.40)*	(−8.68)*	(−9.56)*	(−19.18)*
West Bengal	1.095	0.938	0.955	0.924	1.184	0.975	0.979	1.001
	(3.11)*	(−3.49)*	(−3.98)*	(−5.39)*	(8.64)*	(−4.59)*	(−4.16)*	(0.28)
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: Method: Tornqvist GEKS Divisia index: 11 food items. Figures in parentheses are the t-statistics for testing significance of ln(PPP), as the estimating equation is equation (2.10).

$^{*}p < 0.01$, $^{**}p < 0.05$, $^{***}p < 0.10$ are levels of significance for testing ln(PPP) = 0.

TABLE A. 13. Testing for statewise variation in prices with respect to all-India (S^{State}) in various NSS rounds for 15 major states: Rural and urban

	Rural price indices				Urban price indices			
State (1)	50th round (2)	55th round (3)	61st round (4)	66th round (5)	50th round (6)	55th round (7)	61st round (8)	66th round (9)
Andhra Pradesh	1.046	1.034	1.078	1.067	0.980	1.020	1.013	1.111
	(8.141)*	(4.635)*	(1.584)	(1.91)***	(−2.269)*	(0.851)	(0.308)	(2.323)*
Assam	1.249	1.237	1.100	1.090	1.102	1.155	1.073	1.083
	(20.13)*	(9.599)*	(4.786)*	(3.681)*	(12.98)*	(5.885)*	(1.74)***	(4.092)*
Bihar	1.029	1.041	0.924	0.977	0.972	0.976	0.917	0.997
	(1.358)	(1.298)	(−6.214)*	(−0.936)	(−0.789)	(−0.564)	(−4.305)*	(−0.180)
Gujarat	1.081	1.101	1.155	0.960	1.077	1.091	1.119	1.008
	(11.79)*	(2.116)*	(2.494)*	(−0.867)	(3.569)*	(2.843)*	(2.187)*	(0.186)
Haryana	0.865	0.932	0.906	0.941	0.920	0.973	0.883	0.951
	(−20.22)*	(−3.649)*	(−2.174)*	(−2.195)**	(−6.576)*	(−1.509)	(−3.579)*	(−1.77)***
Karnataka	0.974	1.065	1.025	0.959	0.987	1.052	1.090	1.016
	(−0.635)	(2.865)*	(0.474)	(−0.701)	(−0.630)	(1.833)***	(1.565)	(0.246)
Kerala	1.253	1.289	1.229	1.172	1.056	1.123	1.077	1.015
	(10.29)*	(22.43)*	(5.291)*	(13.71)*	(13.32)*	(12.439)*	(2.758)*	(0.657)
Madhya Pradesh	0.954	0.928	0.905	0.903	0.939	0.905	0.854	0.910
	(−1.757)***	(−1.877)***	(−3.273)*	(−3.008)*	(−3.978)*	(−2.372)*	(−5.241)*	(−2.40)**
Maharashtra	0.995	1.036	0.989	1.095	1.152	1.116	1.103	1.171
	(−0.129)	(0.682)	(−0.557)	(2.960)*	(2.703)*	(2.272)**	(2.442)**	(−11.02)*

TABLE A. 13. (Continued.)

	Rural price indices				Urban price indices			
State (1)	50th round (2)	55th round (3)	61st round (4)	66th round (5)	50th round (6)	55th round (7)	61st round (8)	66th round (9)
Orissa	0.982	1.013	0.966	0.916	0.922	0.950	0.944	0.969
	(−2.560)*	(0.343)	(−1.306)	(−3.743)*	(−5.622)*	(−1.599)	(−2.026)**	(−1.162)
Punjab	0.911	0.891	1.137	1.015	0.945	0.904	1.076	1.007
	(−15.03)**	(−3.605)*	(3.473)*	(−16.49)*	(−5.338)*	(−4.669)*	(2.941)*	(0.112)
Rajasthan	0.884	0.916	0.918	0.962	0.895	0.908	0.894	0.944
	(−11.87)*	(−3.027)*	(−2.16)**	(−1.115)	(−7.264)*	(−13.54)*	(−5.367)*	(−0.944)
Tamil Nadu	1.172	1.075	1.006	1.015	1.046	1.061	1.029	0.998
	(2.919)*	(1.518)	(0.185)	(0.522)	(3.775)*	(3.132)*	(0.763)	(−0.075)
Uttar Pradesh	0.854	0.879	0.946	0.969	0.872	0.882	0.902	0.932
	(−12.92)*	(−3.443)*	(−1.85)***	(−0.892)	(−10.28)*	(−5.218)*	(−2.958)*	(−2.54)**
West Bengal	1.123	1.136	1.054	0.981	1.035	1.071	1.067	1.033
	(5.571)*	(5.456)*	(2.139)**	(−0.719)	(2.749)*	(3.685)*	(1.547)	(0.849)
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: Method: Laspeyres index: 11 food items. Figures in parentheses are the t-statistics given by $S^{\text{State}} - 1/se(S^{\text{State}})$. $^{*}p < 0.01$, $^{**}p < 0.05$, $^{***}p < 0.10$ are levels of significance for testing PPP = 1.

TABLE A. 14. Statewise real expenditure comparisons[a] for 15 major states of India: Rural and urban NSS 50th round (1993/1994): 11 food items

	Rural real income					Urban real income				
		Spatial price deflated					Spatial price deflated			
State (1)	Nominal (2)	Coondoo et al. (2011) index (3)	QAIDS (4)	Tornqvist index (5)	Laspeyres index (6)	Nominal (7)	Coondoo et al. (2011) index (8)	QAIDS (9)	Tornqvist index (10)	Laspeyres index (11)
Andhra Pradesh	1.026	1.014	1.288	1.063	0.981	0.892	0.993	1.094	0.870	0.910
Assam	0.917	0.836	1.130	0.788	0.734	1.001	0.897	1.274	0.758	0.908
Bihar	0.776	0.891	0.612	0.796	0.754	0.771	0.880	0.522	0.797	0.793
Gujarat	1.078	0.913	1.900	1.052	0.997	0.992	0.940	1.687	0.999	0.921
Haryana	1.368	1.044	1.017	1.392	1.582	1.035	0.984	1.182	1.080	1.125
Karnataka	0.957	1.034	1.744	1.04	0.983	0.924	1.013	1.078	0.903	0.936
Kerala	1.387	1.027	1.609	1.421	1.107	1.078	0.990	2.399	1.153	1.021
Madhya Pradesh	0.896	0.998	1.011	0.903	0.939	0.891	1.005	0.603	0.931	0.949
Maharashtra	0.969	1.109	1.154	0.987	0.974	1.157	1.054	1.973	1.086	1.004
Orissa	0.781	0.913	0.767	0.774	0.795	0.879	0.946	0.849	0.898	0.953
Punjab	1.539	1.104	1.466	1.391	1.689	1.115	0.989	1.142	1.143	1.180
Rajasthan	1.146	0.991	1.154	1.253	1.296	0.927	0.921	0.767	0.973	1.036
Tamil Nadu	1.043	0.985	1.067	0.997	0.89	0.957	1.031	1.496	0.953	0.915
Uttar Pradesh	0.973	1.087	1.012	1.056	1.139	0.849	0.986	0.652	0.928	0.974
West Bengal	0.991	0.963	0.665	0.905	0.882	1.035	0.944	1.528	0.874	1.000
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[a] Real income (nominal) = State per capita expenditure/All-India per capita expenditure. Real income (spatial price deflated) = Real income (nominal)/S^{State}.

TABLE A. 15. Statewise real expenditure comparisons[a] for 15 major states of India: Rural and urban NSS 55th round (1999/2000): 11 food items

	Rural real income					Urban real income				
		Spatial price deflated					Spatial price deflated			
State (1)	Nominal (2)	Coondoo et al. (2011) index (3)	QAIDS (4)	Tornqvist index (5)	Laspeyres index (6)	Nominal (7)	Coondoo et al. (2011) index (8)	QAIDS (9)	Tornqvist index (10)	Laspeyres index (11)
Andhra Pradesh	0.933	0.925	1.109	0.953	0.902	0.905	1.034	0.994	0.935	0.887
Assam	0.877	0.813	0.762	0.824	0.709	0.952	0.881	1.746	0.909	0.824
Bihar	0.792	0.852	0.757	0.750	0.761	0.704	0.915	0.571	0.651	0.721
Gujarat	1.134	0.935	1.365	1.274	1.030	1.043	0.971	1.243	1.147	0.956
Haryana	1.469	1.069	1.649	1.620	1.577	1.067	1.044	0.901	1.112	1.096
Karnataka	1.028	0.939	1.151	1.100	0.965	1.066	1.056	1.234	1.111	1.013
Kerala	1.575	1.028	1.538	1.555	1.222	1.091	1.012	1.230	1.083	0.971
Madhya Pradesh	0.826	0.988	0.971	0.865	0.890	0.811	1.017	0.847	0.831	0.896
Maharashtra	1.022	1.003	1.134	0.955	0.986	1.139	1.130	1.217	0.980	1.020
Orissa	0.768	0.908	0.760	0.777	0.758	0.723	0.876	0.736	0.740	0.762
Punjab	1.528	1.131	1.780	1.378	1.715	1.051	1.027	0.905	1.000	1.163
Rajasthan	1.129	0.958	1.757	1.268	1.233	0.931	0.964	1.073	0.997	1.025
Tamil Nadu	1.057	0.964	1.098	0.997	0.984	1.137	1.104	1.252	1.108	1.071
Uttar Pradesh	0.960	1.019	1.065	1.029	1.092	0.807	1.022	0.761	0.844	0.916
West Bengal	0.935	0.849	0.767	0.996	0.823	1.014	0.981	1.318	1.040	0.946
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[a]Real income (nominal) = State per capita expenditure/All-India per capita expenditure. Real income (spatial price deflated) = Real income nominal/S^{State}.

TABLE A. 16. Statewise real expenditure comparisons[a] for 15 major states of India: Rural and urban 61st round (2004/2005): 11 food items

	Rural real income					Urban real income				
		Spatial price deflated					Spatial price deflated			
State (1)	Nominal (2)	Coondoo et al. (2011) index (3)	QAIDS (4)	Tornqvist index (5)	Laspeyres index (6)	Nominal (7)	Coondoo et al. (2011) index (8)	QAIDS (9)	Tornqvist index (10)	Laspeyres index (11)
Andhra Pradesh	1.043	0.954	0.995	1.010	0.967	0.988	1.057	1.070	0.961	0.975
Assam	0.996	0.802	0.615	0.975	0.905	1.023	0.851	0.932	0.979	0.953
Bihar	0.768	0.856	0.684	0.809	0.832	0.660	0.863	0.618	0.694	0.720
Gujarat	1.113	0.988	0.743	1.220	0.964	1.092	0.938	0.747	1.207	0.976
Haryana	1.563	1.125	1.150	1.635	1.725	1.071	1.018	1.259	1.209	1.213
Karnataka	0.937	0.974	1.079	0.958	0.915	1.030	1.045	1.142	1.025	0.945
Kerala	1.780	1.202	1.456	1.532	1.448	1.226	1.118	1.332	1.184	1.138
Madhya Pradesh	0.796	1.049	0.848	0.859	0.880	0.809	1.054	0.958	0.894	0.947
Maharashtra	1.030	1.085	0.884	1.055	1.042	1.112	1.081	0.957	1.082	1.008
Orissa	0.729	0.959	0.664	0.765	0.754	0.715	0.843	0.671	0.725	0.757
Punjab	1.563	1.133	1.260	1.311	1.375	1.182	1.069	1.055	1.148	1.099
Rajasthan	1.033	0.937	1.395	1.096	1.125	0.855	0.947	0.767	0.925	0.957
Tamil Nadu	1.039	0.982	1.285	1.016	1.033	1.056	1.002	1.149	1.029	1.026
Uttar Pradesh	0.931	1.023	0.940	0.950	0.984	0.796	0.947	0.781	0.857	0.883
West Bengal	0.994	0.928	0.860	1.041	0.943	1.049	0.937	0.856	1.072	0.983
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[a] Real income (nominal) = State per capita expenditure/All-India per capita expenditure. Real income (spatial price deflated) = Real income nominal/S^{State}.

TABLE A. 17. Statewise real expenditure comparisons[a] for 15 major states of India: Rural and urban 66th round (2009/2010): 11 food items

	Rural real income					Urban real income				
		Spatial price deflated					Spatial price deflated			
State (1)	Nominal (2)	Coondoo et al. (2011) index (3)	QAIDS (4)	Tornqvist index (5)	Laspeyres index (6)	Nominal (7)	Coondoo et al. (2011) index (8)	QAIDS (9)	Tornqvist index (10)	Laspeyres index (11)
Andhra Pradesh	1.144	0.985	1.056	0.973	1.072	1.086	0.998	0.913	0.838	0.977
Assam	0.910	0.845	0.936	0.845	0.835	0.864	0.814	0.840	0.799	0.798
Bihar	0.723	0.878	0.757	0.771	0.740	0.591	0.780	0.568	0.646	0.593
Gujarat	1.118	0.979	1.331	1.263	1.164	1.031	0.935	1.085	1.057	1.023
Haryana	1.493	1.042	1.646	1.582	1.587	1.082	1.008	1.199	1.195	1.138
Karnataka	0.932	0.971	1.245	1.009	0.972	1.110	1.066	0.799	1.124	1.092
Kerala	1.850	1.306	1.090	1.404	1.578	1.221	1.095	0.893	1.066	1.203
Madhya Pradesh	0.843	1.035	1.156	0.942	0.933	0.824	1.053	1.094	0.787	0.906
Maharashtra	1.100	1.047	0.937	1.106	1.004	1.213	1.075	0.982	1.293	1.036
Orissa	0.751	0.937	0.729	0.702	0.820	0.791	0.943	0.872	0.729	0.817
Punjab	1.643	1.163	1.504	1.467	1.619	1.116	1.013	1.266	1.285	1.109
Rajasthan	1.086	0.951	1.365	1.274	1.129	0.850	0.875	1.123	0.940	0.900
Tamil Nadu	1.067	1.047	1.213	0.988	1.051	0.967	0.963	0.901	0.940	0.969
Uttar Pradesh	0.873	0.971	1.057	0.964	0.901	0.815	0.942	1.060	0.907	0.874
West Bengal	0.900	0.896	0.612	0.974	0.918	0.970	0.958	0.627	0.969	0.939
All India	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[a]Real income (nominal) = State per capita expenditure/All-India per capita expenditure. Real income (spatial price deflated) = Real income nominal/S^{State}.