DEMOGRAPHICALLY EXTENDED & STATE SPECIFIC OPTIMAL COMMODITY TAXES FOR INDIA

A K SETH
University of Delhi
akseth20202@yahoo.com

ANKUR BHATNAGAR
University of Delhi
ankur3674@yahoo.co.in

ABSTRACT

This paper attempts to provide conclusive evidence of regional variations in demand behaviour in India using the Restricted Non Linear Preference System. Also the importance of household composition is brought out clearly via its influence on optimal commodity taxes for India. This is done by recognizing each of the chosen 16 Indian states separately and estimating tax rates for them, while incorporating demographic variables. The results show considerable variations in not only the estimated tax rates, but also in the demand behaviour as revealed by response of tax rates to changes in revenue requirements and changes in a social planner's aversion to inequality. In other words, the estimated tax rates are extremely sensitive to the degree of aversion to inequality and the required revenue; the response of each state to these changing parameters is also non uniform. Our results reveal that indirect taxes are ineffective in redistributing income in the majority of the states under consideration.

I . INTRODUCTION

Most recent studies on consumer demand behaviour have outlined the importance of demographic variables and regional effects in shaping demand behaviour. Since the 1980s (see Pollack and Wales, 1980, 1981) considerable literature has been devoted to attempts o specifically capture the role of demographic variables in influencing demand behaviour. Such literature has focused on variables like size of a household, age and number of kids in a household in their analysis of consumer demand, optimal tax rates, formulation of child benefits, optimal government grants, besides other issues. Most of these issues are of importance and relevance in developed nations where subsidies and grants are used by the government as an easy and convenient tool of income redistribution. However, due to a variety of reasons (administrative, social and economic) developing nations are not able to use tools for income redistribution; they rely on indirect tax structure instead.

India, being a developing nation also uses indirect tax rates as an instrument of income redistribution. As a result the influence of demographic variables on a host of issues, including calculation of optimal commodity taxes assumes importance. This paper is an attempt in this direction; it incorporates household effects in the estimation of optimal commodity taxes for 16 states of India; thus giving due importance to difference in regional consumer behaviour.

Studies in Business and Economics
Vol. 12 No. 2

II. LITERATURE REVIEW

Notwithstanding a large body of work, the empirical evidence on optimal commodity taxes is relatively recent and scarce for developing nations. Most part of the earlier literature focuses on theoretical aspects of deriving a set of sufficient conditions for optimal commodity taxes; empirical part came much later.

The initial empirical work on optimal commodity taxes was for a one-person case (see Atkinson and Stiglitz (1972), Fukushima and Hatta (1989),). The more realistic case for a many person economy (see Deaton (1977), Harris and MacKinnon (1979), Ebrahim and Heady (1988)) uses the first order conditions derived by maximizing social welfare subject to a pre-set revenue requirement. In recent times, optimal commodity taxes have been estimated for a variety of purposes, including tax reform exercise. In a pioneering study by Ahmed and Stern (1984) for India, they used the estimated tax rates as a basis for a tax reform exercise. This was repeated for many developed countries (Cragg, Madden, Decoster and Schokarat). Among developing nations such studies are relatively few due to the absence of a longterm and reliable, continuous data set.

However, owing to a rich, continous and detailed data set from National Sample Survey Organisation, many studies have been done for India relating to estimation of optimal commodity taxes and their further use in analysis of other issues. In a series of studies using the RNLPS (Restricted Non Linear Preference System) Ray focused on India. He concluded that optimal commodity taxes were non uniform across commodities and across rural-urban India. Other studies came to the same conclusion, but differed in terms of demand system used Ray (1980) uses Almost Ideal Demand System(AIDS), whereas Srinivasan (1986) and Majumdar (1988) use Linear Expenditure System(LES). The only exception is Hatta (1986) who finds that a move towards uniform tax rates increases welfare. In Murty and Ray (1989) optimal commodity taxes were estimated and used to illustrate the possibility of marginal tax reforms in India.

None of the above studies relating to India made any reference to any kind of household compositional variables or regional differences. (All of them estimated optimal commodity taxes for India as a whole). The effect of household composition has still not been documented on Indian data to the best of our knowledge. This could partly be attributed to lack of data on demographic variables like number of kids, age of kids, number of male and female kids. Data relating to the demographic profile of a household has started being reported at a state level only since 1987-88(round 43 of NSSO). In countries like Australia and United Kingdom where such rich and abundant household compositional data is available on a longterm basis, numerous studies (Blacklow and Ray, 2000) have documented the role of household composition in influencing consumer behaviour and the consequent effect on optimal commodity taxes and other issues. The importance of regional differences in consumer demand was reported later by Meenakshi (1996) using the restrictive Linear Expenditure System. This was supported by Meenakshi and Ray (1999) using AIDS and its variants. Despite the documented importance of regional differences their effect on optimal commodity taxes has not been documented for India in any study.

III. BACKGROUND

The standard model for calculating optimal commodity taxes is outlined below:

Let $u_h(x_h,m_h)$, $v_h(p,m_h, y_h)$ denote household h's direct and indirect utility function. where x_h denotes the household's vector of commodity demand, m_h is the equivalence scale and y_h is the aggregate expenditure/income. Let us also define a social welfare W over households' indirect utilities:

$W(p,m,y) = W[v_1(p,m_1, y_1), \ldots\ldots\ldots\ldots v_H(p,m_H, y_H)]$. Also, let X(p) Also, let X(p) denote aggregate demand vector:

$$\mathbf{X(p, m_1, m_2, m_3, m_H, y_1, y_2, y_H) = \sum_h x_h(p,m_h, y_h).}$$

The revenue constraint is given by:
$R = R_0 = \sum_i t_i X_i$ where R0 is set exogenously by the authorities.

The logic of optimal commodity taxes is based on maximizing the social welfare function subject to the government raising a preset revenue through them. The Lagrangean for this problem can be set as

$L=W(v^1,v^2,\ldots\ldots\ldots, v^H)+\lambda[\sum_i t_i X - R_0]$

$i = 1,2 \ldots\ldots n.\ \ h = 1,2,\ldots\ldots H$

Differentiating L with respect to the tax ti and λ, using Roy's identity we can rewrite the first order conditions as follows:

$$-\sum_{h=1}^{H} \beta^h x_i^h + \lambda\ X_i + \sum_{k=1}^{n} t_k \frac{\delta X_k}{\delta p_i} = 0$$

$i = 12.3 \ldots\ldots n$ .....1 (a)

$$R_0 = \sum_{i=1}^{n} t_i X_i \qquad \text{.....1 (b)}$$

where λ : Lagrangean multiplier that can be interpreted as the social cost of raising 1 extra unit of revenue

$\beta_h^{\ i}$: social marginal utility of income of household h. It is also referred to as the 'welfare weight' assigned to a household h. in simple words, it refers to society's valuation of 1 Re. more of income to household h. A society which cares about low income groups will attach a greater value to an increment in the income of a poor household, compared to a similar increment in the income of a rich household.

Differentiating the social welfare function wrt prices, using Roy's identity and assuming fixed produced prices, we have

$$\partial V / \partial t_i = -\sum_h \beta_h x_h^{\ i} \qquad \text{.....(2)}$$

where $\beta_h = \partial W/\partial y_h$. and is the social marginal utility of income for a household h. Assuming W to be additive in individual utilities, we have,

$W = (1/1-\varepsilon)\sum_h v_h^{1-\varepsilon}$ where ε denotes the "inequality aversion parameter"[2]. Normalizing $\beta_h = 1$ for a reference household (household 1),

$$\beta_h = [v_1/v_h]^{\varepsilon}[v_h'/v_1'] \qquad \text{.....(3)}$$

where $v_h' = \partial v_h/\partial y_h$ is the private marginal utility of income of h. This expression implies that *h depend , via the vh 's on prices, household composition and income.

The demand system used in this study is the RNLPS form proposed by Blundell and Ray (1984). Its indirect utility function can be demographically extended by the technique of linear scaling . The demographically

extended indirect utility function is as follows:

$$v_h = \{ [y_h / m_h]^{\alpha} - \sum_i p_i^{\alpha} b_i \} / \Pi_k p^{\alpha ck}, \quad \sum_k b_k = 1, \ 0 < \alpha \leq 1. \qquad \ldots\ldots(4)$$

We have used two forms of mh . In the first one m_h =1+ d_1(no. of kids in h) + d_2(no. of adult males in h) +d3(no. of adult females in h). in the second one mh =1+ d1(no. of kids in h) + d2(no. of adults in h)

Using equation 3 and 4, the social marginal utility of household h is given by:

$$\beta_h = \{([y_1 / m_1]^{\alpha} - \sum_i p_i^{\alpha} b_i) / ([y_h / m_h]^{\alpha} - \sum_i p_i^{\alpha} b_i)\} \varepsilon \{[y_h / m_h] / [y_1 / m_1]\}^{\alpha - 1} \qquad \ldots\ldots\ldots(5)$$

The budget share equation for RNLPS is given as:

$$w_i^h = b_i (p_i / E_h)^{\alpha} + c_i [1 - \Sigma_j b_j (p_j / E)^{\alpha}]$$

where $(0 < \alpha \leq 1)$ and $(\sum c_i = 1)$

The parameter allows for both non-linear Engel curves and non-separable behaviour. If $\alpha = 1$ our system reduces to the LES. Since $\alpha < 1$ in RNLPS, $\varepsilon = 0$ does NOT imply utilitarianism.

IV. DATA USED

This study uses data released by National Sample Survey Organisation (NSSO) which carries out surveys (National Sample Survey) in India. The National Sample Survey (NSS) is a multipurpose socio-economic inquiry of all-India coverage carried out in the form of rounds. For nearly three decades, NSS has been collecting each year, till 1973-74 and at five-year intervals after that data on the level and pattern of consumption from a representative sample of households in rural and urban India. It is the most comprehensive source of information on the subject- providing detailed, continuous and invaluable data over such a long period of time. The NSS collects detailed itemwise consumption data in value and quantity terms (wherever possible) for the last 30 days preceding the date of inquiry from the sample household by interviewing the head of the household. The survey period of each round of inquiry (which is one year) is subdivided into 4 sub-rounds.

This study uses data on urban India for 16 different states and, 9 commodity groups released by NSSO. The states include: Assam, Andhra Pradesh, Bihar, Haryana, Gujarat, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orrisa, Punjab, Rajasthan, West Bengal, Kerela, Tamil Nadu and Uttar Pradesh. The commodity groups are: Edible oil, Meat, fish and eggs, Sugar, salt and spices, Clothing and footwear, Beverages, Pan, tobacco and intoxicants, Fuel and light and Miscellaneous goods.

In this study, data from five rounds- 28th (1973-74), 32nd (1978), 38th (1983), 43rd (1987-88) and 50th (1993-94) was used to yield a total of 970 sample points. . Price data has been used in the form of state-wise and commodity-wise consumer price indices provided by Jain and Minhas (1991) and, Tendulkar and Jain (1993). For the last round price indices were generated on a compound growth basis using growth rates provided in Tendulkar and Jain (1993).

V. METHODOLOGY

This paper attempts to analyse the following issues:

* Sensitivity of consumer demand behaviour to demographic variables.

* Sensitivity of optimal commodity taxes to regional variations (where variations are considered in geographical terms)

* Sensitivity of optimal commodity taxes to revenue requirements

* The redistributive impact of optimal tax rates.

In view of the evidence on sensitivity of optimal commodity taxes to departure from linearity assumptions of LES, we use a non linear demand system- RNLPS suggested by Blundell and Ray(1984) to analyse the above issues. This system has found wide use over time for Australia (Blacklow and Ray (2000)) and India (Ray (1986a, 1986b,1980)).

To test the sensitivity of consumer demand to demographic variables, we estimate a simple RNLPS (Model A) and compare it against extended versions that incorporate demographic variables, at all India level. Linear Scaling (Pollack and Wales (1980)) has been used to allow for demographic effects. The demographic variables that were considered are: number of adult males, number of adult females and number of kids in a household.

(Model A)

$w_i^h = b_i (p_i / y_h)^\alpha + c_i[1 - \Sigma_j b_j (p_j / y)^\alpha]$.

(simple RNLPS)

(Model B)

$w_i^h = b_i (p_i / y_h)^\alpha (m_h^\alpha) + c_i[1 - (m_h^\alpha) \Sigma_j b_j (p_j / y)^\alpha]$.

Where m_h involves no, of kids and adult males and females separately.

(Model C)

$w_i^h = b_i (p_i / y_h)^\alpha (m_h^\alpha) + c_i[1 - (m_h^\alpha) \Sigma_j b_j (p_j / y)^\alpha$

Where m_h involves no, of kids and adults (males +females) only.

The two models B and C differ from A as they allow demographic influences on consumer preferences. Between B and C the differences lie in the demographic variables used. Model B uses no. of kids, no. of adult males and no. of adult females in a household. Model C uses no. of kids and no. of adults (males+females) only. The difference therefore, lies in the gender specification of adults only. Ideally we would have liked to define demographic variables in terms of gender and age. But gender specific data for children is not available for the earlier NSS rounds. As a result, we have made no distinction for male and female children.

We have attempted to give due importance to regional differences by estimating RNLPS separately for each of the 16 states allowing for linear scaling. These demand system parameters for each state are then used to estimate the first order conditions (equations1a and 1b) at state level to arrive at optimal commodity taxes.

The evidence for regional differences was confirmed when we introduced a new variable for each of the 6 regions that we divided the states into. (details available with the authors. Refer to Meenakshi(1996)). This new variable was then included in the estimable budget share equation of each good. The significance of this variable signaled that there are major differences in the consumption of different goods across regions.

Lastly, the first order conditions are re-estimated by differing the revenue requirements of the state. This allows us to analyse the direction of taxation/ subsidization on different commodities as the State attempts to mop higher/lower revenues. The calculated tax rates are used to estimate the redistribution implied by the optimal tax structure. This involves investigating the difference in the amount of indirect taxes paid by a specific chosen household before and after the imposition of the optimal taxes.

Following Sah (1983) the public revenue constraint is $\sum T^h = 0$ where T^h is the total indirect tax paid by household h for all commodities used. This implies that all the revenues generated are by taxing some households and subsidizing some other set of households. The constraint also implies that the tax revenue generated is used only for redistributive purposes by the government. Let 'l' be the worst household in the economy. Also let Il denote the hypothetical payment to household l before the tax imposition such that the household is indifferent between receiving Il or paying the new prices(that include the new tax rate),then

$I^l = G\,(pr_0, v^l\,(p_n,E^l))$ where

G: expenditure function, v: indirect utility function

pr_0: pre-tax price, pr_n: post-tax price so that $pr_n = pr_0 + t$

If (I^l / E^l) denotes the proportional increase in real income due to taxation and payment made by the government, then this can be used as a metric of redistribution. This metric can also be interpreted in relation to a welfare index. This index Wl is defined as $G^l\,(pr_0, v^l\,(pr_n,E^l)\,/\,G^l\,(pr_0, v^l\,(pr_0,E^l))$. The numerator denotes the expenditure at pre-tax prices to achieve post-tax welfare. The denominator is the money income in the pre-tax period or E^l. This can also be expressed as $I^l / E^l = W^l - 1$. If $I^l / E^l > 0$ then $W^l > 1$: the welfare of worst household has improved in the post-tax scenario- taxes have led to redistribution in the economy. In other words, such a household has received a net tax subsidy on its total purchases. A part of this subsidy causes his real income to increase, the rest goes as dead weight loss. Sah (1983) goes on to describe the ceiling on possible redistribution in terms of budget shares also. Specialising the above concepts for a RNLPS demand system Ray (1986c) has attempted a quantification of the redistributive role of indirect taxation using tax rates. He uses the expenditure function along with the aggregate revenue constraint to derive formulae that quantify redistibution as follows:

$-T^l / E^l = \sum_i c_i\,\theta_i\,\{(E^* / E^l) - 1\}$ where $E^* = \sum_h E_h / \sum_h E_h^{1-\alpha}$

The logic of the above formula can be easily seen if we $\alpha = 1$. This reduces the system to Linear Expenditure System. Then $E^* = \sum_h E_h / H$ or average expenditure of all the households in the sample. Then

$-T^l / E^l = \sum_i c_i\,\theta_i\,\{(E^* - E^l)/ E^l\}$

$-T^l = \sum_i c_i\,\theta_i\,(E^* - E^l)$ To improve the welfare of the worst-off household, $-T^l / E^l > 0$, or we need $E^* < E^l$. In other words for any household below the average household, indirect taxation acts as a redistributive mechanism. In the Indian context, as in most

developing economies indirect taxation is relied upon as a major source of revenue, which modifies the public budget to $\sum T^h - d$ where $d > 0$ is the tax revenue from indirect taxes.

The redistribution implied by the optimal tax rates can then be expressed as:

$$- T^l / E^l = \sum_i c_i \theta_i \{(E^* / E^l) - 1\} - d$$

VI. RESULTS

These can be divided into many parts

- Analysis of the data in terms of budget shares.
- Estimates of RNPLS at all India level.
- Estimates for RNLPS for different states
- Estimates of optimal tax rates at state level for different levels of revenue and different welfare weights.
- Measurement of the income redistribution (if any) implied by our tax rates.

VI. A BUDGET SHARE ANALYSIS

As a first step, we calculate weighted budget shares. Table 1 presents data on weighted budget shares for the commodities for 4 rounds for all states separately, where the weights used correspond to the no. of households surveyed in each expenditure class. The importance to weighted budget share over average budget share is based on the fact that in each NSS round, the number of households surveyed is not same in each expenditure class. Not just absolute number of households, but the share of households in an expenditure class in total households surveyed does not remain same over time. This could lead to illogical budget share when a simple average is used across all classes. Our preliminary results show unexpected results when average budget share are used. For example, some states like Punjab, food registers an increase in budget share. However when weighted budget share were used in these states, the results were very sensible, and have been reported. Clearly, essential items like food, beverages and clothing show a decline. Miscellaneous goods register a two fold rise in budget share. For other states the results are generally sensible.

Table 2 and 3 present budget shares of two different kinds. The former brings out the importance of income in deciding where the incremental income will be spent. The latter focuses on the influence of family size/ no. of kids on the spending patterns. Table 2 presents estimates of marginal budget shares of different commodities in each state for the 50th Round (1993-94) , for three different households- richest, poorest and average. Note that for RNLPS, MBS depends critically on the value of a. These results amply demonstrate the inadequacy of using an average value of income in reflecting the actual demand response to incremental income. In line with common beliefs, MBS of a richer family will be lower than that of a poorer one, for basic goods like food, fuel, spices; the opposite holds true for miscellaneous goods.

Next, the role of household demographic variables in a household's budget is considered explicitly. Common sense dictates that consumption patterns of a household are influenced mot only by

income levels, but also by the size of the family. To check such logic, Table 3a provides budget shares of different goods according to no. of kids for 1993-94 (Round 50) on an all India basis. As expected the budget share of food, spices, fuel rises with the no. of kids. On the other end, the share of miscellaneous goods, meat, and clothing decreases. This is logical; clothes tend to get handed over from the eldest to the youngest; meat is still not a basic food item. Surprisingly, the share of pan and intoxicants rises despite rise in the no. of kids. This is a reflection of the importance of this item in a household's budget. A similar pattern is revealed in Table 3b for the year 1987-88 (Round 43). Both tables can be compared to reveal the changes over time; the results are similar to the ones derived from table 1.These results on pan ,etc are disturbing. Further analysis shows that for Round 38, as the no. of kids grows beyond 4, the share of pan falls. this implies that an average household cuts down on is consumption of pan only in the face of very high demand of other items. Initial rises in the demand for basic goods (as no. of kids rises from 0 to 4)is met by reducing consumption of items like beverages, clothing, rather than pan and intoxicants, even though health concerns dictate otherwise

VI.B DEMAND YSYTEM ESTIMATES

Table 4 provides the values of Log L for models A ,B and C along with the no. of parameters in each. Clearly, the models incorporating demographic variables perform better. Between the two representations of household characteristics , B is better and has been used in state level estimation of demand behaviour.

Table 5 provides all India estimates of the demand system (Model B), using the data (970 cell points) from all 5 NSSO rounds described in section IV. These estimates are used as starting values to estimate the demand system for each state. It was seen that the use of starting values improves estimation in terms of Log L and overall significance of parameter estimates. For each state we used 55-60 observations which pertained to different rounds of NSS data. (Demand system parameters of each state are available with the authors)

VI.C OPTIMALCOMMODITY TAX RATES

Based on these parameters, we are able to derive the optimal tax rates by solving the first order conditions. Tables 6a and 6b provide tax rates are provided at two levels of inequality aversion parameter (.01 and 5.0), and two revenue levels (18% and 30% of total incomes of households included in the data). The results can be interpreted as follows: a value of 0.35 implies that if price of cloth is 1 Re. then a tax of 35 paisa must be levied at the optimum. A negative value would imply a subsidy. Items like food, spices, fuel, attract a subsidy reflecting on their necessity in a household.

A cursory glance at each these tables reveals considerable non uniformity of tax rates across goods and more importantly, across states. Not only do the absolute values of optimal tax rates vary across states for any chosen good at chosen levels of revenue and inequality aversion parameter but, some states demand a tax on the good, whereas another some demand a subsidy on the same good. This implies that a good cannot be uniformly treated as a taxable/subsidized

good. This confirms that optimal tax rates over broad geographical regions/ all India level have little relevance.

Next we compare tables 6a and 6b to reveal the reaction of optimal tax rates to an increase in revenue requirement, keeping the inequality aversion parameter same. One possible reaction could be that the higher revenues are generated by uniformly increasing tax rates/ reducing subsidy rates on all goods. This is indeed the case for most states(eg Rajasthan). But there are also some exceptions for eg, in Jammu & Kashmir, as revenue required rises the tax rate on edible oil does not rise, in West Bengal the subsidy on spices rises even though greater revenues are required. It can be argued that such goods are essential in every household's budget irrespective of income. Therefore, such goods should not attract higher taxes, despite the need for more revenues. We refer to these goods as "everyman's goods". Besides such state specific and commodity specific cases, there is one state where such exceptions are the rule- Bihar. Here higher revenues are generated by a changing the mix of taxed and subsidised goods. It seems logical to argue that the tax rates are already very high compare to other states. As a result when higher revenues are required, they are not generated by a uniform rise in tax rates on all goods. This state generates higher revenues by changing the overall mix of tax and subsidy rates; this may involve a fall in certain tax rates/a rise in subsidy rates.

These observations are reinforced when we compare the two tables with the inequality aversion parameter at Rawlsian levels of 5.0.the list of everyman's goods rises when inequality aversion parameter is higher. This implies that when the social consideration to poorer sections rises, more and more goods become essential to a household budget. In some cases like food in Orrisa, taxes are replaced by a subsidy even though higher revenues are needed. Thus, our results show that the State satisfies the higher revenue demand by making appropriate changes in the tax/subsidy rates on different goods- keeping in mind that everyman's goods should not be taxed at higher rates. Optimality dictates that the State does not raise tax rates across the board; especially when the inequality aversion parameter is higher, the mix of tax/ subsidy rates witnesses radical changes in response to higher revenues.

These tables can be compared again to examine the effect of rising inequality aversion parameter on optimal tax rates, for given levels of revenues. Since a rise in inequality aversion parameter signals greater weightage to the poorer sections it is reasonable to argue that as inequality aversion parameter rises taxes on goods consumed by the richer sections of society should be raised; subsidies on goods that form a major part of poor household' s budget must be increased. We refer to the latter as " poorman's goods". For eg, food is a broad commodity group which attracts a higher subsidy in most states as the inequality aversion parameter rises from 0.01 to 5.0. spices and fuel also fall in this category. On the other hand, miscellaneous goods call a tax hike; it is safe to assume that these are more important to a rich man. These results are generally sensible, except for some exceptions. To illustrate, in Gujarat and Haryana optimal tax rates are nominally higher for food when inequality aversion parameter rises. Some of these cases can be attributed to specific reasons like the overall well being/ richness of a state or specific consumer demand pattern. In an earlier study

(Bhatnagar) it was shown that at all India urban level, optimal tax rates on food do fall as the weightage to a poorer household rises. This reiterates the importance of differences in demand patterns across states, the differences are getting reflected in the optimal tax rates calculated at different levels of the inequality aversion parameter.

VI.D REDISTRIBUTIVE EFFECT OF TAXES

Tables 7a and 7b provide evidence of the role of indirect taxes as a tool for redistribution. The redistribution implied by the optimal tax rates was determined at different levels of the inequality aversion. The calculations were performed on 3 hypothetical households - one, the poorest household in the sample; two, the average household; three, the household that gets half the average income of all households in our sample. A negative reported value for a household implies that this household has to pay some amount of taxes; there is no real gain in real income due to the imposition of optimal taxes. For any household to gain, the reported value must be positive. At the margin $-Th / Eh = 0$. this is possible when $E^* = Eh$.

Tables 7a and 7b show a negative value for most states, pointing at the limited/ ineffective role of indirect taxes as a tool for redistribution. There are two exceptions to this observation-Gujarat and Haryana. It can also be seen that as the importance of the poorer households rises, the amount of tax too be paid by any of the chosen household reduces in some states like Karnataka, Andhra Pradesh, Gujarat, Haryana, Orrisa, UP and West Bengal, as expected. This is a positive sign although the households still do not benefit as they still pay a tax, rather than receive a real income at the optimal tax rates. Our calculations show that for any household to benefit, its income (E^*) must be extremely low in all states- the value of this income is as low as Re1 - Re2. Thus, the scope of indirect taxes as a tool for redistribution seems limited in India.

VII. CONCLUSION

Our study is an attempt to study the effects of regional variation and demographic variables on consumer demand behaviour, through their manifestation on optimal tax rates. This has been done by treating each of the chosen 16 Indian states separately for the purposes of demand system estimation. We have used the Restricted Non Linear Preference System, while incorporating demographic variables in it through the technique of scaling.

Our results are in line with those of earlier studies in terms of non uniformity of optimal tax rates. The results also reinforce our hypothesis that the tax rates are heavily influenced by demand patterns. The tax rates are non uniform across commodities and across states. The sensitivity of tax rates to different revenues levels and the choice of inequality aversion parameter has been amply demonstrated. It can be argued that the reaction of optimal tax rates to changes in these parameters is not uneven across goods and even varied across states. Figures suggest that there is a unique mix of taxed/ subsidsed goods along with the respective rates specific to a chosen level of social inequality and revenues. Finally, the role of indirect taxes as a tool for redistribution of income is limited in most states

REFERENCES

Ahmad, E and N.H. Stern (1984) The theory of reform and Indian indirect taxes, Journal of Public Economics, Vol 25, 259-298.

Atkinson, A.B. and J. E. Stiglitz (1972) The structure of indirect taxation and economic efficiency, Journal of Public Economics, Vol 1, 97-119.

Bhatnagar,A. (2000) M.Phil Dissertation, Dept of Economics, Delhi School of Economics.

Blacklow, P and Ray, R (2000) Optimal Commodity taxes in Australia and their sensitivity to consumer preference and demographic specification, University of Tasmania, working Paper (2000)

Blundell, R. W. and R. Ray (1984) Testing for linear Engel curves and additively separable preferences using a new flexible demand system, Economic Journal, Vol 94, 800-811.

Cragg, M. (1991) Do we care? A study of Canada's indirect tax system, Canadian Journal of Economics, Vol 24, 124-142.

Deaton. A. (1977) Equality, efficiency and the structure of Indirect taxes, Journal of Public Economics, Vol 8. No. 3, 299-312.

Decoster, A and E. Schokkaert (1990) Tax reform results with different demand systems, Journal of Public Economics, Vol 41, 277-296.

Ebrahimi, A. and C. Heady (1988) Tax design and household composition, Economic Journal (Conference Supplement) Vol 98, 83-96.

Fukushima, T. and T. Hatta (1989) Why not tax uniformly rather than optimally?, Economic Studies Quarterly, Vol 40, 220-238.

Harris, R.G. and J.G. Mackinnon (1979) Computing optimal tax equlibria, Journal of Public Economics, Vol 11, 197-212.

Hatta, T. (1986) Welfare effects of changing commodity tax rates towards uniformity, Journal of Public Economics, Vol 29(1), 99-112.

Madden, D. (1995) Labour supply, commodity demand and marginal tax reform, Economic Journal, Vol 105,485-497.

Majumdar, A. (1988) A note on optimal commodity taxation in India, Economic Letters, Vol 27,167-171.

Meenakshi, J.V and Ray,R (1999) Regional differences in India's food expenditure pattern: A Complete demand systems approach, J. of International Development, Vol 11, 1999.

Meenakshi, J.V.(1996) How important are changes in taste? A state level analysis of food demand, EPW,Dec 14,1996.

Muelbauer, J.(1976) Commodity preferences and the representative consumer, Econometrica, Vol 44, 979-999.

Murty, M.N. and R. Ray (1989) A computational procedure for calculating optimal commodity taxes with illustrative evidence from Indian budget data, Scandinavian Journal of economics, Vol 91(4) 655-670.

Pollack, R. A. and Wales, T. J.(1980) Comparison of Quadratic Expenditure system and translog systems with alternative specifications of demographic effects, Econometrica, Vol 3 . Apr 1980

Pollack, R. A. and Wales, T. J.(1981) Demographic variables in Demand analysis, Econometrica, Vol 6, Nov 1981.

Ray, R (1980) Analysis of a time-series of household expenditure surveys for India, Review of Economics and Statistics, November, 595-602..

Ray, R (1985) A dynamic analysis of expenditure patterns in rural India, Journal of Development Economics, Vol 19, 283-297.

Ray,R (1986a) Sensitivity of 'Optimal' commodity tax rates to alternative demand functional forms: An econometric case study of India, Journal of Public Economics, Vol 31, 253-268.

Ray,R (1986b) On setting indirect taxes in India using the Ramsey approach: evidence from household budget data, Journal of Quantitative Economics, Vol 20, 171-190.

Ray. R (1980) Analysis of a time-series of household expenditure surveys for India, Review of Economics and Statistics, November, 595-602.

Sah, R. K. (1983) How much redistribution is possible through commodity taxes? Journal of Public Economics, Vol 20, 89-101.

Srinivasan, P.V. (1989) Redistributive impact of 'Optimal' taxes, Economic Letters, Vol 30,385-388.

Tendulkar, S.D. and L.R. Jain (1993) An analysis of interstate and inter-commodity groups-Rural and urban consumer price indices in India:

1983 to 1988-89, Journal of Indian School of Political Economy, Vol 5, no. 2, April- June, 267-285.

A Short Bio of Dr. A. K. Seth and Ms. Ankur Bhatnagar

Dr. A. K. Seth is a reader in Department of Commerce, Delhi School of Economics & Ms. Ankur Bhatnagar is a Lecturer in the Department of Economics, Satyawati College. Both are in University of Delhi

End Notes

[1] The values on β^h are derivable from the consumer expenditure surveys as they involve only expenditure levels of different households.. If $\varepsilon>0$, $\beta^h<1$ so that any increment to expenditure is more valuable to the poor household 1 than to household h.

[2] Different values to ε can be assigned by a social planner, which have different meanings A value of 1 to ε says that a marginal unit to household h is worth half as much as a marginal unit to household 1 if the former makes twice the expenditure made by household 1. A value of above 5 to ε would imply a Rawlsian social welfare function, where only the welfare of the poorest is considered.

Briefly then, higher is the value of ε, the aversion (dislike) for inequality is higher. The tax planner can express desired levels of inequality in the system by specifying ε value while setting taxes, as it represents the preference accorded to the lower income households vis-à-vis the richer households.

[3] Linear scaling is a special case of scaling which involves replacing p_i in the original demand function with $p_i m_i$ where $m_i = 1 + \sum_k d_{ki} \eta_k$ where k= no. of demographic variables, η represents the demographic variables, I refers to commodity group i. This causes a maximum of (k*n) no. of extra parameters. n is the 5 no. of commodity groups. To limit the no. of new parameters we use $m_i = m$ for all i in this study.

[4] The choice of these variables is forced by data availability. Given a choice we would like to incorporate the difference in the sex of kids in a family, along with the age of kids. These variables have been shown to be important determinants of consumer behaviour in gender studies and studies on optimal commodity taxes for developed nations. However, the NSSO in India does not report the age of kids. In fact the reporting of distinction in the sex of kids is also very recent Continuous data as required by this study is available only about the no. of males, female adults and no. of kids.

[5] Estimation was done using SHAZAM and SURE method was employed. For this, the equation for pan and intoxicants was dropped as its budget share was the lowest. However it was seen that the results are sensitive to the exact equation dropped for estimation. This corroborates our earlier work which found that the sensitivity of the esti,mates rises with the complexities of non linear estimation. For a linear system like LES the results were indifferent to the equation dropped.

TABLE 1(a): WEIGHTED BUDGET SHARES: COMMODITY WISE FOR EACH STATE

ROUND 32(1977-78), ROUND 38(1983), ROUND 43(1987-88), ROUND 50(19993-94)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA	.066026	.05318	.039193	.65842	.034627	.04205	.131062	.034506	.056873
PRADESH	.076606	.063497	.046471	.597874	.67878	.045803	.197786	.032315	.048127
	.061296	.068443	.050763	.578576	.067708	.039605	26668	.033863	.049645
	.049798	.063418	.047983	.57263	.065883	.040641	.262586	.03083	.047256
ASSAM	.055961	.05887	.048155	.666054	.067724	.03828	.095728	.037996	.043886
	.05462	.05969	.040194	.66966	.075261	.072569	.149028	.02882	.02882
	.092618	.068613	.045487	.625526	.070741	.074177	.171212	.031878	.038329
	049374	.070894	.038221	.620083	.063092	.078115	.206174	.040548	.029923
BIHAR	.055668	.045905	.051775	.71278	.061184	.037516	.101988	.022141	.040291
	.07501	.047806	.048268	.689229	.067532	.03514	.133678	.022074	.03576
	.04873	.047996	.057059	.6605	.070195	.32645	.183668	.019271	.039408
	.037843	.057514	.046943	.653873	.070196	.035773	.206243	.017357	.041235
GUJARAT	.058346	.052553	.071522	.639382	.052111	.014149	.130445	.020082	.068334
	.069804	.056905	.085703	.640309	.072948	.105298	.18281	.020838	.059434
	.036254	.054669	.056524	.626363	.084739	.012915	.205902	.021293	.059874
	.039157	.073121	.080604	.600718	.073021	.013339	.243962	.019987	.052721
HARYANA	.064613	.042782	.046411	.635419	.065555	.00515	.159089	.016497	.060023
	.105051	.039661	.047907	060521	.007192	.009094	.168369	.037655	.056736
	.062447	.051806	.056903	.584109	.071725	.010966	.192173	.026012	.055574
	.041299	.049308	.037971	.563356	.072623	.006761	.263854	.02358	.05766
J & K	.049785	.086044	.060294	.683255	.08524	.053451	.123373	.025963	.052764
	.093579	.042233	.057289	.60014	.068431	.049947	.133848	.023429	.038899
	068985	.053632	.066232	.625603	.069045	.05337	.181095	.034454	.037308
	.054277	.062863	.045566	.585939	.04526	.022626	.26197	.025069	.041849

TABLE 1(b): WEIGHTED BUDGET SHARES: COMMODITY WISE FOR EACH STATE

ROUND 32(1977-78), ROUND 38(1983), ROUND 43(1987-88), ROUND 50(19993-94)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
KAR	.053751	.066575	.032415	.647402	.080178	.029697	.137494	.025671	.063749
	.079294	0079061	.038751	.604412	.079757	.033824	.186377	.029026	051859
	.062314	.077581	.044918	.594983	.078959	.033047	.202537	.027477	.056814
	.044487	.0794	.039496	.579684	.075187	.035378	.258879	.026207	.050866
KERELA	.052653	.709591	.022585	.637589	.066754	.059049	.128332	.031554	.057944
	.056539	.102208	.030348	.64178	.066369	.068843	.177185	.026949	.035774
	.067793	.135703	.047785	.871788	.099852	.115722	.281896	.032477	.071048
	.070985	.090653	.028273	.578598	.060988	.085074	.229516	.025955	.048638
MAHA	.066396	.067666	.05163	.610869	.073514	.031751	.156815	.023244	.061678
RASHTRA	.069222	.069222	.059618	.597538	.074638	.034895	.202624	.020766	.050658
	.059141	.069635	.064878	.585145	.070409	.036827	.226272	.0214	.052407
	.040213	.081594	.055392	.549221	.067911	.03363	.273746	.020488	.047224
MADHYA	.061086	.0433994	.056923	.654621	.065729	.018273	.101537	.027072	.061041
PRADESH	.072804	.052193	.055902	.632196	.077691	.022574	.177786	.028152	.053394
	.0591	.054674	.063371	.600629	.071514	.020723	.205783	.025706	.054757
	.057669	.050125	.052646	.5645	.071592	.019207	.245468	.030184	.030187
ORRISA	.059125	.060028	.042298	.692774	.068537	.040516	.09796	.028062	.044389
	.073597	.059363	.038595	.678873	.073946	.045076	.13169	.025363	.039244
	.106714	.064813	.046931	.606166	.074844	.042576	.169493	.027523	.038536
	.065609	.073343	.035061	.59702	.080736	.048146	.048146	.028815	.038258
PUNJAB	.069007	.06021	.04585	.620908	.69014	.012616	.168159	.019883	.074581
	.074088	.063096	.51657	.584826	.082328	.011429	.20419	.020375	.069776
	.068506	.032722	.059695	.565868	.078819	.009759	.230988	.024909	.065627
	53719	.065257	.046195	.540385	.078218	.077805	.277877	.020479	.060171

TABLE 1(c): WEIGHTED BUDGET SHARES: COMMODITY WISE FOR EACH STATE

ROUND 32(1977-78), ROUND 38(1983), ROUND 43(1987-88), ROUND 50(19993-94)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
RAJAS	.077111	.044729	.051411	.634895	.068315	.01691	.142485	.028059	.067266
THAN	.098139	.049502	.0566	.60633	.074095	.020654	.168177	.027631	.06204
	.061735	.043534	.0672	.598102	.069035	.016355	.208178	.028065	.062652
	.046744	.055291	.047087	.566225	.074645	.013776	.238901	.031605	05935
TAMIL	.057633	.078868	.034032	.650817	.072577	.036578	.130201	.021632	.06043
NADU	.052836	.072898	.036242	.639893	.07325	.03625	.192079	.024291	.049489
	.061665	.077323	.038514	.566377	.064449	.036206	.209563	.022073	.078233
	.040248	.089273	.038787	.592733	.069735	.044368	.252483	.021069	.043647
UTTAR	.065045	.035806	.05478	.66024	.075336	.024963	.118003	.024569	.059453
PRADESH	.067293	.041934	.051763	.625979	.130839	.028122	.179224	.02617	.05517
	.062065	047489	.059913	.603874	.084126	.020464	.19863	.025191	.057793
	.053228	.050409	.043254	.596043	.077383	.023727	.232338	.024927	.057864
WEST	.057889	.06264	.05218	.658996	.063998	.074492	.107307	.03006	.043545
BENEGAL	.063844	.069208	.044633	.637279	.072008	.07178	.187709	.02762	.035538
	.063786	.071134	.049358	.611003	.079649	.021527	.19314	.034612	.033658
	.049396	.075384	.040285	.5956680	.07755	.073666	.232261	.029918	.036526

TABLE 2a: MARGINAL BUDGET SHARE OF AN AVERAGE HOUSEHOLD (ROUND 50)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA PR	0.119116	0.129539	0.043822	0.465001	0.05641	0.041035	0.291814	0.018003	0.03548
ASSAM	0.101505	0.12294	0.03028	0.514491	0.052296	0.073877	0.248512	0.031465	0.026677
BIHAR	0.070315	0.091477	0.043722	0.537073	0.056213	0.039821	0.275106	0.024429	0.035346
GUJARAT	0.050196	0.084333	0.077124	0.549968	0.07651	0.011584	0.264563	0.050451	0.047285
HARYANA	0.072872	0.081632	0.028378	0.472518	0.066127	0.005207	0.29065	0.096281	0.043163
J & K	0.068977	0.086812	0.044253	0.547623	0.049734	0.12035	0.279181	-0.06648	0.03819
KARNATAKA	0.090842	0.124984	0.036143	0.495482	0.05194	0.039493	0.307628	0.025932	0.035143
KERELA	0.085182	0.108201	0.029787	0.517177	0.048844	0.073314	0.250018	0.049092	0.041169
MADHYA PR	0.054716	0.094984	0.053655	0.500286	0.05548	0.029626	0.303745	0.06649	0.034601
MAHARSTRA	0.08865	0.082791	0.049114	0.49332	0.056203	0.023528	0.292838	0.031562	0.046305
ORRISA	0.097873	0.114703	0.035085	0.485843	0.062366	0.049586	0.265963	0.039638	0.032986
PUNJAB	0.063933	0.075472	0.047175	0.533814	0.076565	0.008952	0.270768	0.044619	0.059368
RAJASTHAN	0.083933	0.092769	0.040622	0.475792	0.054651	0.014436	0.285398	0.070647	0.048289
TAMIL NADU	0.075524	0.125535	0.036181	0.492989	0.056167	0.042734	0.306497	0.048114	0.032464
UTTAR PR	0.086098	0.079368	0.039053	0.516228	0.058524	0.02292	0.274368	0.033053	0.048742
WEST BEN	0.07822	0.102293	0.036785	0.512152	0.058118	0.084529	0.274223	0.033626	0.02703

TABLE 2b: MARGINAL BUDGET SHARE OF THE RICHEST HOUSEHOLD (ROUND 50)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA PR	0.164955	0.065656	0.026559	0.273329	0.032122	0.034052	0.414315	0.016921	0.015224
ASSAM	0.135198	0.114073	0.022893	0.334725	0.02103	0.085919	0.333386	0.064424	0.011608
BIHAR	0.14658	0.101883	0.030338	0.30089	0.033573	0.041175	0.399231	0.01647	0.018854
GUJARAT	0.105929	0.079585	0.028943	0.277704	0.047001	0.00435	0.410459	0.037768	0.013434
HARYANA	0.119606	0.083804	0.008577	0.273546	0.020098	0.01201	0.389228	0.085201	0.005955
J & K	0.126954	0.076467	0.014641	0.349509	0.022623	0.134843	0.341581	-0.07041	0.012695
KARNATAKA	0.143668	0.132263	0.01615	0.277344	0.020758	0.022176	0.455202	0.013979	0.004235
KERELA	0.134569	0.078198	0.015742	0.275342	0.017957	0.043933	0.345238	0.03928	0.012825
MADHYA PR	0.088654	0.106199	0.021373	0.284544	0.031453	0.016665	0.43456	0.059614	-0.00041
MAHARSTRA	0.148421	0.06064	0.018438	0.204848	0.010613	0.014719	0.442299	0.021756	0.010994
ORRISA	0.139312	0.158682	0.019176	0.26374	0.01265	0.040293	0.408103	0.031669	0.013674
PUNJAB	0.122223	0.060383	0.015167	0.293443	0.035487	0.009198	0.438473	0.03948	0.01463
RAJASTHAN	0.196154	0.095043	0.015734	0.275069	0.011891	0.005729	0.43158	0.062684	0.010348
TAMIL NADU	0.137839	0.102637	0.016413	0.212862	0.015825	0.025595	0.441618	0.03497	0.005078
UTTAR PR	0.170244	0.077117	0.01729	0.278143	0.021643	0.007072	0.381027	0.018985	0.0167
WEST BEN	0.139711	0.102198	0.01908	0.269314	0.032593	0.075668	0.429918	0.02926	0.009871

TABLE 2c: MARGINAL BUDGET SHARE OF THE POOREST HOUSEHOLD (ROUND 50)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA PR	0.084078	0.06885	0.054293	0.573248	0.07549	0.040172	0.209031	0.022647	0.047928
ASSAM	0.070434	0.068822	0.032083	0.622029	0.074653	0.027147	0.152889	0.032122	0.043215
BIHAR	0.03248	0.054603	0.043392	0.663177	0.095727	0.016825	0.177399	0.023843	0.041854
GUJARAT	0.016902	0.06874	0.100962	0.649592	0.101983	0.000793	0.187287	0.047478	0.071322
HARYANA	0.090072	0.05365	0.038501	0.538837	0.176958	-0.00055	0.203928	0.100651	0.058514
J & K	0.0337	0.033487	0.079771	0.486316	0.086809	0.13573	0.298686	-0.09244	0.035189
KARNATAKA	0.05539	0.079153	0.053777	0.589841	0.069558	0.082675	0.211721	0.043163	0.056191
KERELA	0.041681	0.081901	0.035596	0.608631	0.078404	0.032312	0.19737	0.047386	0.062127
MADHYA PR	0.031416	0.073066	0.06635	0.580073	0.078822	0.007965	0.230229	0.073042	0.069443
MAHARSTR	0.050333	0.046282	0.063488	0.616174	0.098634	0.040981	0.198937	0.041025	0.066635
ORRISA	0.061675	0.050193	0.037699	0.613245	0.089758	0.014556	0.148271	0.052544	0.042756
PUNJAB	0.037381	0.072011	0.066123	0.666622	0.107196	0.010251	0.163671	0.047696	0.081828
RAJASTHAN	0.049943	0.06122	0.030505	0.527875	0.054651	0.027863	0.23443	0.087895	0.069187
TAMIL NADU	0.041148	0.089183	0.040285	0.598753	0.102889	0.023691	0.233615	0.051666	0.057198
UTTAR PR	0.042688	0.049515	0.045503	0.636025	0.083578	0.038084	0.185621	0.033674	0.07135
WEST BEN	0.043852	0.061655	0.043865	0.640806	-0.01229	0.014311	0.167662	0.036686	0.036849

TABLE 3a: BUDGET SHARES ACCORDING TO NO. OF KIDS: ROUND 50

NO.OF KINDS	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
0-1	.086	.088	.104	.462	.0513	.037	.326	.0216	.0293
1-2	.0407	.0646	.047	.615	.074	.04	.227	.0535	.0521
2-3	.0168	.152	.059	.692	.091	.029	.162	.0318	.067
3-4	.0164	.037	.051	.693	.096	.0179	.151	.0375	.0705

TABLE 3b: BUDGET SHARES ACCORDING TO NO. OF KIDS: ROUND 43

NO.OF KINDS	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
0-1	.13	.0778	.041	.459	.048	.038	.259	.259	.032
1-2	.059	.065	.055	.616	.072	.042	.208	.208	.052
2-3	.026	.052	.066	.693	.087	.038	.153	.153	.064
3-4	.0169	.041	.068	.714	.095	.028	.131	.131	.066

TABLE 4: COMPARISON OF MODEL RESULTS

MODEL NAME	N	LOG LIKELIHOOD
0-1A	18	12889.4
B	21	13058.1
C	20	13041.1

TABLE 5: PARAMETER ESTIMATES FOR ALL INDIA RNLPS

PARAMETER	VALUE	T-RATIO
b1	.43349	16.812
b2	.19678	4.1933
b3	.066681	2.0144
b4	.11518	2.0308
b5	-.024412	-2.1094
b6	.07411	8.7798
b7	.77148	20.009
b8	.0026217	.040731
b9	-.036471	-3.8242
c1	.46861	13.81
c2	.16941	2.8819
c3	.032037	.78428
c4	-.45523	-5.5132
c5	-.096568	-6.1368
c6	.057835	5.4942
c7	.77265	15.457
c9	-.09368	-7.173
l	.0711822	-28.38
e1	8.5921	114.14
e2	1.7013	24.17
e3	.58724	6.9878

e1 stands for no. of kids. e2 stands for no. of adult males e3 stands for no. of adult females.

TABLE 6a: OPTIMAL COMMODITY TAX RATES

(REVENUE = 18 %)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA	-0.4435	0.242	-0.076	-0.0092	-0.067	0.088	0.668	0.094	-0.09
PRADESH	0.231	0.113	0.302	0.26	0.273	0.208	-0.07	0.133	0.26
ASSAM	0.35	0.182	0.144	0.0933	-0.0082	0.224	0.225	0.388	-0.0643
	0.162	0.453	0.84	-0.32	0.83	0.72	0.486	1.07	0.8108
BIHAR	5.9228	3.2884	-1.2194	-2.7861	-5.1751	2.83	4.55	18.53	-3.1704
	6.0068	3.3352	-1.2396	-2.8303	-5.25	2.87	4.62	18.8	-3.22
GUJARAT	0.379	0.13	0.12	0.197	0.0344	0.248	0.207	-2.7	0.357
	0.39	0.39	0.124	0.202	0.022	0.26	0.21	-2.9	0.367
HARYANA	0.15	0.256	0.429	0.192	0.296	0.611	0.226	-2.79	0.274
	0.133	0.266	0.468	0.222	0.269	0.792	0.269	-4.0066	0.22334
JAMMU &	0.541	0.167	3.57	-0.102	-0.533	0.341	0.242	0.2007	-0.34105
KASHMIR	0.82	0.107	9.2	-0.444	-1.32	0.38	0.225	0.00756	-0.831
KARNATAKA	0.50468	0.267	-0.04	0.049	0.049	-0.012	0.3117	0.2488	-0.0622
	-0.363	-0.067	0.414	0.347	0.328	0.498	-0.1322	-0.1045	0.481
KERELA	0.403	0.23	0.00149	0.0496	-0.09	0.082	0.373	0.241	-0.157
	0.72	0.301	-0.124	-0.0455	-0.362	0.063	0.533	0.361	-0.477
MAHARASTRA	0.58	0.45	-0.07	-0.0021	-0.155	-0.028	0.43	1.29	-0.59
	0.866	0.68	-0.2	-0.10057	-0.388	-0.0819	0.613	2.02	-1.1395
MADHYA	0.852	0.53	-0.158	-0.163	-0.78	0.755	0.665	0.627	-0.495
PRADESH	1.0028	0.614	-0.22	-0.23	-0.98	0.897	0.768	0.716	-0.639
ORRISA	0.496	0.452	0.0293	-0.0174	-0.375	0.177	0.4268	0.623	-0.128
	0.555	0.518	0.148	0.109	-0.211	0.277	0.496	0.667	0.00914
PUNJAB	0.605	0.223	-0.026	0.0689	0.0659	0.128	0.391	-1.1153	-0.0373
	0.564	0.215	-0.011	0.074	0.071	0.127	0.377	-1.0137	-0.0187
RAJASTHAN	0.66	0.36	-0.089	-0.0207	-0.246	-0.067	0.452	0.611	-0.2769
	0.77	0.41	-0.133	-0.062	-0.362	-0.104	0.523	0.713	-0.38
TAMIL NADU	0.981	0.421	-0.0735	-0.193	-0.628	0.142	0.657	2.73	-1.19
	1.203	0.49	-0.127	-0.286	-0.833	0.155	0.788	3.42	-1.5827
UTTAR	0.497	0.283	-0.0169	0.062	0.0402	-0.168	0.323	0.126	-0.505
PRADESH	0.308	0.216	0.087	0.1189	0.11	0.0256	0.23	0.133	0.072
WEST	0.102	0.088	-0.0949	0.061	-0.02	-0.057	0.163	0.822	-0.013
BENGAL	0.033	0.036	-0.0289	-0.01017	0.0122	-0.034	0.0789	0.808	0.033

The first row for each state is for inequality aversion parameter = 0.01; the second row is for inequality aversion parameter =5.0

TABLE 6b: OPTIMAL COMMODITY TAX RATES

(REVENUE = 30 %)

	CLOTHING	BEVERAGES	EDIBLE OIL	FOOD	FUEL	MEAT, ETC	MISC GOODS	PAN, ETC	SPICES
ANDHRA	-0.358	0.323	0.061	0.121	0.064	0.18	0.731	0.194	0.035
PRADESH	0.237	0.209	0.397	0.359	0.365	0.286	0.08	0.228	0.345
ASSAM	0.497	0.284	0.245	0.2006	0.11037	0.3168	0.30114	0.46	0.0608
	0.33	0.522	0.858	-0.163	0.85	0.757	0.531	1.06	0.831
BIHAR	4.811	2.736	-0.821	-2.06	-3.9381	2.3605	3.7289	14.669	-2.3698
	4.892	2.78	-0.849	-2.12	-4.014	2.39	3.79	14.93	-2.417
GUJARAT	0.468	0.248	0.237	0.286	0.152	0.318	0.318	-2.108	0.408
	0.479	0.249	0.235	0.289	0.142	0.329	0.3206	-2.29	0.417
HARYANA	0.295	0.362	0.452	0.283	0.351	0.637	0.343	-1.9139	0.3187
	0.28	0.37	0.485	0.308	0.327	0.792	0.379	-2.9532	0.448
JAMMU &	0.628	0.32	1.56	0.118	-0.248	0.464	0.386	0.371	-0.10
KASHMIR	0.856	0.272	6.1931	-0.16	-0.895	0.496	0.372	0.214	-0.499
KARNATAKA	0.578	0.348	0.0688	0.165	0.164	0.126	0.393	0.337	0.065
	-0.184	0.053	0.468	0.427	0.409	0.575	0.0028	0.0272	0.542
KERELA	0.473	0.324	0.115	0.169	0.0338	0.1866	0.451	0.3344	-0.029
	0.753	0.392	0.00511	0.086	-0.2044	0.1688	0.5917	0.43964	-0.309
MAHARASTRA	0.629	0.517	0.06	0.12	-0.017	0.093	0.5	1.26	-0.407
	0.88	0.717	-0.053	0.034	-0.22	0.047	0.66	1.9	-0.886
MADHYA	0.86	0.59	-0.0199	-0.0075	-0.55	0.84	0.71	0.67	-0.301
PRADESH	0.998	0.663	-0.073	-0.067	-0.73	0.96	0.79	0.75	-0.42
ORRISA	0.555	0.518	0.148	0.109	-0.211	0.277	0.496	0.667	0.00914
	0.854	0.753	0.091	-0.049	-0.67	0.378	0.74	1.0073	-0.2142
PUNJAB	0.672	0.325	0.103	0.186	0.184	0.23	0.468	-0.885	0.095
	0.637	0.317	0.116	0.1909	0.1894	0.1897	0.229	0.4566	-0.797
RAJASTHAN	0.693	0.445	0.051	0.113	-0.077	0.071	0.518	0.633	-0.106
	0.79	0.48	0.013	0.077	-0.17	0.0388	0.58	0.722	-0.2029
TAMIL NADU	0.957	0.485	0.063	-0.033	-0.406	0.245	0.688	2.45	-0.88
	1.15	0.5469	0.015	-0.115	-0.587	0.257	0.804	3.06	-1.23
UTTAR	0.572	0.387	0.111	0.179	0.155	-0.021	0.415	0.225	0.0801
PRADESH	0.407	0.328	203	0.229	0.217	0.148	0.333	0.231	0.188
WEST	0.252	0.198	0.009	0.0366	0.0698	0.0622	0.26028	0.829	-0.093
BENGAL	0.189	0.1508	0.069	0.082	0.099	0.083	0.183	0.816	0.111

The first row for each state is for inequality aversion parameter = 0.01; the second row is for inequality aversion parameter =5.0

TABLE 7a: MEASUREMENT OF INEQUALITY:VALUES OF T/E

(REVENUE = 18%)

inequality aversion parameter = 0.01 inequality aversion parameter=5.0

	HOUSE 1	HOUSE 2	HOUSE 3	HOUSE 1	HOUSE 2	HOUSE 3
ANDHRA PR	-0.13356	-0.1356	-0.13691	-0.10204	-0.10361	-0.1046
ASSAM	-1.15877	-1.1634	-1.166	-2.52616	-2.53568	-2.54191
BIHAR	-46.3997	-46.57	-46.6869	-47.0974	-47.2757	-47.3888
GUJARAT	11.39719	11.4358	11.46026	11.8539	11.89406	11.9195
HARYANA	5.62385	5.64362	5.658619	7.941412	7.969328	7.990508
J & K	-0.57613	-0.578	-0.57979	-0.73331	-0.73582	-0.73796
KARNATAKA	-0.76262	-0.7668	-0.76921	0.855278	0.85983	0.862675
KERELA	-0.26715	-0.2714	-0.27361	-0.38422	-0.39039	-0.3935
MADHYA PR	-2.41894	-2.4308	-2.43778	-3.94009	-3.95949	-3.97077
MAHARSTRA	-3.06258	-3.0762	-3.08378	-3.67762	-3.69406	-3.70307
ORRISA	-2.23065	-2.2396	-2.24542	-2.06901	-2.07734	-2.08271
PUNJAB	-0.03572	-0.0358	-0.03591	-0.05007	-0.05022	-0.05033
RAJASTHAN	-4.00533	-4.0191	-4.02876	-4.90515	-4.92209	-4.93385
TAMIL NADU	-5.41068	-5.4434	-5.45699	-6.82126	-6.86258	-6.87964
UTTAR PR	-2.12328	-2.1314	-2.1363	-0.91948	-0.92302	-0.92511
WEST BENGAL	-0.57029	-0.5726	-0.574	-0.42966	-0.43142	-0.43246

Household 1 refers to the household with the lowest income in the sample
Household 2 refers to the household with half the average income in the sample
Household 1 refers to the household with the average income in the sample

TABLE 7b: MEASUREMENT OF INEQUALITY:VALUES OF T/E

(REVENUE = 30%)

inequality aversion parameter = 0.01 inequality aversion parameter=5.0

	HOUSE 1	HOUSE 2	HOUSE 3	HOUSE 1	HOUSE 2	HOUSE 3
ANDHRA PR	-0.21351	-0.21679	-0.21887	-0.18585	-0.18871	-0.19051
ASSAM	-1.27132	-1.27611	-1.27924	-2.46984	-2.47915	-2.48525
BIHAR	-36.7114	-36.8504	-36.9386	-37.4362	-37.578	-37.6679
GUJARAT	9.040302	9.070932	9.090335	9.784129	9.817279	9.838278
HARYANA	3.887016	3.90068	3.911046	5.948191	5.9691	5.984964
J & K	-0.80519	-0.80795	-0.8103	-0.92734	-0.93052	-0.93322
KARNATAKA	-0.79521	-0.79944	-0.80208	0.626855	0.630191	0.632277
KERELA	-0.35321	-0.35889	-0.36174	-0.45681	-0.46415	-0.46785
MADHYA PR	-2.25403	-2.26513	-2.27158	-3.58432	-3.60198	-3.61224
MAHARSTRA	-2.78378	-2.79623	-2.80304	-3.31243	-3.32724	-3.33535
ORRISA	-2.06901	-2.07734	-2.08271	-3.89372	-3.9094	-3.9195
PUNJAB	-0.13445	-0.13485	-0.13517	-1.75335	-1.75857	-1.76267
RAJASTHAN	-3.51788	-3.53003	-3.53846	-4.29809	-4.31293	-4.32323
TAMIL NADU	-4.71628	-4.74485	-4.75665	-5.96095	-5.99706	-6.01197
UTTAR PR	-1.88069	-1.88794	-1.89222	33.07452	33.20196	33.2773
WEST BENGAL	-1.26616	-1.27133	-1.27439	-0.66989	-0.67263	-.67425

Household 1 refers to the household with the lowest income in the sample
Household 2 refers to the household with half the average income in the sample
Household 1 refers to the household with the average income in the sample