Price Elasticity Estimates for Tobacco and Other Addictive Goods in India*

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Abstract

The tax base of tobacco in India is found to be heavily depended on about fifteen per cent of the tobacco users who represent cigarettes smokers. Non-cigarette tobacco products that are used by the majority of tobacco users in India are largely out of the tax net. Analysis of the price elasticity of various tobacco products would bring out the potential of tax as an instrument to control tobacco use of any kind. In this context, this paper examines how the demand for a variety of tobacco products and addictive goods such as pan and alcohol respond to changes in prices. The spatial variations of prices that are obtained from a cross section of more than one lakh households spread across the country have been used for this purpose. Estimates of price elasticities showed that the own price elasticity estimates of various addictive goods in India ranged between -0.5 *to* -1.0 *with bidis, leaf tobacco and alcohol having elasticities close to unity. Cigarettes are the least price elastic of all. As against the general notions regarding the complementarity between cigarettes and alcohol, our study finds that these are substitutes at least in urban India. We also observed that, over a five year period, the addictive goods such as bidis and leaf tobacco in India have become slightly more price responsive while elasticity of cigarettes and pan have stabilized. The price elasticity estimates indicate the potential of increasing prices of addictive goods through taxation.*

Keywords: *Tobacco, Bidi, Cigarette, Alcohol, Consumption, Elasticity, India.*
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1 Introduction

Tobacco has become the predominant cause of preventable deaths in the world. There is overwhelming evidence in literature to prove the hazardous nature of tobacco use and a variety of diseases and disability associated with it. In India an estimated sixty five per cent of all men and thirty three per cent of all women consume some form of tobacco and India is home to nearly seventeen per cent of the smokers in the world (Shimkhada and Peabody, 2003). Estimates of household expenditure shares from the National Sample Survey (NSS) in India shows that expenditure on consumption of addictive goods account for 4.4 per cent of total budget of a household who choose to consume any of the addictive goods, in both rural and urban India. High prevalence of tobacco use coupled with a sizeable proportion of the family budget spent on its consumption will have far reaching implications on welfare of the public, in general, and the tobacco using households in particular.

The opportunity costs of spending on tobacco is very high especially for poor households. Busch *et al.* (2004) find that compared to non-smokers, smokers spent less on housing and apparels. Moreover tobacco use also imposes burden, especially on users, in the form of numerous tobacco related diseases such as cancer, tuberculosis, heart diseases and various acute respiratory diseases. Probability of various respiratory, vascular and neoplastic diseases and mortality rates are found to be higher among tobacco users compared to non-users (Gajalakshmi *et al.*, 2003). Hence, for a household, in addition to the dire health consequences ranging from disease to death and the consequent loss of an income earning member, it has also to bear other costs like consumption forgone for children in the form of milk and milk products and investment forgone in the form of education, which have a long term consequence in terms of adverse implications for human development and income earning opportunities. Considering the fact that prevalence of all kinds of tobacco consumption is higher among poor income groups in India[1], it is argued that tobacco

[1]See Rani *et al.* (2003); Subramanian *et al.* (2004) for information on prevalence of smoke and smokeless tobacco among various socio-economic groups based on the National family health survey data and John (2004) for a detailed analysis of the use of different kinds of tobacco products among

use has the potential to trap the poor in a vicious circle of poverty and ill health (John, 2005).

Regulating the use of all tobacco products is necessary as it would reduce the potential burden of decease, while leaving more disposable income in the hands of tobacco consuming households, which would have alternative uses. Ever since the huge morbidity and mortality associated with tobacco became evident, nations all over the world have been trying to regulate its use by various price and non-price instruments. Taxation is used as one of the important price instrument to regulate tobacco use. Like many other countries, cigarettes consumption has been under heavy taxation in India too. But unlike other countries, tobacco consumption in India is characterized by heavy use of non-cigarette tobacco in the form of bidis[2], leaf tobacco etc. Roughly eighty five per cent of the tobacco consumption in India is non-cigarette type. However, taxation of tobacco products in India is highly skewed towards cigarettes as shown in table 1. As high as eighty six per cent of the excise revenue collected from tobacco products is contributed by cigarettes whereas bidis, which is the predominant form of tobacco consumption, contribute only five per cent to the tobacco tax. Chewing tobacco also attracts only very small tax. The issue here becomes more serious when we consider the fact that bidis, which are consumed by the majority of tobacco users in India, is more harmful than cigarettes. Bidis contain only a small amount of tobacco compared to cigarettes. However, it delivers as much as 45mg - 50mg of Tar and 1.74mg - 2.05mg of Nicotine compared to 18mg - 28mg and 1.55mg - 1.92mg of Tar and Nicotine respectively in Indian cigarettes (Gupta *et al.*, 1992). If the tobacco products are sufficiently price responsive, an increase in the tax rate of addictive goods will have the effect of reducing the consumption substantially, while in fact raising the revenue.

To explore the potential of curbing tobacco use by raising taxes on non-cigarette tobacco along with cigarette tobacco it is imperative that we know the price re-

various socio-economic and religious groups based on the NSS data from the year 1999-2000.

[2]Bidi is an indigenous tobacco preparation in India made by rolling a dried piece of *Temburini* leaf (*Diospyros melanoxylon*) with 0.15 to 0.25g of sun-dried, flaked tobacco into a conical shape and securing the roll with a thread (Gupta *et al.*, 1992).

sponsiveness of various tobacco products. To the best of our knowledge there is no study that provide some information on the price responsiveness of tobacco and tobacco products in India. Against this backdrop, this paper examines how the demand for a variety of tobacco products and other addictive goods such as pan and alcohol respond to changes in prices. Major focus of this study is to analyze the behavior responses with respect to changes in prices of tobacco products. Earlier studies have, however, found association between consumption of tobacco products and pan and alcohol products in India.[3] Hence we explicitly introduce alcohol and pan consumption also into the analysis.

2 Studies on demand for tobacco and alcohol

Unlike most other consumer goods, demand for tobacco and alcohol is often presumed to be addictive in the sense that the consumption decision on these products at any given time is not independent of the past choices of the same good. Consumption of a good can be considered to be addictive if an increase in the past consumption of that good leads to an increase in current consumption. Different models of addiction have been developed in economic theory to model addictive behaviors.[4] However, these models are questioned within and outside the realm of economics due to its applicability and various restrictive assumptions they require. Moreover, a rapidly expanding and substantial literature clearly indicates that the demand for tobacco products do respond to changes in prices and other factors in spite of its addictive nature. Most estimates of the price-elasticity of demand for tobacco products from developed countries range from -0.25 to -0.50, whereas those from the low-income and middle-income countries suggest that price elasticity of demand varies between -0.50 to -1.00 (Chaloupka and Warner, 2000). Similar estimates for alcohol products show that own price elasticities range between -0.35

[3] Studies by Rahman (2003) and John (2004) bring out such associations.

[4] Chaloupka *et al.* (2000) gives a good review of such studies relating to the demand for tobacco products.

and −0.98 in developed countries (Clements *et al.*, 1997).

Estimates of price elasticities for various tobacco products are hardly available in India. Nonetheless, National Council of Applied Economic Research (NCAER) has estimated the price elasticity of cigarettes consumption to be −0.67 for the sample period 1981-82 to 1992-93 (Sarma, 2000). However cigarettes smokers alone constitute only fifteen per cent of the tobacco users in India. Comparable and more recent estimates for other tobacco products are essential to formulate any comprehensive price control measures. There are no national level studies in India that estimates the price responsiveness and cross price elasticities of various tobacco products, to the best of our knowledge. Hence, the imposition of taxation or any other tobacco use regulatory measures in India lacks sufficient empirical knowledge of own and cross price elasticity estimates from the Indian data. Price elasticity estimates are however available for alcohol consumption in India. A recent study by Mahal (2000) showed that own price elasticity of demand for alcohol participation is −0.50 for people aged twenty five years and above and −1.00 among those aged between 15 and 25 years. This study used data collected by NCAER, in a survey in the year 1994 among the rural households of fifteen major Indian states.

The main reason why estimates of price elasticities are not available in India is the lack of sufficient time series data on prices and quantity consumed for various tobacco products. Hence one has to rely on cross sectional data sources. Unfortunately there are no large scale cross sectional data that provides direct information on prices and quantity of consumption of various tobacco products in India. But we do have data on quantity consumed and amount spent on various tobacco products, which gives information on unit values, from the National sample Survey, for a cross section of roughly 120,000 households from rural and urban India. The spatial variation in these unit values can be used to derive the own and cross price elasticities for various tobacco products, along with pan and alcohol, using the information on prices contained in unit values.

3 Data on consumption of addictive goods

National Sample Survey Organization (NSSO) conducts nationwide sample surveys on the consumption habits of households in India. The last major survey that was carried out during July 1999 to June 2000 collected information on consumption from 120,309 households spread over 10140 villages in India. The goods of consumption on which it collected the information included a wide variety of addictive goods such as tobacco, pan and alcohol products along with 500 food and non-food items. Various household characteristics were also surveyed along with it. The quantity purchased as well as the expenditure incurred for consumption of various products over the last thirty days prior to the date of interview were recorded. Addictive goods that are surveyed included eight tobacco products, six pan products[5] and six alcohol products. Pan and alcohol products are grouped into pan and alcohol respectively in our analysis. Pan includes pan leaf and finished pan. Similarly alcohol, in our exercise, is an aggregate commodity comprising of toddy, country liquor, beer and foreign liquor.[6]

Our data indicates that sixty five per cent of the rural households and forty nine per cent of the urban households report consumption of at least one of these addictive goods in the last thirty days prior to the date of interview. Tobacco users constitute the major chunk of households consuming addictive goods. Approximately ninety five percent of the reporting tobacco users consume either bidis, cigarettes, leaf tobacco or a combination of these. Except cigarettes and foreign liquor, consumption of every other item is higher among rural households than their urban counterparts. Table 3 gives average unit value over those households who bought the good and the average over all households (including those who do not buy) of the share of total expenditure that is devoted to each goods along with the fraction of house-

[5]Pan consists of betel leaf, areca nut, slaked lime, catechu and tobacco. Tobacco forms only a small portion of pan and the amount of tobacco varies in different pan products.

[6]Foreign liquor refers to items formally produced in large distilleries such as whisky, rum, gin and brandy. Whereas country liquor includes liquor that is generally made from locally available raw materials such as sugarcane, rice, coconuts and so on. Toddy is a drink made from either coconut or palm tree.

holds consuming each of them. Right hand panel of the table shows the weighted averages using inverse sampling probabilities as weights so that estimates should be representative of the corresponding rural and urban households in India. It can be observed that the unit value of alcohol is substantially higher in urban India than in rural India. This is mainly because beer and foreign liquor users as a proportion of total alcohol users is relatively much higher in urban India than in rural India. Whereas toddy and country liquor constitute the major chunk of alcohol users in rural India. Given that toddy and country liquor are cheaper than beer and foreign liquor it is natural that unit value for alcohol is substantially higher in urban India. Portion of household budget spent on addictive goods, averaged by the number of all households, including those who do not consume any of it, shows that three per cent of the rural and 2.2 per cent of the urban household budget is spent on consuming addictive goods.

4 Methodology

Unit values that we get from the survey are different from prices so far as there are measurement errors involved in quantity and variations in quality due to heterogenous nature of the commodity. A theoretical model is developed by Deaton (1988, 1997), wherein consistent estimation of price elasticities is made possible in such cases. We have adapted the same model here to estimate the own and cross price elasticities of various addictive goods. Deaton (1997) provides detailed exposition of the methodology described here and we only describe the basic equations to estimate the model. This is a model of consumer behavior in which households chose both quantity and quality so that expenditure on a good is the product of quantity, quality and price. Commodities are defined as collections of heterogeneous goods and quality is defined as a property of commodity aggregates. Because the unit values are defined to represent quality also, the analysis must take account of price and income elasticities of quality as well. Model requires that the households

are geographically clustered within the sample. Spatial variations in prices are used to estimate the demand responses. Once we know that there is sufficient variability in prices we can proceed to the estimation of the demand model.

Village demand patterns as represented by the budget shares are regressed on the average village prices, as represented by unit values. The following two equations link the budget shares and unit values to household expenditures, other household characteristics, and the underlying prices of commodities.

$$W_{Ghc} = \alpha_G^0 + \beta_G^0 \ln x_{hc} + \gamma_G^0 . Z_{hc} + \sum_{H=1}^{N} \theta_{GH} \ln p_{Hc} + (f_{Gc} + u_{Ghc}^0) \quad (1)$$

$$\ln UV_{Ghc} = \alpha_G^1 + \beta_G^1 \ln x_{hc} + \gamma_G^1 . Z_{hc} + \sum_{H=1}^{N} \psi_{GH} \ln p_{Hc} + u_{Ghc}^1 \quad (2)$$

W_{Ghc} is the budget share of good G in the budget of household h living in village (cluster) c. The budget share of the household is taken to be a linear function of the logarithm of total household expenditure, x, a vector of household characteristics, Z, and the logarithm of N prices.[7] However, coefficients of these equations are not elasticities, which needs to be calculated. The first element of the residual in equation (1), f_{Gc}, is a village-level effect that is same for all households within a village. Since both f_{Gc} and price are unobserved it is required to assume that the term f_{Gc} is uncorrelated with price in order to estimate the influence of the later. The term u_{Ghc}^0 is the standard error term representing, among other things, measurement errors in the budget share and taste (quality) variations. The price in equation (1) is not observed but is related to unit value (UV) as given in equation (2). Logarithm of unit value is a function of $\ln x$, household characteristics represented by the vector Z, and price. Since unit value is price multiplied by quality, β_G^1 is the expenditure

[7]The budget share equation here closely follows the one suggested by Working (1943) with an extra price term and household demographic terms. This has the theoretical advantage of being consistent with a utility function (Deaton, 1997). Though the budget share equation resembles Almost Ideal Demand System it is actually not. Budget shares are taken for all households with both zero and positive consumption. It is thus an unconditional formulation of demand function covering non-consumers as well as consumers. It is important to include all households to analyze the effects of changes in prices or taxes.

elasticity of quality. Differentiating (1) with respect to $\ln x$ and defining ϵ_G to be the elasticity of expenditure with respect to quantity, yields $\partial \ln W_G / \partial \ln x = \beta_G^0 / W_G = \epsilon_G + \beta_G^1 - 1$, since the logarithm of share is the sum of logarithms of quantity and quality less logarithm of expenditure. Rearranging it will yield the expenditure elasticity of quantity

$$\epsilon_G = (1 - \beta_G^1) + (\beta_G^0 / W_G) \tag{3}$$

so that the total income elasticity of quantity and quality together will be $\epsilon_G + \beta_G^1$.

The non-price parameters such as α, β and γ in both the equations can be consistently estimated by standard OLS with the assumption that market prices do not vary for a given commodity within each village over the relevant reporting period. The unit value equation does not contain village fixed effects because, conditional on prices, unit values depend only on quality effects and measurement errors. The price terms in this equation are introduced by way of dummy variables for each villages following a result from Frisch-Waugh theorem.[8] Introduction of village dummies will control for the village fixed effects in equation (1) and for the prices.

ψ_{GH} is the matrix of own and cross price elasticities of the unit values. In the absence of quality shading the matrix Ψ would be an identity matrix. Elasticities of quality with respect to price are $\psi_{GH} - \delta_{GH}$ for Kronecker delta δ_{GH}. Let ϵ_{GH} be the standard matrix of own and cross price elasticities of quantities. Differentiating (1) with respect to $\ln p_{_H}$ gives $\partial \ln W_G / \partial \ln p_{_H} = \epsilon_{GH} + \psi_{GH} = \theta_{GH} / W_G$, so that

$$\epsilon_{GH} = -\psi_{GH} + \theta_{GH} / W_G \tag{4}$$

Then price elasticity of quantity and quality together will be $\epsilon_{GH} + \psi_{GH} - \delta_{GH}$. Given that prices are not observed identification of all parameters require further prior information. Given a separability assumption about the basic goods that

[8] As noted in Deaton (1997, P. 288), Frisch-Waugh (Frisch and Waugh, 1933) theorem states that the regression of deviations from village means gives identical parameter estimates to those that would have been obtained from the regression containing the village dummies.

comprise each heterogenous commodity, Deaton (1988) shows that

$$\psi_{GH} = \delta_{GH} + \beta^1_G \epsilon_{GH}/\epsilon_G \tag{5}$$

The price of good H effects the quality of good G only to the extend that there is a cross price quantity elasticity ϵ_{GH}. Assuming that (5) holds at the sample means, (3) and (4) can be used to substitute for ϵ_{GH} and ϵ_G in (5), and we obtain the relationship linking the underlying parameters:

$$\psi_{GH} = \delta_{GH} + \frac{\beta^1_G(\theta_{GH}/W_G - \psi_{GH})}{(1-\beta^1_G) + \beta^0_G/W_G} \tag{6}$$

This analysis also allows for completing the system of demand equations by adding a composite commodity which will then exhaust the total household budget. Symmetry restrictions that add to the precision of parameter estimates can also be imposed.

5 Empirical results

We start with the results of spatial variations in prices which are necessary to estimate the demand responses in this model. Table 4 provides the extent and significance of the spatial variation in prices along with the source of variability. Results are given separately for rural and urban India. First column in each panel shows standard deviation of the logarithms of unit values multiplied by 100 so that the figures can be interpreted as percentage variability. Tobacco leaf seems to have maximum variability in both rural and urban areas. F and R^2 are the F-statistics and R^2-statistics from a regression of unit values on dummy variables, one for each village[9] in the survey where there is at least one purchaser of the good. In other words, this is the result of a decomposition of variance over villages. We observe that more than seventy per cent of the variation in prices are explained by variability

[9]villages are the first stage units (clusters) in the NSSO surveys. For urban areas they are referred to as urban frame survey blocks. There are 6018 villages and 4122 blocks in the data.

between villages for most of the goods. Within village variation is thus relatively small. We also tested for the broad regional effects.[10] Column F-reg in each panel shows the F-statistics for the regression of log unit values on seventy eight region dummies and it shows strong evidence of regional price variation. The F-statistics are significant at one per cent level for all the regressions.

The set of household socio-economic characteristics that we have considered for the regression in equations (1) and (2) includes; log of household expenditure, log of household size, ratio of number of adults (fourteen years of age or more) to household size, ratio of total adult males to household size, average education (total education, in years, received by all the members divided by household size) of the household, years of education received by the most educated member in a household, a dummy variable taking the value one if the household resides in major tobacco producing states[11], and dummies for the religion, social groups and occupational groups. Region dummies were also introduced to eliminate broad regional taste differences, if any, that we may not want to attribute to regional price differences. These variables are introduced with the main intention of purging the budget shares and unit values of the household specific effects so as to allow for the quality effects and enable consistent estimation of own and cross price elasticities.

5.1 Estimates from unit value and budget share regression

Table 5 shows the estimated coefficients of log household size and log expenditure from both unit value and budget share equations along with income (expenditure) elasticities. The coefficient of $\ln x$ in the unit value equation gives the expenditure elasticity of quality. As we can observe, in all cases it is positive and in most cases significant at one per cent level for both rural and urban India. As expected the most heterogeneous item in the group, alcohol, has the highest quality elasticity in both

[10]NSSO divides the entire geographical region of the survey into seventy eight regions which are called NSSO regions.

[11]In India, the three States Andhra Pradesh, Gujarat and Karnataka account for roughly 75 per cent of the area under tobacco crop (Agricultural Statistics at a Glance 2002, Ministry of Agriculture, Government of India).

rural (0.39) and urban (0.5) India. Among the different tobacco product considered, cigarettes have the highest expenditure elasticity of quality with 0.11 in rural and 0.24 in urban India. It implies a doubling of the household total expenditure would raise the average price paid for cigarette by eleven and twenty four per cent in rural and urban India respectively. This is also evidence that lower income households spent more on lower quality cigarettes, mostly the ones without a filter.[12] This is actually the case with alcohol as well. Quality elasticity of bidis are around five per cent and that of leaf tobacco is insignificant.

Coefficients on the logarithm of household size are similar in size and opposite in sign to the coefficients on the logarithm of total expenditure in the unit value regression. There seem to be inverse relationship between both the coefficients suggesting that increases in household size act like reductions in income. Except in the case of pan in urban India, the estimated coefficients on household size are smaller in absolute size than the coefficients of total expenditure. With total household expenditure and other household characteristics remaining the same, an increase in household size has a significant effect of decreasing the average price paid by the household. It may mean that given the total expenditure, as household size increases, household may increase the consumption resorting to consuming lower quality products which are cheaper.

Budget share equation also shows similarity in magnitudes and opposite signs in case of coefficients of log total expenditure and log household size. Keeping the expenditures and other variables constant, an increase in household size increases the budget shares of bidis and leaf tobacco and it decreases the budget shares of other addictive goods. The pattern is similar in both rural and urban regressions though the extent of the effect varies. Total expenditure elasticity (sum of the expenditure elasticity of quantity and quality) is less than one for both bidis and leaf tobacco in rural and urban India and is more than unity for cigarettes, pan and alcohol. High expenditure elasticities of cigarettes and alcohol show the nature of

[12]There is, however, no conclusive evidence that suggests non-filtered cigarettes are hazardous than the filtered ones.

these commodities as luxury goods. An increase in the total household expenditure more than doubles the consumption of cigarettes among rural households.

Other socio-demographic variables in the regression exerts only occasional and modest effect on the unit values and budget shares. Hence we have not reported them. However few results are worth mentioning. An increase in male ratio would lead to an increase of budget spent on bidis in rural and urban India. Education has mild but significant decreasing effects on budget share devoted to tobacco consumption. Similarly households belonging to the sikh religious group also exhibited a mild but significant negative effect on budget share of various tobacco products.

5.2 Estimates of own and cross price elasticities

Table 5 reports the own and cross price elasticity estimates of various addictive goods with symmetry restrictions. Symmetry constrained estimates guarantee the unique substitution complimentary patterns, ruling out the possibility that good i is a substitute of good j when j is a complement of i. The elasticity in row i, column j estimates the effect of a change in the price of good j on the quantity demanded of good i. Elasticity coefficients are comparable to other price elasticity estimates available in India for few of these goods as noted in section 2 and falls in the range of elasticity estimates available in the literature from other developing countries. As we can observe, all of the own price elasticities (diagonal elements in table 5) are negative and are statistically significant at one per cent level except cigarettes in urban India. Many of the cross price elasticities are however not significant.

Looking at the own price elasticities we observe that elasticity coefficients for rural and urban households are approximately same, nevertheless the elasticity of alcohol was found to be marginally lower in urban than in rural India. All goods have own price elasticities greater than 0.5 and some of them such as bidis, leaf tobacco and alcohol have elasticities close to unity. This is a clear evidence to indicate that consumption of addictive goods in India do respond to the changes in prices, though the proportionate increases in price leads to slightly less than proportionate

reduction in consumption. Hence prices can be used as an important instrument to curtail tobacco consumption or, for that matter, consumption of any of the addictive goods considered here.

Analysis of cross price elasticities indicate that bidis are complement to all addictive goods in rural India, though this complementarity is not significant in case of alcohol and leaf tobacco. In urban India, on the other hand, bidis are complement only to cigarettes and pan, though the coefficient is not significant for cigarettes. This reiterates the results we obtained from a previous study wherein we found that the relative probability of consuming tobacco products increases relative to not consuming them, if the household has the habit of either alcohol or pan consumption (John, 2004). As against the general notions regarding the complementarity between cigarettes and alcohol, we see that they are substitutes in both rural and urban regressions, although the effect is not significant in the rural regression. Analyses were also carried out using the 50^{th} round of NSS data for the period 1993-94 with the objective of checking the robustness of the results from 55^{th} round and to examine if there is any change in the elasticities over time. We found that own price elasticities of bidis and leaf tobacco have shown increase over the five year period while that of cigarettes and pan have stabilized. Table 8 gives own price elasticities and income elasticities of various addictive goods for the 50^{th} round. It appears that the addictive goods have become more elastic, or more precisely, less inelastic over the period. The substitutability and complementarity of these addictive goods indicate that changes in price of one commodity through taxation or any other means would affect the consumption decisions on other commodities as well.

Price elasticity estimates derived here show that addictive goods in India do respond to changes in prices most of them having own price elasticities close to unity. However as noted earlier, the taxation of tobacco in India is highly skewed towards cigarettes. Bidis and other tobacco products other than cigarettes are taxed at very low rates. Our analysis show that there is great potential for taxing bidis and other tobacco products as well. Taxing the non-cigarette tobacco in India has always

been a political problem than an economic problem per se (Reddy and Gupta, 2004). Even the latest budget presented on 28^{th} February, 2005 in the Indian parliament, proposed a further hike in tax of cigarettes without effecting any change in taxation of bidis. While it is true that millions of people are directly engaged in bidi making, which has a substantial share in the total employment in tobacco industry, and increased taxation on non-cigarette tobacco will have direct consequence on these labors, it is also the case that non-cigarette tobacco accounts for more than eighty five percent of the tobacco use and hence impose maximum burden on society in the form of various health calamities. Moreover it has been observed that, employment in bidi making and leaf-tobacco growing is characterized by part-time and seasonal employment (Reddy and Gupta, 2004). One argument against taxing non-cigarette tobacco is the fact that it is mainly used by the poor, hence increasing bidi taxes would amount to taxing the poor more, given the addictive nature of its consumption. But the price elasticity estimates in our exercise shows that increase in prices of bidis (say by taxation) would have the effect of reducing consumption almost by an equally proportionate rate. Similar is the case of leaf tobacco.

6 Conclusion

The analysis clearly brings out price as an effective instrument in regulating tobacco use. Taxation of various tobacco products would be a useful means to achieve large scale reduction in consumption. But tax base of tobacco is heavily depended on about fifteen per cent of the tobacco users, who represent cigarettes smokers. Bidis and other tobacco products, which constitutes more than eighty five per cent of the tobacco consumption in India, have been substantially out of the tax net. Raising taxes do have multiple benefits. It has the potential to increase tax revenue while decreasing the consumption. At the same time there are also arguments against raising taxes beyond a point, citing mainly the arguments based on *Laffer curve*,[13]

[13]It says raising the taxes above an optimal level will not result in an increase of revenue, rather it causes revenue to fall.

but on the other hand there are strong health reasons why consumption should be curbed.

Given the price responsive nature of tobacco products, taxation of different tobacco products can be seen as a tool to raise government revenue while simultaneously reducing the consumption. It is possible to raise taxes to a point where actual revenue from taxation falls. Given that non-cigarette tobacco is taxed at very low rate, there is a huge potential to increase its taxes uniformly and thereby reduce its consumption substantially while increasing tax revenue. The objectives of tobacco taxation should be defined in much clearer terms and the emphasis needs to be given on curbing consumption of various tobacco products. A large scale regulation of tobacco consumption also will have implications on tobacco farming and manufacturing of various tobacco products. Hence a detailed analysis of the economics of tobacco farming and manufacture of various tobacco products would be highly useful to analyze the net effects of various regulatory policies.

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Table 1: Share of different tobacco products in total Union excise duty (basic and additional) collected from tobaco.

Year	Cigarettes	Bidi	Chewing	Others	Total Revenue (Rs.Billion)
1994-95	86.71	6.90	4.69	1.62	31.577
1995-96	85.86	4.54	5.29	4.21	39.877
1996-97	85.60	5.18	5.59	3.57	46.529
1997-98	86.30	5.66	5.37	2.61	51.376
1998-99	86.29	5.70	5.99	1.98	55.954
1999-00	86.06	5.77	6.25	1.87	55.660
2000-01	85.10	5.40	7.14	2.33	60.389

Source: Calculated from P.240, Reddy and Gupta (2004).

Table 2: Unit values and budget shares of different addictive goods

	Rural India					
	Unweighted			Weighted		
Commodty	% Consuming	Unit value	Share	% consuming	Unit value	Share
Bidi	35.33	0.22	0.97	36.50	0.17	1.08
Cigarette	5.46	1.59	0.18	3.69	1.40	0.14
Leaf-Tob	18.68	70.00	0.23	19.42	69.86	0.24
Pan	22.54	0.70	0.36	18.47	0.65	0.30
Alcohol	15.65	48.02	0.82	16.40	47.02	0.72
Total	64.77	NA	3.16	64.23	NA	2.92
	Urban India					
Bidi	18.93	0.21	0.50	19.84	0.21	0.54
Cigarette	11.32	1.47	0.43	9.61	1.32	0.39
Leaf-Tob	7.39	74.98	0.09	7.25	74.73	0.08
Pan	18.79	1.13	0.39	15.46	1.13	0.32
Alcohol	9.65	99.10	0.59	10.20	95.07	0.56
Total	48.95	NA	2.27	44.16	NA	2.14

Notes: Total includes all the addictive goods including the ones that are not listed here but are there in the NSS data. Unit of measurement for bidi, cigarette and pan is number, leaf tobacco is Kg., and alcohol is litre. Unit values are all in Rupees. Budget shares are in percentages.

Source: Author's calculation from NSSO (2000) data.

Table 3: Variability in unit values

	Rural India				Urban India			
	SD	F	R^2	F-reg	SD	F	R^2	F-reg
Items	SD	F-stat	R-sq	F-reg	SD	F-stat	R-sq	F-reg
Bidi	59.8	12.35	0.76	71.63	56.3	4.58	0.68	23.73
Cigarette	63	4.08	0.81	7.52	55.7	2.82	0.68	9.75
Leaf Tobacco	206.6	7.67	0.68	39.1	227.5	5.72	0.76	11.4
Pan	123.9	16.89	0.83	304.97	120.25	8.46	0.77	127.3
Alcohol	125.5	8.98	0.79	92.66	130.1	3.26	0.7	14.2

Notes: SD refers to 100 times the standard deviation of log unit values calculated over the households reporting positive consumption. F and R^2 are the F-statistics and R^2-statistics associated with the presence of dummy variables for each village in the survey. F-reg is the F-statistics of an ANOVA of log unit values on dummies for seven regions. All statistics are significant at 1% level.

Table 4: Income and household size coefficients and income elasticities

	Rural India					Urban India				
	log Unit Value		Budget Share			log Unit Value		Budget Share		
Items	$\ln x$	$\ln n$	$\ln x$	$\ln n$	η_x	$\ln x$	$\ln n$	$\ln x$	$\ln n$	η_x
Bidi	0.05*	-0.03*	-0.19*	0.19*	0.76	0.04*	-0.02	-0.16*	0.12*	0.63
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.29)	(0.00)	(0.00)	
Cigarette	0.11*	-0.11*	0.27*	-0.2*	2.37	0.24*	-0.16*	0.41*	-0.3*	1.72
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	
Leaf Tobacco	0.005	-0.005	-0.09*	0.04*	0.6	0.1	-0.3*	-0.03*	-0.005	0.58
	(0.92)	(0.91)	(0.00)	(0.00)		(0.29)	(0.00)	(0.00)	(0.34)	
Pan	0.03	-0.12*	0.06*	-0.09*	1.12	0.13*	-0.23*	0.08*	-0.11*	1.08
	(0.08)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	
Alcohol	0.39*	-0.32*	0.72*	-0.46*	1.48	0.5*	-0.32*	0.62*	-0.38*	1.54
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	

Notes: Each panel shows the partial results of log unit value and budget share equations separately for rural and urban India. $\ln x$ & $\ln n$ are logarithms of total expenditure and household size respectively. η_x is the total expenditure or income elasticity as given by $\epsilon_G + \beta^1$. Coefficients of $\ln x$ & $\ln n$ in the budget share equations are all multiplied by 100 for the convenience in reporting.

Table 5: Own- and Cross-price elasticities (With symmetry restrictions)

Items	Bidi	Cig	Tleaf	Pan	Alcohol	Composite
Rural India						
Bidi	**-1.005***	-0.070*	-0.009	-0.029***	-0.017	0.325*
	(0.029)	(0.027)	(0.010)	(0.018)	(0.018)	(0.042)
Cigarette	-0.381*	**-0.562***	0.001	-0.015	0.161	-1.685*
	(0.140)	(0.188)	(0.032)	(0.070)	(0.110)	(0.224)
Leaf Tobaco	-0.035	0.004	**-0.851***	-0.027	-0.038	0.346*
	(0.041)	(0.025)	(0.020)	(0.024)	(0.057)	(0.081)
Pan	-0.077***	-0.005	-0.019	**-0.601***	0.037	-0.490*
	(0.047)	(0.035)	(0.015)	(0.053)	(0.038)	(0.079)
Alcohol	-0.034	0.044	-0.016	0.018	**-1.033***	-0.850*
	(0.025)	(0.029)	(0.020)	(0.020)	(0.039)	(0.064)
Composite	0.000	0.000	0.000	0.000	0.000	**-0.264***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban India						
Bidi	**-0.923***	-0.058	0.008	-0.165*	0.022	0.444*
	(0.062)	(0.101)	(0.017)	(0.037)	(0.041)	(0.108)
Cigarette	-0.078	**-0.215**	-0.007	0.103**	0.126**	-1.887*
	(0.125)	(0.478)	(0.029)	(0.076)	(0.092)	(0.447)
Leaf Tobaco	0.053	-0.032	**-0.801***	0.021	-0.172	0.250
	(0.110)	(0.146)	(0.052)	(0.101)	(0.189)	(0.295)
Pan	-0.220*	0.113	0.004	**-0.597***	0.057	-0.569*
	(0.049)	(0.081)	(0.021)	(0.050)	(0.050)	(0.113)
Alcohol	0.016	0.106	-0.030	0.042	**-0.866***	-1.318*
	(0.043)	(0.077)	(0.031)	(0.040)	(0.069)	(0.127)
Composite	0.000	0.001*	0.000	0.000	0.000	**-0.264***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)

Notes: The elasticity in row i, column j estimates the effect of a change in the price of good j on the quantity demanded of good i. Values in parentheses are the bootstrapped standard errors. Coefficients with *, **, *** implies a levels of significance at 1%, 5% and 10% respectively.

Table 6: Own price and Expenditure elasticities for 50^{th} round

	Rural India		Urban India	
Items	own elsty	η_x	own elsty	η_x
Bidi	-0.769	0.65	-0.707	0.589
Cigarette	0.601	2.24	0.251	1.527
Leaf Tobacco	-0.003	0.44	-0.141	0.669
Pan	-0.665	1.03	-0.592	1.042
Alcohol	-1.162	1.34	-1.050	1.690