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CONSUMPTION PATTERNS OF TOBACCO AND INTOXICANTS IN INDIA

Kanika Aggarwal, Charandeep Singh, Nayan Gupta

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Tobacco smoking and binge alcohol drinking are two of the leading risk factors for premature mortality worldwide. In India, studies have examined the geographic distributions of tobacco smoking and alcohol drinking only at the state-level; sub-state variations and the spatial association between the two consumptions are poorly understood. We analyze the consumption patterns, socio-economic distribution and the household choice of a variety of harmful tobacco and alcohol products across India.

INTRODUCTION

Alcohol and tobacco consumption are the major global public health problem. By 2030, and if current trends are maintained, they are expected to be the highest cause of death worldwide. India, who is the second largest producer of tobacco in the world, is no exception to the growing burden of tobacco related diseases and morbidity. In India, 14% per cent of the population above age 15 smoke tobacco (24% for men and 3% for women).

Most studies examined tobacco smoking and alcohol drinking behaviors separately among the Indian population. Few studies which examined the concurrent use of tobacco and alcohol found that smokers have a higher likelihood to drink alcohol than non-smokers and vice versa.

The main goal of this study is to analyze the consumption behavior of the households living in India for the given commodities.

Also, we will discuss about the policy implication on taxes using elasticity on howgovernment can change the tax structure and earn higher revenues. Evidence from countries of all income levels suggest that price increases of tobacco and alcohol products are highly effective in reducing demand. Higher taxes induce some smokers and drinkers to quit and prevent other individuals from starting. They also reduce the number of ex- smokers and drinkers who return to cigarettes and alcohol reduce consumption among continuing smokers.

LITERATURE REVIEW

In the paper "***Price Elasticity Estimates for Tobacco Products in India***", Rijo M John examines the price elasticity of demand 3 major tobacco products: bidis, cigarettes and leaf tobacco at the national level using 55th round of household level data collected by NSSO for the time period July 1999 to June 2000.

Findings: Total expenditure elasticity (sum of the expenditure elasticity of quantity and quality) is less than one for both bidis and leaf tobacco in both rural and urban India andis more than unity for cigarettes. High expenditure elasticities of cigarettes imply that cigarettes are luxury goods both in rural and in urban India. They found own-price elasticity estimates of different tobacco products in India ranged between −0.4 and −0.9. The estimates for rural and urban households were approximately the same with bidis and leaf tobacco having own-price elasticities close to 1 except for cigarettes which are relatively more inelastic in urban India(-0.20) than in rural India(-0.34). This explains heavy taxation on cigarettes in India, as economic logic supports taxing luxuries which are highly inelastic.

Another paper by the same writer Rijo M John, "***An Analysis of Household's Tobacco Consumption Decisions: Evidence from India***" uses the same 55th round household leveldata collected by NSSO to analyze the consumption patterns, socio-economic distributionand the household choice of a variety of tobacco products across rural and urban India. They use *Multinomial Logit Model* and odd ratios to examine the factors that lead to increased chances of consumption of tobacco products.

Findings: The socio-economic and demographic factors that significantly impacted the probability of consuming tobacco products were household expenditure and size, ratio of adult males to household size, mean education of the household, alcohol and pan consumption habits of the household, socio-economic status of the household etc. For example increase in household size or

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education level of head of the family turned the odds against tobacco consumption. They also found that the effects of these variables differed for rural and urban households. Also, policies targeted at reducing cigarettes and not bidis and other tobacco products will be wasteful because of the complementarity between tobacco products.

DATA

Data for the study has been taken from the 68th Round of National Sample Survey Office (NSSO) conducted from June 2011-July 2012. The round considered was the ninth survey to cover various Household Consumption Expenditures.

The data set is cross-sectional and includes observations of 1, 01,405 households. Our analysis is centered on household consumption of Tobacco, Alcohol and related products. For our analysis we stick to consumption over 30 days recall period. Because of the fact that quantity consumed of these products (simultaneously) can very well be zero. The imputed unit values calculated by dividing total expenditure by quantityconsumed of a particular tobacco item turns out to be infinite if the quantity is 0 andhence was an obstruction to our calculations. So we have replaced those values with the mean of the prices, values for which existed. The data set used for the logit model had 1, 01,090 observations. Also for households consuming at least one type of tobacco products, we had 62,619 observations which are sufficiently high to get consistent estimates.

Tobacco Products Used For Our Analysis

The 68th Round of NSS had information on consumption of 18 tobacco products commonly consumed by Indian Households.These are mentioned as codes in the data which have been modified by us for simpler analysis.

Code of the tobacco product(as per NSS 68thRound)	Name of the Product	Measured Units
310	Bidi	No of sticks
311	Cigarettes	No of sticks
312	Leaf tobacco	In gm
316	Zarda,kimam,surti	In gm
322	Country liquor	Litres
324	Foreign /refined liquor or wine	Litres

SUMMARY STATISTICS

This section summarizes the insights of NSS 68th Round pertaining to tobacco and relatedproducts.

Table 1: Per Capita Monthly Values and Quantities Consumed for all households

BIDI		CIGERETTE		LEAF TOBACCO		ZARDA, KIMAM,SURTI		COUNTRY LIQOUR		REFINED LIQOUR	
Value (Rs.)	Quantiy (No.)	Value (Rs.)	Quantiy (No.)	Value (Rs.)	Quantiy (No.)	Value (Rs.)	Quantiy (gm.)	Value (Rs.)	Quantiy (ml.)	Value (Rs.)	Quantiy (ml.)
7.41	20.80	9.63	3.24	1.33	6.71	1.11	2.82	6.31	81.07	10.57	29.47

Table 1 shows Aggregate per capita monthly quantities consumed and value spent for all tobacco products. An individual on an average consumes 81 ml of domestic liquor and 24 ml of foreign liquor, which makes sense as given the high proportion of poor households, domestic liquor is mostly consumed since it's cheaper.

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Table 2: Per Capita Monthly Statistics On The Basis Of Income

IncomeGroup	Bidi		Cigarette		Leaf tobacco		Zarda,kimam		Country Liquor		Refined Liquor	
	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (gm.)	Value (Rs.)	Quantity (ml.)	Value (Rs.)	Quantity (ml.)
LOW (Bottom 30%)	7.650	23.769	1.569	0.646	1.825	9.994	0.833	2.354	5.594	97.397	2.466	7.755
MEDIUM (30% to 70%)	8.806	23.964	7.438	2.749	1.323	6.511	1.204	3.091	6.492	80.114	8.237	24.187
HIGH (Top 30%)	5.312	13.625	20.636	6.515	0.871	3.714	1.269	2.953	6.800	66.028	21.784	58.258

Table 2 shows didis and leaf tobacco is highly consumed by bottom 30% income group, 23 sticks and 10 grams respectively, which also makes its expenditure the highest amongst all groups. Cigarette and foreign liquor are mainly consumed by top 30% households with slightly low values for middle income groups.

Table 3: Per Capita Monthly Statistics On The Basis Of Social Group

Social Group	Bidi		Cigarette		Leaf tobacco		Zarda,kimam,Surti		Country Liquor		Refined Liquor	
	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (gm.)	Value (Rs.)	Quantity (ml.)	Value (Rs.)	Quantity (ml.)
ST	7.527	20.571	16.554	6.736	1.910	9.093	1.007	2.485	9.705	206.877	9.915	32.398
SC	9.569	27.969	6.173	1.997	1.385	7.195	1.307	3.452	8.860	91.489	9.711	27.755
OBC	6.904	18.586	7.519	2.352	1.355	7.000	0.937	2.453	5.116	57.953	10.664	29.142
Others	6.937	20.138	11.033	3.501	1.055	5.153	1.275	3.128	5.135	52.050	11.148	29.529

Table 3 shows similar variables as above but the variations are seen across social groups. We observe that Scheduled Tribe people are the top most consumers of all tobacco and allied products, followed by others, Scheduled Castes and Other Backward Classes. Bidi, leaf tobacco and country liquor are highly consumed by STs, which is realistic because such products are usually made in rural areas and STs have access to these only.

Table 4: Per Capita Monthly Statistics On The Basis Of Education

Education (Years)	Bidi		Cigarette		Leaf tobacco		Zarda,kimam,Su		Country Liquor		Refined Liquor	
	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (No.)	Value (Rs.)	Quantity (gm.)	Value (Rs.)	Quantity (ml.)	Value (Rs.)	Quantity (ml.)
1 to 5	14.662	41.932	2.866	1.055	2.713	14.574	1.974	5.211	10.023	175.943	7.747	21.019
6 to 10	9.013	25.562	7.208	2.572	1.507	7.640	1.166	2.977	7.408	97.154	9.077	27.133
11 to 12	4.561	12.390	13.798	4.520	1.108	5.321	0.997	2.415	4.616	53.271	12.676	33.906
above 12	3.406	8.910	14.792	4.521	0.571	2.746	0.834	2.273	3.412	32.374	14.337	34.130

Table 4 shows similar results for individuals with different education levels. People with less education, are consumers of bidi, leaf tobacco and country liquor. As education increases, people shift to consumption of cigarettes and refined liquor.

METHODOLOGY

Analyzing the demand behavior of households in two phases:

First determining the related covariates because of which household chooses to consume Tobacco and related products and then, in the subset of population that consumes at least one, determining the patterns of demand by studying elasticities.

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Role of Factors Affecting Probability of Consumption

We address this issue by using a *Logit Model*, which assesses how the probability of a household consuming tobacco and related products (and in another case alcohol) isaffected by various factors like age, gender, household size, social group, etc. Econometrically, the logit model can be defined as the regression to find the β parametersthat best fit the following model where ε is an error distributed by the logistic distribution.

$$y = \begin{cases} 1 & \beta_0 + \beta_1 x + \varepsilon > 0 \\ 0 & \text{else} \end{cases}$$

The interpretations are represented in the terms of log-odds which can be defined as:

$$\mathrm{OR} = \frac{\mathrm{odds}(x+1)}{\mathrm{odds}(x)} = \frac{\left(\frac{F(x+1)}{1-F(x+1)}\right)}{\left(\frac{F(x)}{1-F(x)}\right)} = \frac{e^{\beta_0+\beta_1(x+1)}}{e^{\beta_0+\beta_1 x}} = e^{\beta_1}$$

Demand estimation using AIDS

The second phase of the analysis is concerned with estimating the demand of Tobacco and Alcohol products. The model we have used was first presented by Deatonand Muellbauer (1980) and is widely known as the Almost Ideal Demand System. AIDS is not just flexible in its very form but also, it allows an exact aggregation of heterogeneous consumers. Also, it can be estimated via non-linear models. Finally, it's widely accepted because of its empirical validation. The general specification is given by

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(x/P)$$

Where:

- w_i is the expenditure share associated with the ith good, *i=1, 2, . . . ,n,*
- α_i is the constant coefficient in the ith share equation,
- γ_{ij} is the slope coefficient associated with the jth good in the ith share equation,
- p_j is the price of the jth good,
- x is the total expenditure on the system of goods and,
- P is the general price index defined by:

$$\log P = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \log p_i \log p_j$$

The same index can also be approximated by the Stone Price Approximation but that can be safely used when we know for sure, that the prices are collinear.

There are various restrictions that arise out of the utility maximization problem of a consumer and hence those restrictions can be parametrically imposed.

- Adding up is satisfied within the data by taking the relevant budget and hence the budget shared added to 1. $\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \beta_i = 0, \sum_{i=1}^{n} \gamma_{ij} = 0$
- Homogeneity can be forced during the estimation and a relevant model was also estimated. $\sum_{j=1}^{n} \gamma_{ij} = 0$
- Symmetry can again be forced during estimation and again, a relevant model was estimated. $\gamma_{ij} = \gamma_{ji}$

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The results revolve around the elasticities, and hence the relevant formulas as given byGreen and Alton (1990) are

- Income elasticity given by: $e_i = 1 + \frac{\beta_i}{\dots}$
- Hicksian Compensated Elasticity: $e_{ij}^* = -\delta_{ij} + w_j + \gamma_{ij}/w_i$
- Marshallian Uncompensated Elasticity of expenditure on commodity i relative to the price of the commodity j:

$$e_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i}$$

where

δ_{ij} is the Kronecker deltataking the value 1 for $i = j$ and 0 for $i \neq j$.

Finally, we also take into account the effects of Age and Education as demographics in the AIDS model by allowing the intercept term of each equation to be a function of Age and Education:

$$w_i = d_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(x/P^*)$$

Where $d_i = \alpha_{0i} + \sum_{k=1}^{\Lambda} \alpha_{ki} z_k$, K is the number of demographic variables which in our case is

xh

—

xk

RESULTS AND DISCUSSION

ESTIMATES FROM LOGIT REGRESSION

Using logit model the effect of a set of household socio-economic characteristics on probability of consumption was analyzed. Odd ratios have been reported in table 6 forsome of the variables and refer to appendix table for the rest.

Table 6: Estimates of Logit Model

Variable	Effect On Tobacco	Effect On Intoxicants
Age	0.998***	0.996***
Education	0.957***	0.973***
HH Size	1.100***	1.036***

*Note: *** denotes significance at 1% level of significance.*

Factors like age, education, household size were found to be significantly affecting the probability of consuming tobacco and alcohol. It was found that increasing age and education reduces the odds of consuming tobacco and alcohol as indicated by odd ratios less than 1 and increase in household size increased the probability of consuming these.

ESTIMATES FROM BUDGET SHARE REGRESSION USING AIDS

Table 7 reports estimates of total expenditure elasticities for budget share equations. The coefficient for cigarette, country liquor and foreign liquor is positive and highly significant which indicates that these are luxuries for the people who are addicted which makes sense because they are relatively expensive commodities and bidi, zarda etc. are necessities as shown by negative coefficients because they are cheaper.

Table 7: Expenditure Elasticities estimates for tobacco products in India

Commodities	Coefficient of Log Expenditure (β)	Expenditure Elasticities
Bidi	-0.045***	0.863
Cigarette	0.057***	1.318
Leaf Tobacco	-0.116***	0.330
Zarda Kimam Surti	-0.025***	0.650
Country Liquor	0.054***	1.407
Foreign/Refined Liquor	0.076***	1.719

*Note: *** denotes significance at 1% level of significance.*

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Table 8 reports constrained own and cross-price elasticity estimates using only tobacco consuming households. As we can observe, all of the own-price elasticities (diagonal elements) are negative and are statistically significant. All the given products have elastic demand as elasticities are greater than unity which means price increase in form of say taxes can reduce their consumption. All the cross-price elasticities are also significant. The goods for which cross price elasticities are positive are substitutes and for which they are negative are complements.

Table 8: Price Elasticity Estimates for Tobacco Products and Intoxicants In India

Prices	Bidi	Cigarette	Leaf Tobacco	Zarda Kimam Surti	Country Liquor	Foreign/Refined Liquor
Bidi	**-1.646**	0.070	0.280	0.184	0.122	0.127
Cigarette	-0.025	**-2.350**	0.106	0.295	0.297	0.358
Leaf Tobacco	0.724	0.290	**-1.826**	0.380	0.041	0.062
Zarda Kimam Surti	0.920	0.846	0.845	**-4.142**	0.365	0.516
Country Liquor	0.126	0.379	-0.125	0.147	**-2.344**	0.411
Foreign/Refined Liquor	0.111	0.532	-0.141	0.277	0.481	**-2.979**

Notes: The elasticity in row i, column j estimates the effect of a change in the price of good j on thequantity demanded of good i.

POLICY IMPLICATIONS

Annual consumption of manufactured cigarettes in India was estimated to be 73.8 billion sticks and the tax revenue from cigarettes amounted to Rs.95.74 billion in the financial year 2010-11. Assuming that the tax is collected from all cigarettes consumed, this yields a weighted average tax per stick of Rs. 1297 per 1000.We computed an *ad valorem* tax rate of 40.94% and a retail price of Rs. 1.29 per stick for an average cigarette in India.

Bidis are taxed at a very low rate with a quantity tax of Rs. 14 per 1000 sticks for man- made bidis and Rs. 26 per 1000 for machine-made bidis in the year 2010-11. The pricefor an average bidi stick was computed as Rs. 0.374 which amounts to Rs. 9 per pack of 25 bidis.

Table 10: (Bidis)

Tax shock	Unit price(per stick)	Tax rate	Tax perstick	Consumption (billions sticks)	Total expenditure (in billion Rs.)	Tax Revenue (in billion Rs.)
0%	0.374	7%	0.026	343.9	128.62	8.9414
20%	0.3792	8%	0.0312	336.032046	127.4234	10.4842
40%	0.3844	9%	0.0364	328.164092	126.1463	11.94517
60%	0.3896	11%	0.0416	320.296138	124.7874	13.32432
80%	0.3948	12%	0.0468	312.428185	123.3466	14.62164

Table 11: (Cigarettes)

Tax shock	Price perstick	Tax rate	Tax perstick	Consumption (billions sticks)	Expenditure (in billion Rs.)	Tax Revenue (inbillion Rs.)
0%	3.169	41%	1.2973886	73.8	233.8722	95.74727868
1%	3.1819738	41%	1.3103624	73.09012865	232.5708807	95.77456268
5%	3.2338694	42%	1.3622580	71.1014616	229.9328431	96.85853701
10%	3.2987388	43%	1.4271274	68.61562779	226.3450378	97.9232466
15%	3.3636082	44%	1.4919968	66.12979397	222.4347232	98.66544694
20%	3.4284777	45%	1.5568663	63.64396016	218.2018994	99.08513804

Table 10 and 11 show the changes in consumption and tax revenue as a result of changes in tax amount. Tax shocks (increases in tax as a percentage of the existing tax) are introduced and the changes in consumption, expenditure and tax revenue are calculated using the price elasticity given in table 8. Revenue from taxation of bidis increases until tax becomes more than 27% of the retail price, which would be equivalent to a multi-fold increase in the current taxes on bidis from the current level of roughly 7% of the retail price. In other words, tax on bidis can be increased to Rs. 100 per 1000 sticks compared with the current Rs. 26 without any

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fear of losing revenue. At that level, the average price of a pack of 25 bidis would be slightly more than Rs. 12 which is tantamount to a 35% increase in the current average retail price.

CONCLUSION

The analysis here also provides strong support for taxing tobacco products whether it is bidis, cigarettes or leaf tobacco. With certain assumptions, it is shown that taxes on cigarettes and bidis can be raised to many times higher than the existing rates withoutfear of losing tax revenue, which reveals the potential of using taxation as an effective way for both regulating tobacco use and generating tax revenue.

However, as mentioned above, taxation of tobacco in India has been predominantly on cigarettes. The tax on bidis of Rs. 26 per 1000 sticks, compared with Rs.1297 per 1000 of the cigarette, is negligible in comparison. Such low taxes on bidis are certainly the most important reason why bidis have such high price advantage over cigarettes, making them one of the cheapest tobacco products in the world.

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