An Analysis of Household's Tobacco Consumption Decisions: Evidence from India*

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Abstract

Tobacco products such as bidi and cigarette, both of which are smoked, cater to different kinds of households in India, and analyzing them separately may yield results that are useful for public policy. Hence, we analyze the consumption patterns, socio-economic distribution and the household choice of a variety of tobacco products across rural and urban India. Using a Multinomial Logit Model, we analyze the choice behavior of a household in deciding whether and which tobacco products to consume. Household level data from National Sample Survey in India for the year 1999-2000, which has information on 120,309 households, has been used for this purpose. We find that most forms of tobacco consumption are higher among socially disadvantaged and low-income groups in the country. Variables such as education, sex ratio, alcohol and pan consumption were found to be significant factors determining tobacco consumption habits of Indian households. The effect of some of the factors on the probability of consumption differs for certain types of tobacco products, increasing some, and decreasing others. Addictive goods such as alcohol and pan were found to be complimentary to tobacco consumption.

Keywords: *Tobacco, Bidi, Cigarette, Consumption, Multinomial Logit, India.*
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I Introduction

Tobacco related illnesses have become a major factor contributing towards the high morbidity in developing countries, where more than 82% of the world smokers reside. Available estimate indicates that tobacco will account for the death of about ten million people per year (World Bank, 1999). 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. Ever since tobacco was introduced in India in medieval times, it has become an important item in the consumption basket of many of her households. Tobacco is a major ingredient in a variety of addictive goods like bidi, cigarette, tobacco leaf, zarda, cheroot, hookah etc. that the Indian households consume.[1] Today in India, an estimated 65% of all men and 33% of all women consume some form of tobacco and India is home to nearly 17% of the smokers in the world (Shimkhada and Peabody, 2003). The ill effects of tobacco consumption on health has been documented well in literature[2] and is one reason why health policy advocates call for regulations to curb tobacco use, in spite of certain economic benefits that tobacco yields in the form of tax revenue, employment generation etc. Any policy regulation to curb tobacco use requires a good deal of knowledge about the economics of tobacco in terms of the nature of consumption of various tobacco products across region and socio-economic groups.

There is however, a dearth of such detailed studies on the economics of tobacco for India. Nevertheless, a few studies on economics of tobacco, especially on tobacco consumption, have appeared very recently. An annotated bibliography of research on use, health effects, economics, and control efforts of tobacco, compiled by Ray *et al.* (2003), provides an excellent source of literature on tobacco in India. It is also a good pointer to the dearth of literature on economics of tobacco in India. There are two major data sources on tobacco consumption in India apart from a few localised household surveys. One is the National Family Health Survey (NFHS) and the second is consumer expenditure surveys of the National Sample Survey Organization (NSSO).

Rani *et al.* (2003) and Subramanian *et al.* (2004) have analyzed the pattern and distribution of tobacco consumption and health behavior of households in India, with the NFHS-2 (1998-1999) data. The main findings by these authors can be

[1] Bhonsle *et al.* (1992) provides a detailed analysis of various tobacco habits prevailing in India.

[2] Refer Gajalakshmi *et al.* (2003) and Jussawalla and Deshpande (1971) for a discussion on the health risks associated with tobacco use.

summarized as follows: (i) prevalence of tobacco use is higher among males and among poor, less educated, scheduled caste and scheduled tribe populations; (ii) there is a positive association between age and the probability of smoking; (iii) wide variations exist in the prevalence of smoking and chewing across different states; and (iv) socio-economic differences are more marked for smoking than for chewing tobacco. These studies, though contributing a great deal about the pattern and characteristics of tobacco consumption, have various limitations too. (i) They do not analyze the nature of tobacco consumption in rural and urban India separately. There are many differences between rural and urban India in terms of the kind of tobacco products used and the socio-economic characteristics of the households. (ii) Analysis in these studies were carried out for smoked and smokeless tobacco. The lack of disaggregated data on different tobacco products in NFHS, thus limits the scope of these studies. (iii) The NFHS surveys generally collect information from female members in the household.[3] But tobacco consumption habits are more prevalent among males, so there might be serious underreporting.

Using NSSO data Gupta and Sankar (2003) and John (2004) have analysed the patterns of tobacco consumption at an all India level. Though both the authors have made a descriptive analysis of the socio-economic distribution and patterns of tobacco consumption separately for rural and urban India, they have not analysed the household characteristics leading to tobacco consumption. More over these analysis were also limited to smoked and smokeless tobacco. Rahman (2003) has used different rounds of NSSO data and have analysed the consumption of tobacco products such as bidi, cigarette and tobacco leaf separately. But the emphasis of this study was to explain the effects of alcohol prohibition in India and hence the tobacco products were introduced into the analysis only to study the spill-over effects of alcohol policies in India.

Apart from the studies based on NSSO and NFHS data, there have also been other studies (Gupta, 1996; Narayan *et al.*, 1996; Sinha *et al.*, 2002) largely based on primary surveys held in specific areas in India. Most of these studies were targeted towards specific population groups and give evidence relating tobacco consumption to various demographic and socio-economic characteristics of individuals.[4]

Thus, even the limited studies on economics of tobacco that are available analyse tobacco products at an aggregate level making no finer distinctions than be-

[3]Refer to Rajan and James (2004) for a detailed critique of NFHS.

[4]Ray *et al.* (2003) provides detailed information on many such studies which have been carried out in different parts of India and among different socio-economic groups.

tween smoked and smokeless tobacco products. However, products such as bidi and cigarettes, both of which are smoked, cater to different kinds of households in India, and analyzing them together may not be helpful from the point of view of formulating meaningful policies to regulate tobacco use. Restricting the analysis only to an all India level, and not considering the rural urban differences explicitly, is yet another limitation of the studies thus far. In a country like India, the rural and urban households are essentially very much different in terms of their socio-economic characteristics and hence any analysis would be much more useful if considered separately.

In this context we analyze the consumption patterns across socio-economic classes and household choices for a variety of tobacco products such as bidi, cigarette, tobacco leaf, hookah, zarda, cheroot etc. across rural and urban India. This, we expect, will mitigate the problems associated with analysing tobacco products at an aggregate level such as smoked and smokeless tobacco. Since the analysis is done separately for rural and urban India, the problems arising out of sectoral differences in household's domicile is also rectified to an extend. The main interest of our paper is to model the choice behavior of a household in deciding whether and which tobacco product to consume. The household level data by the NSSO for the year 1999-2000 has been used for this purpose.

The paper is organized as follows: Section two gives a detailed description of the data we have used, including a description of the different tobacco products that are considered for our analysis. A detailed descriptive analysis of the geographical and socio-economic distribution of tobacco consumption in India is given in section three followed by a summary of the econometric methodology in section four. Section five discusses the major empirical results from our study, which is followed by a concluding section.

II Data description

The National Sample Survey (NSS) was commenced by the Government of India in 1950 to collect socio-economic data using scientific sampling methods. Different subjects are taken up for survey in different rounds of NSS. The 55^{th} round of NSS (1999-2000) collected data on household consumption expenditure covering over 500 food and non-food items along with a large set of household characteristics. The survey covered the whole of the Indian Union excepting (i) Ladakh & Kargil districts

of Jammu and Kashmir, (ii) interior villages of Nagaland situated beyond five kms. of a bus route and (iii) villages of Andaman & Nicobar Islands remaining inaccessible throughout the year. All the villages of the country, uninhabited according to 1991 census, were also left out of the survey coverage of the NSS 55^{th} round (NSSO, 2000). Household is the ultimate sampling unit for which the data on consumption are recorded. Hence our analysis of tobacco consumption habits will be limited to the household. However, a variety of demographic and socio-economic information on individuals within a household are also collected, which can be merged with the household information.

Total Consumption data on various tobacco products are collected using both 30-day and 7-day recall periods. However, the analysis below will be based on only the reported consumption of various tobacco products in the last thirty days prior to the interview.[5] The 55^{th} round of NSS collected data on consumption from 120,309 households, which comprised 71,385 rural and 48,924 urban households. But while merging the household and individual information there were a mismatch of 499 and 256 households in rural and urban sectors respectively. Hence the data for our analysis effectively contains 70,886 rural and 48668 urban households.

Tobacco products considered for analysis

The 55^{th} round of NSS collected information on consumption of eight tobacco products, which are commonly used by Indian households. They are bidi, cigarette[6], hookah, cheroot, tobacco leaf[7], snuff, zarda and others.[8] The first four are consumed as smoke tobacco and the rest are smokeless tobacco.[9] Bidi is 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.[10]

[5]We have done all our analysis using both 30-day and 7-day recall data and have found that the results are more or less the same. Hence we report only the results from 30-day recall data. NSSO Expert Group (2003) provides an analysis of the issues related to different recall periods and Sen (2000) provides a detailed discussion on NSSO sampling methodology.

[6]Cigarette paper and tobacco are sometimes purchased separately for making cigarettes. In such cases value to be recorded would be the value of tobacco plus the value of paper taken together. The corresponding entry in quantity column will be in terms of number of cigarettes actually made.

[7]It will include all leaf tobacco consumed during the reference period in any form. If tobacco leaf is burnt and powdered for brushing teeth then consumption will be shown against this item

[8]Other tobacco products that are not reported here such as *gutkha, mishri, dhumti* etc.

[9]NSS also gives similar data on Pan consumption. But we don't use pan explicitly in our analysis.

[10]Description of this and the other products are taken from Bhonsle *et al.* (1992) and Gupta *et al.* (1992).

Cigarette is made from fine-cut tobacco, which are wrapped in a paper. It is a blend of different grades of flue-cured (virginia), Maryland and air-cured tobacco and contains almost one gram of tobacco. Though bidi contains only a small amount of tobacco compared to cigarette, 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 Cigarette (Gupta *et al.*, 1992). Hookah is an Indian water pipe favored among aristocratic families. Cheroots are small cigars made of heavy bodied tobacco with no wrapper. Snuff is a smokeless tobacco often confused with chewing tobacco. Users do not chew snuff, but put small amounts between their cheek and gum and allow the nicotine to absorb into the bloodstream. Zarda is a form of chewing tobacco prepared by cutting tobacco leaves into small pieces and boiling them in water with slaked lime and spices until the water evaporates. NSS collects information also on Pan (betel-quid chewing). Pan consists of betel leaf, areca nut, slaked lime, catechu and tobacco. Since tobacco forms only a small portion of pan and the amount of tobacco varies in different pan products, we have not considered pan consumption explicitly in our analysis. However, it has been used as a control variable.

III Patterns of tobacco consumption

This section provides a detailed and descriptive analysis of the geographical and socio-economic distribution of tobacco consumption in India. Table 1 gives the number and percentage of households consuming different tobacco products as well as the share of household budget spent on consuming them in rural and urban India. Roughly 62% of rural and 40% of urban households in India report some form of tobacco consumption.[11] Bidi is the most commonly used tobacco product and roughly 57% of rural and 48% of urban total tobacco users in India use it. Bidi, cigarette and tobacco leaf are the three main items consumed and approximately 95% of the total tobacco users in rural and urban India consume one or more of these products. Nearly 23% of the tobacco users use other tobacco products.

This table also shows the distinct rural urban differences in the nature and type

[11]Population percentages are calculated using inverse sampling probabilities as weights so that given the validity of sampling, the estimates should be representative of the respective rural and urban households in India as a whole. Weighted and unweighted numbers are close to each other, and since using the weights in more complex analysis poses a number of econometric problems (Deaton, 2000) we shall not make further use of them.

of consumption of various tobacco products. These differences are marked in the case of bidi, cigarette and tobacco leaf. For example, while 36% of rural households consume bidi only 19% of urban households choose to consume it. The budget share for "Total" is the percent that all tobacco products together account for of the total household budgets of households with non-zero expenditures on tobacco. The budget share shown for each individual tobacco product (bidi, cigarettes, hookah, etc.) indicates expenditures on that type of tobacco product as a percentage of expenditure on total tobacco. This would mean, for example, in rural India 2.5% of the total consumption expenditure of an average tobacco consuming household is spent on consuming tobacco of which 50.6% is spent on consuming bidis and only 6.7% is spent on cigarettes. Whereas in urban India, 42.8% and 25.1% of the total budget for tobacco is shared by bidi and cigarette respectively.

Table 2 shows the percentage of households consuming tobacco products among different socio-economic groups in rural and urban India. As we can observe, bidi is the most preferred tobacco product among all the socio-economic groups in rural India, while in urban India among Christians, Jains and high-income groups cigarette consumption is more prevalent. Considering the income groups we see that in rural India, percentage of people consuming tobacco is the highest among middle-income groups, whereas in urban India the prevalence is decreasing as we move from lower to higher income groups. We observe that the proportion of households consuming bidi, in urban India, decreases as we move from lower to higher income groups. There is notable difference in the cigarette consumption between lower and higher income groups in both rural and urban India with the lower-income groups having the lowest proportion of households consuming cigarette. On the other hand, prevalence of tobacco leaf, cheroot and snuff consumption are highest among lower income group and lowest among higher income groups in rural and urban areas, while the opposite is true in case of hookah.

Observing the pattern of tobacco consumption among different social groups such as Scheduled Tribes (ST), Scheduled Castes (SC), Other Backward Castes (OBC)[12] and others, we see that, the proportion of households consuming most of the tobacco products are highest among the backward castes compared to the general population. Even among the backward castes, we observe that prevalence is highest among the most deprived sections (ST/SC) within them. Moving over to

[12]SCs and STs are historically marginalized and the most deprived section in Indian society. SCs are a constitutionally declared collection of castes, who suffered from the practice of untouchability. Whereas STs constitute the tribal population, who may be also referred to as the indigenous groups.

the religious groups, we observe that, the use of most of the tobacco products are similar across all religious groups in rural and urban India except Sikhs and Jains. The proportion of households consuming most of the products is lowest among Sikhs and Jains. This could be probably because of the religious sanctions against using tobacco among these groups (Gupta, 1996; Mahal, 2000). Noticeably prevalence of cigarette consumption is very high among Christians in both rural and urban India compared to the other religious groups.

The data also shows significant variation in prevalence of tobacco consumption and in the types of products consumed across states. While only 21% of households in rural Punjab reports some form of tobacco consumption, 94% in rural Mizoram reports the same. The lowest prevalence of tobacco use in Punjab is evident from the majority sikh population in this state. In most states we also observe prevalence of tobacco use higher among the rural areas compared to the urban areas. Though bidi is the most preferred item across the rural areas of most states, in Assam, Bihar, Maharashtra and Mizoram, use of tobacco leaf is more prevalent. In the urban areas, on the other hand, preference between bidi and cigarettes varies across states without any discernible patterns. Orissa becomes distinct for the reason that, among the tobacco consuming households reporting consumption, majority preferred other tobacco products and they spent roughly 45% and 50% of the total budget for tobacco on other tobacco products in rural and urban areas respectively.

IV Econometric methodology

The main objective of this paper is to analyze the choice behavior of households in deciding whether and which tobacco products to consume. The typical household is faced with a variety of tobacco products and it has to decide; firstly, whether to consume any of the tobacco product at all, and secondly, whether to consume one or a combination of these products. We address this issue using a Multinomial Logit Model (MNLM). MNLM can be thought of as simultaneously estimating binary logits for all possible comparisons among the outcome categories (Long, 1996). We specify each nominal outcome as a nonlinear function of the independent variables x's. Once the model is identified we express this nonlinear probability model as linear in the log of odds.[13]

Let y be a dependent variable with J nominal outcomes. The J categories are

[13]See Ch.6, Long (1996) for a detailed exposition on Multinomial Logit Model.

numbered 1 through J but are not ordered in any ways. Let $\Pr(y_i = m \mid X_i)$ be the probability of observing outcome m for individual i given X, the set of explanatory variables. As a probability model MNLM can then be written as:

$$\Pr(y_i = m \mid X_i) = \Pi_{im} = \frac{\exp(X_i\beta_m)}{\sum_{j=1}^{J}\exp(X_i\beta_j)} \quad \text{where } \beta_1 = 0 \tag{1}$$

$\beta_1 = 0$ is a constraint that is imposed in order to identify the model. MNLM can also be expressed in terms of the ratio of odds. The odds of outcome m versus outcome n given X, indicated by $\Pi_{m|n}(X_i)$, can be written as:

$$\Pi_{m|n}(X_i) = \frac{\Pr(y_i = m \mid X_i)}{\Pr(y_i = n \mid X_i)} = \frac{\exp(X_i\beta_m)}{\exp(X_i\beta_n)} \tag{2}$$

Combining the exponents and taking the logs shows that odds ratio (Π_m/Π_n) depends log-linearly on X_i: i.e.,

$$\ln \Pi_{m|n}(X_i) = X_i(\beta_m - \beta_n) \tag{3}$$

where the difference $\beta_m - \beta_n$, is the effect of X on the logit of outcome m versus outcome n. Since $\beta_1 = 0$ by assumption, we can write the equation for the comparison with the outcome 1 as follows:

$$\ln \Pi_{m|1}(X_i) = X_i(\beta_m - \beta_1) = X_i\beta_m \tag{4}$$

The model can be estimated using Maximum Likelihood (ML). The associated log-likelihood function for this will be:

$$\log \mathcal{L} = \sum_{i=1}^{N}\sum_{j=1}^{J} d_{ij}\log(\Pi_{ij}) \tag{5}$$

Where $d_{ij} = 1$ if individual i chooses alternative j and $d_{ij} = 0$ otherwise. The ML estimator $\hat{\beta}$ is consistent, and asymptotically normally distributed.

The dependent variable for our analysis is a polychotomous variable and represents the choice made by a household. We have households that consume a single tobacco product like bidi or cigarette as well as those who consume a combination of different products. Hence, we would want to know the probabilities for a household not consuming any of the products, consuming only a single product and consuming

a combination of the products. For this purpose we classify the choices of households into various groups. First of all we regroup the eight tobacco products in the data set into four main items: bidi, cigarette, tobacco leaf and others.[14] Then we group the households into twelve categories such as those consuming none, only bidi, only cigarette, only tobacco leaf, only others, only bidi & cigarette, only bidi & tobacco leaf, only bidi & others, only cigarette & tobacco leaf, only cigarette & others, only tobacco leaf & others and all other combinations.[15] The category of households who do not consume any of the products constitute the base category for the MNLM. Table 3 describes the number of households belonging to each category. As we can see, there is a substantial number of households using a combination of tobacco products. Hence modelling such households as a special choice category is justified by the data.

The set of explanatory variables we have considered in our analysis comprises of a variety of household socio-economic characteristics. The log of total expenditure spent over the thirty days prior to reporting was taken to see if increase in the budget increases the probability of consuming tobacco. The log of household size was considered essentially to know, if having a small or large family has an effect on the choice behavior of a household with regard to consuming different tobacco products. Tobacco products are essentially adult goods and the prevalence of tobacco consumption is found to be higher among the elderly.[16] It is also perceived that tobacco use in any form is higher among males than females. To empirically analyse these factors, we have considered the ratio of number of adults (fourteen years of age or more) to household size and the ratio of total adult males to household size. Variables to indicate the educational status of household were also considered, since education increases the awareness about the ill effects of tobacco consumption, and we expect a reduction in the probability of consumption of tobacco as education increases. But whether the increase in education of all members in the household or increase in education received by the most educated member in a household, that has the effect on reducing the probability of tobacco consumption, is worth analysing. Use of alcohol or other intoxicants and pan may also influence

[14]The others here would include all those products that are not bidi, cigarette or tobacco leaf. This regrouping was done mainly due to the small sample size for products such as snuff, hookah, zarda etc. See Table 1.

[15]The number of households belonging to the other combinations were small and so we clubbed all of them into one group called "all".

[16]Refer Gupta and Sankar (2003) for information on tobacco use prevalence among different age groups in India.

the probability of consumption of tobacco since all these products are addictive in nature. We have captured these effects through control variables for alcohol[17] and pan consumption. We have also considered an indicator variable to check if residing in tobacco producing States affects household's tobacco consumption decisions. In India, the three States Andhra Pradesh, Gujarat and Karnataka account for roughly 82% of the area under tobacco crop (Anon, 2000). The descriptive analysis in section 3 showed lowest prevalence of tobacco consumption among Sikh and Jain religious groups and higher prevalence of tobacco consumption among socially backward groups such as STs, SCs and OBCs. By using appropriate control variables here, we will empirically examine these. Household occupational types also may affect tobacco consumption decisions. Households are classified into different occupational groups: Self employed in non-agriculture (Type1R), Agricultural labor (Type2R), Other labor (Type3R), Self employed in agriculture (Type4R) and Others (Type5R) in rural areas; and Self employed (Type1U), Regular wage/salary earning (Type2U), Casual Labor (Type3U) and Others (Type4U) in urban areas. Agricultural laborers are the poorest occupational group in rural India and casual laborers in urban India.[18] Table 4 gives a description of variables that were used for the analysis.

V Empirical results

Analysis is done separately for rural and urban households as well as rural urban combined. Results are presented in Tables 5 through 7.[19] We present here only the odds ratios for each of the categories for both rural and urban households. The likelihood ratio test to test the effect of each independent variable on the dependent variable has been carried out and the null hypothesis[20] was rejected at five percent level of significance. Hausman test was also carried out to test the assumption of

[17]The control variable for alcohol takes the value one if the household consumes one or more of the following items: ganja (Marijuana), toddy, country liquor, beer and foreign liquor, else it takes the value zero.

[18]See Sundaram and Tendulkar (2003) for a detailed analysis on the relative economic status of each of the occupational groups in rural and urban India.

[19]While defining dummies for social groups and household types, we lost 116 observations in rural and 102 in urban India, since there were households for whom such information are not available in the data.

[20]With J possible outcomes and K independent variables, the hypothesis that x_k does not affect the dependent variable is written as $H_0 : \beta_{k,1|r} = ... = \beta_{k,J|r} = 0$ and can be tested either with a LR or Wald test.

Independence of Irrelevant Alternatives (IIA) and the null hypothesis, H_0 : Odds (Outcome-J vs Outcome-K) are independent of other alternatives, was accepted.[21] The results for these tests are not reported here.

From the table of odds ratios for all India[22] we see that, as log expenditure increases the relative probability of consuming bidi increases relative to *not consuming any tobacco product* (here after "none"). Same is true for cigarette and so is the case for most other combinations, where cigarette or bidi is part of a combined outcome.[23] The odds are highest for the combined consumption of cigarette-others. On the other hand, we see that odds are against choosing tobacco leaf and tobacco leaf-others relative to none for a given increase in household expenditure. While this result is more or less same for the rural India, we see that among the urban households, an increase in household expenditure does not increase the relative probability of choosing bidi relative to none. Instead it decreases the probability. It also points to the fact that, an analysis of bidi and cigarette combined as smoke tobacco, may not give clear insights.

An increase in household size has the effect of turning the odds against consuming cigarette relative to not consuming any of the tobacco products among both rural and urban households, while it has the opposite effect with regard to all other choices. In other words, cigarette being an expensive item smoked mostly by higher income groups, a large sized household might find it difficult to afford and hence the probability of consuming cigarette decreases. Whereas, this does not happen in case of other products since they are more affordable compared to cigarettes.

An increase in male ratio has similar effects across rural and urban India. We can see that, as male ratio increases, or alternatively, as the number of adult males in a household increases the likelihood of consuming one or more of tobacco product increases compared to not consuming tobacco. Adult ratio, the ratio of total adults to family size, on the other hand, decreases this likelihood at least in case

[21]The IIA assumption states that the odds are determined with out reference to the other outcomes that might be available. Hence this assumption requires that if a new choice becomes available then all probabilities for the prior choices must adjust in precisely the amount necessary to retain the original odds among all pairs of outcome.

[22]We explain the results for all India and take note of the differences, if any, between rural and urban India.

[23]In general the interpretation goes like this: The parameter (odds ratio) $\beta_{k,J|r} > 1$ for a variable k means that, given all the other variables, the relative probability of choosing J increases relative to the probability of choosing r, which is the base category and $\beta_{k,J|r} < 1$ implies the relative probability decreases compared to the base category. One can also make comparisons between outcome p versus q by finding the difference between two of the known parameters: e.g., $\beta_{k,p|q} = \beta_{k,p|r} - \beta_{k,q|r}$.

of individual products like bidi and cigarette. These findings reiterate the fact that tobacco products are basically adult goods and are mostly consumed by males.

In both rural and urban India, an increase in the average education of a household has the effect of increasing the relative probability of not consuming any of the tobacco products against consuming them. Whereas, an increase in years of education of the most educated member in a household turns the odds in favor of consuming Cigarette and a few other items in all India regression, while relative probabilities decrease for choosing bidi. However, the coefficient for cigarette is not significant in separate rural urban regression. Notably, we also observe that the mean education of a household is not significant in deciding the relative probability of choosing cigarette. What is important is the finding that education does not affect the probability of cigarette smoking, while it does have an effect on the probability of consumption of other tobacco products. Given that cigarette constitutes only 15% of total tobacco consumption India and the remaining 85% consume bidi and other tobacco products (John, 2004), educating the the households about the ill effects of tobacco use, will have an effect on reducing the consumption.

The dummies for both alcohol and pan are significant at one percent for all the regressions and for all choices, implying that relative probability of choosing any one or a combination of tobacco product increases relative to none if the household has the habit of either alcohol or pan consumption. In general the gradient is higher for urban India in case of alcohol consumption, while it is higher in rural India for pan consumption. It means, for instance, the relative probability of consuming tobacco is higher for an alcohol-consuming household living in urban India, compared to the one living in rural India. Similarly a pan consuming household in rural India is more likely to use tobacco than a similar household in urban India. This result points to the fact that pan and alcohol are acting as compliments to tobacco products. Hence any policy directed towards reducing tobacco use also has to take similar steps to restrict the use of pan and alcohol as well.

Moving to the dummy for tobacco producing states, we observe that the relative probabilities are in favor of none except for cigarette in rural India. Meaning households in tobacco producing states, in general, has less probability of consuming most tobacco products compared to none. This results is counter intuitive. Only in case of rural households we see that the relative probabilities are increasing for consuming cigarette compared to none if the household belonged to the tobacco producing state.

An analysis of the effect of household's social group status reveals that, if the household belonged to Sikhs or Jains, the relative probability of not consuming tobacco increases compared to any other choices in both rural and urban India. Whereas, if the household belonged to STs or SCs, their relative probability of choosing most of the tobacco products increase in relation to none. Thus, it empirically establishes the results we observed from the descriptive analysis in section 3. Dummies for various household occupational types also show an increase in relative probability compared to the base category. But these dummies are not significant in case of many of the items.

VI Conclusion

The main objective of this paper was to analyze the choice behavior of households in deciding whether and which tobacco product to consume. The study has thrown up certain interesting results which may be important from the point of view of public policy regarding tobacco use. A descriptive analysis of the pattern and distribution of tobacco consumption among various socio-economic groups revealed that the prevalence of most forms of tobacco use is higher among socially disadvantaged and lower income groups in India. Our paper also takes note of the perceptible differences in prevalence of consumption of various tobacco products among different socio-economic groups as well as across rural and urban India. An econometric analysis of the tobacco consumption decisions of households revealed that various factors affecting the probability of consumption of tobacco products have differential impacts on these products. The findings in this paper warrants the need for disaggregated analysis of various tobacco products such as bidi, cigarette, tobacco leaf etc. rather than analysing them together as smoked and smokeless tobacco.

Many variables such as 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. were found to be important factors determining the probability of choosing a particular tobacco product over the other. We find that, more than the increase in education of a single member in a household, it is the average education of a household that has a positive effect in reducing the probability of tobacco use. The study also brought out the complimentary nature between tobacco products and other addictive goods such as alcohol and pan. we find that the relative probability of consuming tobacco

increases if a household has the habit of using either alcohol or pan. It necessitates the formulation of comprehensive policies targeting all addictive goods to regulate the consumption of tobacco use. Policies directed towards reducing tobacco use also warrant similar steps to restrict the use of alcohol and pan in order to yield better results.

Finally, the fact that prevalence of tobacco use is different across different socio-economic groups as well as rural and urban areas, and that the factors affecting the probability of choosing different forms of tobacco are different, have implications in terms of formulating policies to regulate tobacco consumption. Policies may need to be targeted towards specific tobacco products, considering socio-economic and geographical determinants of tobacco consumption. More importantly, any tobacco control policies that does not target bidi and chewing tobacco products, which are consumed predominantly, will not yield the desired results in terms of reducing tobacco consumption.

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Table 1: Number and Percentage of households consuming tobacco and budget share spent on it (Rural and Urban)

	Number of Households		**Sample Percentage**		**Population Percentage***		**Budget Share**	
Item	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Bidi	25217	9263	35.33	18.93	36.50	19.84	50.60	42.80
Cigarette	3900	5536	5.46	11.32	3.69	9.61	6.70	25.10
Hookah	2344	372	3.28	0.76	2.62	0.43	3.10	1.30
Cheroot	627	194	0.88	0.40	1.03	0.61	1.30	0.90
Tobacco Leaf	13335	3625	18.68	7.41	19.42	7.26	24.90	15.70
Snuff	1036	286	1.45	0.58	1.37	0.61	1.50	1.00
Zarda	2919	1359	4.09	2.78	4.20	3.37	4.90	5.40
Others	4442	1985	6.22	4.06	5.68	3.61	7.10	7.80
Total	44435	19433	62.25	39.72	62.63	39.69	2.50	2.88

* These percentages are calculated using inverse sampling probabilities as weights, while all the other values in the table are from the sample without using any probability weights.

Notes: The share for total tobacco is the share in total household budget while that of other items are shown as percentage of share allocated from the share for total tobacco.

Source: Computed from NSSO (2000)

Table 2: Percentage consumption of tobacco among socio economic group

Category	bidi	cig	huka	cheru	tleaf	snuff	zarda	other*	Total
Rural India									
Income									
Lower	29.3	1.4	1.6	1.2	21.7	2.0	3.3	7.3	59.08
Middle	39.6	4.5	2.6	0.9	19.4	1.3	4.1	5.9	65.68
High	35.6	10.8	5.9	0.5	14.7	1.1	4.9	5.5	60.84
Caste									
ST	38.7	6.6	3.3	0.8	28.0	1.9	3.3	11.3	74.59
SC	42.9	3.3	2.3	1.0	19.0	1.8	4.9	6.5	68.15
OBC	33.0	4.7	2.8	1.1	20.3	1.4	4.1	5.6	60.6
Others	32.1	7.0	4.2	0.6	12.8	1.2	4.0	4.6	55.4
Religion									
Hindu	35.9	4.6	2.6	1.1	20.0	1.6	4.2	6.5	63.39
Muslim	39.3	7.8	9.4	0.1	12.0	0.6	2.9	2.7	63.16
Christian	35.1	14.5	2.8	0.5	20.7	1.5	2.2	10.2	65.64
Sikh	7.7	0.7	0.3	0.0	0.4	0.1	7.1	0.3	15.10
Jain	10.7	1.3	0.0	0.0	5.3	0.0	2.7	4.0	24.00
Buddhist	19.9	13.0	1.7	0.1	19.0	0.6	11.0	7.6	61.08
Others	39.3	7.5	1.3	0.0	23.3	0.6	0.7	15.8	69.81
Urban India									
Income									
Lower	24.1	5.1	0.3	0.7	9.2	0.8	3.1	4.5	42.6
Middle	21.0	11.0	0.9	0.4	7.8	0.5	2.9	4.2	41.5
High	11.1	18.0	1.0	0.2	5.2	0.6	2.4	3.4	34.5
Caste									
ST	20.0	20.1	1.6	0.2	20.4	0.9	2.5	14.2	63.1
SC	33.4	8.5	0.6	0.5	9.6	0.8	4.3	5.3	54.0
OBC	20.6	10.0	0.3	0.7	8.0	0.8	2.4	3.4	40.3
Others	14.6	11.6	0.9	0.3	4.9	0.4	2.7	2.9	33.2
Religion									
Hindu	18.9	10.9	0.3	0.5	7.2	0.6	3.0	3.8	39.2
Muslim	25.6	10.4	2.9	0.2	6.9	0.6	2.3	2.7	44.2
Christian	10.4	22.4	1.6	0.3	14.1	0.9	1.5	11.9	49.2
Sikh	3.6	0.8	0.0	0.0	0.8	0.1	1.1	0.3	5.5
Jain	3.1	7.3	0.0	0.0	3.4	0.5	1.7	2.4	16.2
Buddhist	12.6	10.9	0.6	0.0	16.1	0.9	8.6	5.4	48.7
Others	26.2	22.5	1.3	0.0	5.4	0.0	1.7	4.7	52.0

Notes: other includes all other tobacco products other than the ones listed here and excluding pan. Middle income groups represents 30^{th} to 70^{th} percentile of the distribution of monthly consumption expenditure of households. Lower and higher income groups are the ones below and above it.

Source: Computed from NSSO (2000)

Table 3: Number of households in each choice category

	Rural		Urban	
Choice	Freq.	Percent	Freq.	Percent
none	26819	37.83	29349	60.3
bidi	17842	25.17	7067	14.52
cigarette	1937	2.73	3921	8.06
tobacco leaf	9636	13.59	2725	5.6
others	6394	9.02	2733	5.62
bidi-cigarette	1078	1.52	890	1.83
bidi-tobacco leaf	2584	3.65	456	0.94
bidi-others	3040	4.29	646	1.33
cigarette-tobacco leaf	173	0.24	164	0.34
cigarette-others	349	0.49	377	0.77
tobacco leaf-others	524	0.74	179	0.37
all tobacco products	510	0.72	161	0.33
Total	70886	100	48668	100

Table 4: Variables used for the analysis

Variables	**Description**
choice	(Dependent variable)
lnexp	Log of the total expenditure of household
lhsize	Log of household size
Mratio	Ratio of the number of adult males (+14 Yrs) to household size
Aratio	Ratio of total adults (+14 Yrs) to household size
Medu	Average education of household (in Years)
Mxedu	Years of education of the most educated member in house
ddrink	Dummy: = 1 if household uses alchohol or such beverages, else 0
dpan	Dummy: = 1 if household chews Pan, else 0
pddum	Dummy: = 1 if household belongs to tobacco farming states
rd	Dummy: = 1 if religion of the household is sikh or jain, else 0
sd1-sd3	Caste dummies representing ST,SC and OBC, Others being the base
Type1R-4R	Dummies for household occupational types (Rural India)
Type1U-3U	Dummies for household occupational types (Urban India)

Notes: There are 5 household types in rural and 4 in urban India. In rural India, type1R - Self employed in non-agriculture, type2R - Agricultural labor, type3R - Other labor, type4R - Self employed in agriculture & type5R - Others; in urban india, type1U - Self employed, type2U - Regular wage/salary earning, type3U - Casual labor, type4U - Others

Table 5: Odds ratios for All India (Base category: Not consuming any tobacco products)

Variables	bidi	cigret	tleaf	other	bidi-cig	bi-tlef	bi-oth	ci-tleaf	cig-oth	tlef-oth	all
log Expenditure	1.08	2.77	0.44	0.89	2.74	0.80	1.80	2.17	3.66	0.87	3.16
P-val	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.32	0.00
log Household Size	2.36	0.77	3.18	1.71	1.37	5.38	2.88	2.37	1.29	3.14	2.24
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Male Ratio	12.12	3.00	7.96	4.23	5.07	19.81	21.80	10.19	9.59	3.63	13.69
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adult Ratio	0.61	0.58	0.83	1.25	1.08	1.14	1.08	0.59	1.07	3.47	0.97
P-val	0.00	0.00	0.02	0.01	0.65	0.39	0.55	0.22	0.83	0.00	0.92
Mean Education	0.82	0.99	0.84	0.81	0.90	0.70	0.65	1.00	0.80	0.74	0.75
P-val	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.00
Max Education	0.96	1.01	1.00	1.02	0.97	0.99	1.01	0.99	1.07	1.07	1.01
P-val	0.00	0.05	0.53	0.01	0.00	0.30	0.41	0.64	0.00	0.00	0.60
Alcohol Dummy	2.48	3.88	3.36	1.92	4.13	4.69	2.80	4.07	2.38	2.10	4.66
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pan Dummy	1.22	1.48	6.10	2.30	1.99	6.53	1.85	17.02	3.04	6.72	8.61
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Dummy	0.74	1.02	0.26	0.57	0.53	0.19	0.38	0.23	0.38	0.27	0.27
P-val	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sikh/Jain Dummy	0.07	0.08	0.06	0.27	0.02	0.04	0.06	0.08	0.04	0.07	0.06
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
ST Dummy	1.11	1.57	1.74	1.57	1.25	1.89	1.56	4.09	2.34	5.15	2.95
P-val	0.03	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
SC Dummy	1.44	1.02	1.34	1.13	1.25	1.79	1.76	2.05	0.66	2.05	1.61
P-val	0.00	0.76	0.00	0.01	0.01	0.00	0.00	0.00	0.04	0.00	0.00
OBC Dummy	0.86	1.10	1.33	0.88	0.79	1.47	1.11	1.67	0.56	1.31	1.22
P-val	0.00	0.02	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.03	0.09
Occupation Type1R	2.53	1.59	1.73	1.71	2.28	2.43	2.45	2.08	2.84	1.00	5.54
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	1.00	0.00
Occupation Type2R	2.50	0.86	2.34	2.31	1.51	3.61	3.13	1.80	1.52	1.88	6.53
P-val	0.00	0.22	0.00	0.00	0.03	0.00	0.00	0.21	0.28	0.10	0.00
Occupation Type3R	3.03	1.72	1.66	1.47	2.98	2.33	3.22	2.38	2.43	0.79	4.31
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.03	0.58	0.01
Occupation Type4R	2.64	0.96	2.61	2.20	1.94	3.45	4.67	2.97	2.26	1.73	8.14
P-val	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.15	0.00
Occupation Type5R	1.45	1.37	1.36	1.46	1.92	1.74	2.02	2.13	3.41	0.87	3.54
P-val	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.08	0.00	0.73	0.01
Occupation Type1U	1.50	1.55	0.98	1.14	1.55	0.89	1.20	1.97	2.29	0.79	2.89
P-val	0.00	0.00	0.85	0.13	0.01	0.58	0.35	0.10	0.01	0.52	0.03
Occupation Type2U	1.27	1.72	1.33	1.32	1.41	1.16	1.19	2.46	2.55	0.83	2.34
P-val	0.00	0.00	0.01	0.00	0.03	0.50	0.36	0.03	0.00	0.64	0.08
Occupation Type3U	2.13	1.82	1.19	1.58	2.83	1.52	1.64	2.16	2.69	1.21	4.07
P-val	0.00	0.00	0.12	0.00	0.00	0.08	0.01	0.12	0.01	0.65	0.01

Notes: A P-val of 0.01 implies level of significance at 1% & 0.05 implies that at 5%. Refer Table 4 for details on variables.

Table 6: Odds ratios for Rural India (Base category: Not consuming any tobacco products)

Variables	bidi	cigret	tleaf	other	bidi-cig	bi-tlef	bi-oth	ci-tlef	cig-oth	tlef-oth	all
log Expenditure	1.33	3.41	0.44	0.98	4.13	0.88	2.25	2.75	4.35	0.86	3.73
P-val	0.00	0.00	0.00	0.75	0.00	0.14	0.00	0.00	0.00	0.38	0.00
log Household Size	2.19	0.76	3.65	1.81	1.29	5.70	2.65	2.52	1.49	3.88	2.31
P-val	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00
Male Ratio	12.79	3.22	7.45	3.88	4.21	16.58	22.83	21.14	16.09	3.24	9.72
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adult Ratio	0.54	0.54	0.94	1.50	0.96	1.25	1.13	0.72	1.16	4.94	1.19
P-val	0.00	0.00	0.48	0.00	0.86	0.19	0.45	0.60	0.77	0.00	0.66
Mean Education	0.84	1.02	0.82	0.77	0.97	0.70	0.63	1.05	0.80	0.71	0.75
P-val	0.00	0.25	0.00	0.00	0.16	0.00	0.00	0.40	0.00	0.00	0.00
Max Education	0.96	1.01	1.01	1.03	0.95	1.00	1.02	0.98	1.05	1.09	1.01
P-val	0.00	0.24	0.06	0.00	0.00	0.73	0.05	0.56	0.07	0.00	0.73
Alcohol Dummy	2.17	3.52	3.16	1.76	3.39	4.32	2.42	4.92	2.58	2.21	4.51
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pan Dummy	1.19	1.39	5.57	2.05	2.04	5.96	1.71	14.04	1.92	5.16	7.54
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Dummy	0.81	1.64	0.27	0.58	0.59	0.18	0.39	0.35	0.42	0.29	0.19
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Sikh/Jain Dummy	0.06	0.05	0.02	0.26	0.01	0.01	0.05	0.00	0.01	0.00	0.02
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST Dummy	1.02	1.32	1.43	1.32	1.49	1.59	1.44	2.12	0.95	3.63	2.39
P-val	0.67	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.85	0.00	0.00
SC Dummy	1.38	0.98	1.30	1.07	1.31	1.77	1.67	1.90	0.60	2.00	1.53
P-val	0.00	0.87	0.00	0.25	0.03	0.00	0.00	0.02	0.05	0.00	0.03
OBC Dummy	0.82	1.01	1.33	0.87	0.70	1.43	1.09	1.34	0.55	1.37	1.21
P-val	0.00	0.88	0.00	0.01	0.00	0.00	0.24	0.16	0.01	0.03	0.16
Occupation Type1R	1.78	1.22	1.19	1.12	1.37	1.39	1.24	1.04	0.77	1.05	1.57
P-val	0.00	0.01	0.01	0.07	0.02	0.01	0.05	0.89	0.17	0.84	0.04
Occupation Type2R	1.97	0.77	1.66	1.57	1.18	2.23	1.75	1.12	0.48	2.07	2.04
P-val	0.00	0.02	0.00	0.00	0.27	0.00	0.00	0.76	0.01	0.00	0.00
Occupation Type3R	2.26	1.53	1.17	0.99	2.09	1.40	1.71	1.30	0.71	0.86	1.27
P-val	0.00	0.00	0.06	0.91	0.00	0.02	0.00	0.50	0.22	0.59	0.41
Occupation Type4R	1.85	0.74	1.81	1.43	1.15	1.98	2.32	1.57	0.65	1.88	2.32
P-val	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.06	0.02	0.00	0.00

Notes: A P-val of 0.01 implies level of significance at 1% & 0.05 implies that at 5%. Refer Table 4 for details on variables.

Table 7: Odds ratios for Urban India (Base category: Not consuming any tobacco products)

Variables	bidi	cigret	tleaf	other	bidi-cig	bi-tlef	bi-oth	ci-tlef	cig-oth	tlef-oth	all
log Expenditure	0.73	2.40	0.46	0.75	1.74	0.68	0.92	1.55	2.84	0.76	2.33
P-val	0.00	0.00	0.00	0.00	0.00	0.02	0.47	0.03	0.00	0.25	0.00
log Household Size	2.76	0.79	2.39	1.62	1.47	4.88	3.97	2.37	1.18	2.40	2.15
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00
Male Ratio	8.59	2.53	6.50	4.05	3.94	21.06	15.49	4.91	6.19	3.71	21.92
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Adult Ratio	0.88	0.58	0.88	1.02	1.40	1.36	0.94	0.43	0.96	1.97	0.77
P-val	0.20	0.00	0.37	0.89	0.17	0.39	0.81	0.16	0.92	0.22	0.68
Mean Education	0.83	0.99	0.87	0.85	0.89	0.72	0.75	1.01	0.81	0.78	0.75
P-val	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00
Max Education	0.95	1.00	0.99	1.01	0.97	0.96	0.94	0.96	1.06	1.03	1.02
P-val	0.00	0.79	0.62	0.43	0.04	0.09	0.01	0.25	0.03	0.49	0.57
Alcohol Dummy	3.41	4.44	3.87	2.41	5.44	5.93	4.50	4.03	2.98	1.93	5.08
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Pan Dummy	1.17	1.53	7.36	2.75	1.88	8.25	2.22	18.76	4.29	14.92	11.40
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Dummy	0.67	0.80	0.26	0.57	0.51	0.29	0.42	0.12	0.36	0.23	0.54
P-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04
Sikh/Jain Dummy	0.10	0.11	0.19	0.21	0.05	0.33	0.16	0.25	0.10	0.58	0.33
P-val	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.12	0.00	0.61	0.11
ST Dummy	1.40	2.09	2.86	2.38	0.95	3.53	1.91	8.16	4.95	10.07	4.97
P-val	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00
SC Dummy	1.48	1.03	1.37	1.22	1.16	1.66	1.87	1.95	0.66	1.90	1.76
P-val	0.00	0.74	0.00	0.01	0.28	0.00	0.00	0.05	0.19	0.04	0.04
OBC Dummy	0.92	1.12	1.20	0.84	0.88	1.48	1.05	1.87	0.49	0.88	1.10
P-val	0.06	0.02	0.01	0.01	0.20	0.01	0.67	0.01	0.00	0.59	0.66
Occupation Type1U	1.68	1.59	1.23	1.34	1.59	1.02	1.26	2.10	2.69	1.02	3.11
P-val	0.00	0.00	0.06	0.00	0.01	0.93	0.24	0.08	0.00	0.97	0.02
Occupation Type2U	1.48	1.79	1.49	1.45	1.55	1.28	1.26	2.73	2.74	0.97	2.41
P-val	0.00	0.00	0.00	0.00	0.01	0.27	0.24	0.02	0.00	0.95	0.07
Occupation Type3U	1.97	1.66	1.44	1.73	2.19	1.48	1.33	1.76	2.58	1.40	3.72
P-val	0.00	0.00	0.00	0.00	0.00	0.11	0.15	0.26	0.01	0.46	0.01

Notes: A P-val of 0.01 implies level of significance at 1% & 0.05 implies that at 5%. Refer Table 4 for details on variables.