CROWDING-OUT EFFECT OF TOBACCO & IMPACT ON ESSENTIAL HUMAN NEEDS

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Abstract

Tobacco consumption adversely affects many aspects of well-being of an individual household as well as the economy as a whole. India being one of the leading producer and consumer of tobacco faces its brunt every passing year. This paper examines whether spending on tobacco crowds out expenditure on basic needs and if so, which commodities are compromised. Using the data of Delhi and Uttar Pradesh from 68th round of National Sample Survey, the pattern of spending of tobacco users and non-users on various commodities in the two financially divergent states is analyzed. By the application of Separability tests and Almost Ideal Demand system (AIDS), the theory of crowding-out is tested formally. The results suggest that there is a difference in the preferences of a tobacco consuming and non-tobacco consuming household. We could also infer that a tobacco consuming household prefers food over other commodities and a poor household tends to compromise on its basic necessities for increasing the tobacco consumption at a greater degree than the richer ones.

INTRODUCTION

Tobacco is one of the leading causes of deaths & disabilities across the world which are easily preventable. This usage kills more than 7 million people each year with around 81% of worlds 1.1 billion smokers living in low and middle income countries. This casualty rate is likely to get enhanced to eight million by 2030 unless remedial measures are initiated now.

Tobacco usage is growing fastest in low income countries where tobacco industry players target the low education levels. Specifically, in India nearly a quarter deaths are caused by unabated tobacco consumption in addition to having adverse economic impacts on the households. Tobacco use inflicts enormous economic costs on individuals and families due to illness, premature deaths, foregone consumption and investments. At macro levels it deteriorates a very healthy workfare, cost productivity, while causing high healthcare costs and degradation of natural environment. Expenditure on tobacco varies from 1% to 10% of

total expenditure of households in different countries. A unique example of Bangladesh highlights that poorest household in Bangladesh spends almost 10 times on tobacco when compared to the expenditure on education. It also causes 1 death every 6 seconds yet after China, India is the second largest consumer of Tobacco products.

Specifically for India the Tobacco sector contributes a whopping Rs 11,79,498 crore to Indian economy and employs an estimated 4.75 crore people. However, the negative efforts of tobacco consumption clearly outweigh the profits in terms of human lives. As per ICMR the total losses in 1999-200 due to tobacco related diseases were about Rs. 277.6 billion.

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Expenditure by a household on tobacco deepens poverty as it eats into the valid share of expenditure on other essentials. Whether spending on tobacco crowds out expenditure on basic needs and if so which commodities are compromised are some questions worth pondering.

The remaining part of this paper is organized to provide an overview of the tobacco consumption composition of India and how it impacts the society as a whole. The section also extensively reviews the impact of its addiction on basic necessities. In the further section there is a thorough but descriptive analysis of the data. The study shall proceed to carry out a formal econometric analysis using AIDS to examine whether tobacco spending has crowding out effects on other commodities. The study then checks for separability with the use of wald test to see the possible difference in the consumption preferences between the households consuming tobacco and those who do not. Subsequently, there is a focus on certain policies that can be effective in curbing the losses due to excessive tobacco prevalence.

Objective of the Study

This study primarily dwells on identifying the crowding out impact of Tobacco expenditure vis-a-vis expenditure incurred on health, education and other key amenities. Various policy changes for curbing the expenditure on Tobacco and optimal channelization of resources on other essentials form an integral part of the Study.

Methodology of Study

(a) Data from 86th consumer expenditure survey has been segregated into two sections as under:-
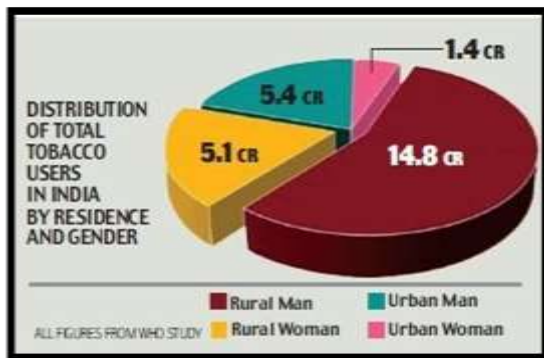
      (i) Households consuming tobacco.

      (ii) Non tobacco consumption households.

(b) Regression models have been separately run on both data sets with variables comprising of education, health, life insurance and nutrition to arrive at logical conclusions.

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OVERVIEW OF THE PROBLEM

Consumption composition in India   Use of tobacco is majorly popular among the males living in rural areas. Based on the WHO study, *rural India comprises of nearly 75 percent of total tobacco consumers in India*. It is not only popular among men but women as well. Rural women consume almost as much as urban men. In India, it is consumed in various forms such as bidi, cigarette, paan, chutta, etc. According to the findings of '*Bidis and smokeless tobacco by Cecily S. Ray and Prakash C. Gupta, 03 June 2014',* only 19% of tobacco is consumed in the form of cigarettes. Over half of all tobacco consumed in India is smoked as bidis (54%) and nearly 27% is consumed in smokeless form. An analysis by NSSO from the 55th Round (1999–2000) suggests low prevalence of cigarettes where less than one-tenth of urban and less than 4% of rural households consume cigarettes. In India as a whole, bidis are sold 7-8 times more than cigarette.

(*Source: WHO- composition of tobacco consumers in India*)

Table 1. Proportion of households consuming tobacco products in India		
Tobacco product	Rural (%)	Urban (%)
Bidis	36.5	19.8
Smokeless tobacco (tobacco leaf, snuff, chewing tobacco, others)	30.7	15.0
Cigarettes	3.7	9.6
Other smoking tobacco (hookah tobacco, cheroot)	3.6	1.0
None	37.4	60.3

(Source: Bidis and smokeless tobacco,Cecily S. Ray and Prakash C. Gupta, 03 June 2014)

Impact on Individual Households and Economy as a whole

Tobacco addiction among poor households leads to a formation of a *Vicious Circle of Poverty and Tobacco*. A poor spend a larger proportion of his income on tobacco than the richer one due to which less is left to satisfy the basic human needs. However, factors such as weak public policies coupled with a lack of access to information on living healthily, mass-targeted tobacco advertising

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and, ultimately, addiction to nicotine - all contribute to poor people spending larger share of their income on tobacco products.

Thus, its addiction inflicts a very high opportunity cost among such households. It also leads to diseases among the income earners of the households. Such health hazards not only affect their productivity but impose burden of high medical costs on the family. This ultimately pushes the family into a poverty trap . The tobacco prevalence not only affects an individual at household level but the economy as a whole. Countries suffer huge economic losses due to high health-care costs and lost productivity due to tobacco-related illnesses and premature deaths. In high-income countries, the overall annual cost of health care attributed to tobacco use has been estimated at between 6% and 15% of total health-care costs in India.
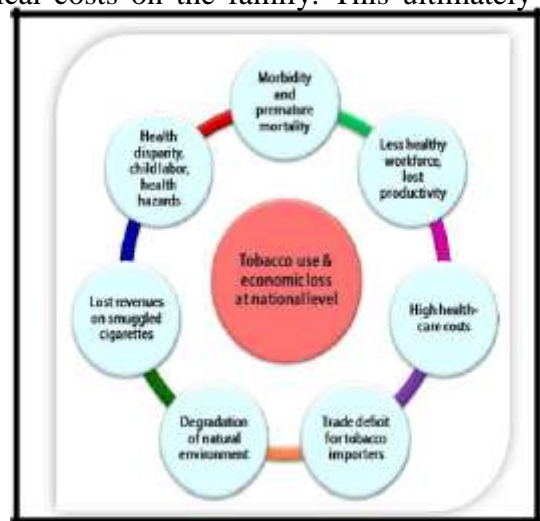
Crowding-out Effect Of Tobacco on Daily Nutrition

A study on *Worldwide Cost of Living Survey. The Economist; 2017* found that the tobacco expenditures can significantly displace a household's food budget. On comparing the costs of cigarettes and rice, it was found that in India the cost of one pack of Marlboro cigarettes would purchase a family 39 portions of rice; in the United States the number would be closer to 198 servings of rice, where one portion of rice is considered equal to 46 grams.
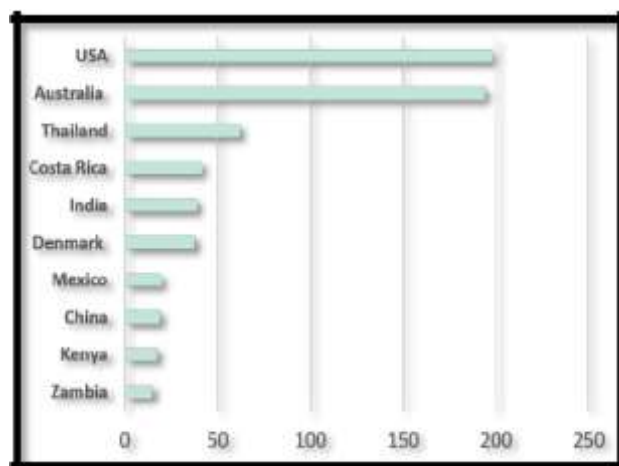
(Source : The Economist, 2017)

Another study *The Tobacco Use and Malnutrition Nexus, Khondker BH, Ahluwalia IB, September 2013* which aimed to quantify the opportunity costs of tobacco expenditure in terms of nutrition (ie, food energy) forgone and the potential improvements in the household level food-energy status if the money spent on tobacco were diverted for food consumption, found on average, a smoking-only household could gain 269-497 kilocalories (kcal) daily under the lower-bound and upper-bound scenarios, respectively. The potential energy gains for smokeless-only and dual-tobacco user households ranged from 148-268 kcal and 508-924 kcal, respectively. Under these lower- and upper-bound estimates, the percentage of

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smoking-only user households that are malnourished declined significantly from the baseline rate of 38% to 33% and 29%, respectively. For the smokeless-only and dual-tobacco user households, there were 2-3 and 6-9 percentage point drops in the malnutrition prevalence rates. The tobacco expenditure shift could translate to an additional 4.6-7.7 million food-energy malnourished persons meeting their caloric requirements.

Crowding-Out Effect of Tobacco on Health and Education

It has also been observed that the consumption of tobacco is more among the poor in India and we argue that the consequent higher health care spending arising out of tobacco related diseases leaves them economically worse off. Such expenditures tend to reduce the healthcare and education expenditure on other members of the family. Example, avoiding

expenditure on vaccinations important at the time of childbirth, not getting children enrolled to schools and sending them to factories as child labor.

In *Relationship Between smoking and Health and Education by Paraje G and Araya D* , it is found that tobacco consumption is associated with lower budget shares allocated to healthcare, education and housing expenditure especially for the poor households. In case of health, not consuming tobacco is related to higher health expenditure up to 32 percent for the total population. Similarly, In case of Education, not consuming tobacco is statistically related to higher educational expense up to sixteen percent for the total population. The strong significant statistical relationship found between tobacco consumption and resources allocated to healthcare and education may be indicative of the crowd out effect of tobacco. In the another research article *Tobacco use and household expenditures on food, education, and healthcare in low- and middle-income countries: a multilevel analysis, Young Kyung Do & Mary Ann Bautista, 31 October 2012* it was found that daily tobacco use was associated with lower household expenditures on education and healthcare by 8 % (95 % confidence interval: −12.8 to –3.2 %) and 5.5 % (−10.7 to –0.3 %), respectively. The association between tobacco use and food expenditure was inconsistent across models.

Thus, according to our intensive review of multiples literature sources we realize that tobacco does have grave implications and it helps us to establish an a-priori expected result according to which tobacco does lead to a crowding out effect on basic necessities. We thus establish this result in the later sections for a consumption basket including rice, wheat, pluses, clothing, footwear and education, which are basic essentials for survival.

DATA STATISTICS

Data for the study has primarily been taken from the 68th Round of National Sample Survey Office (NSSO) conducted for the period of July 2011 – June 2012. The data contains

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information on consumption for a wide variety of goods from the households spread over more than 10,000 villages in India along with the various household characteristics. This has been the latest and the only nationally representative household consumption survey in India. Consumption of various commodities is recorded over a 30 day recall period and some over a 365 day recall period. In our study, we examine the expenditure pattern of 9,004 and 946 households of Uttar Pradesh and Delhi respectively. Our motive behind choosing Delhi i.e. a state with second highest per capita income and Uttar Pradesh having the second lowest per capita income after Bihar is to analyze the consumption pattern between poor and riches and

particularly the behavior of tobacco consuming and non-consuming households among them. We consider expenditure on 7 distinct items namely, Wheat/Atta, Rice, Pulses and Pulse Products, Tobacco, Clothing, Footwear and Education wherein last three items are recorded over 365-day recall period. The item codes, taken form the NSS data, for the variables used in our analysis are specified in the table.

Table 1: Item Codes and Names as specified in 68th round of NSS

ITEM CODE	ITEM NAME
102	Rice – Other Sources
108	Wheat/Atta – Other Sources
159	Pulses and Pulse Products
319	Tobacco
379	Clothing
399	Footwear
409	Education

With the use of the stated data we are able to find some results as depicted in table 2 and 3. These tables represent a summary of average monthly total expenditure by the households on different commodities which is further classified into expenditure by tobacco consuming and non-consuming households of Uttar Pradesh and Delhi. It can be observed that total expenditure by the households in UP is less than the relatively affluent state, Delhi, wherein there budget share is skewed more towards food items (including wheat, rice and pulses) than the latter. It may point towards the bias in the resource allocation within the households. We also see the prevalence of tobacco use is higher in UP with spending 1.09% of their budget on tobacco (Delhi spending only 0.57%). Considering specifically the tobacco consuming households, higher share of budget is allocated to tobacco in Delhi relative to UP which is contradictory to some studies (Nichter and Cartwright, 1991; de Beyer et al., 2001; Shah and Vaite, 2002) which find that poor spent more of their income on tobacco compared to rich. However, this can be because of differences in the tobacco products used by the individuals in different states and their price differentials. Since Uttar Pradesh has a high proportion of rural population as compared to Delhi, there may be a higher consumption of Bidis and smokeless tobacco products which are comparatively cheaper than cigarettes, which is dominantly consumed by the urban population.

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Table 2: Average Monthly Household Expenditure and Budget share in Uttar Pradesh

COMMODITIES	TOTAL EXPENDITURE	SHARE	EXPENDITURE BY TOBACCO USERS	SHARE	EXPENDITURE BY NON-USERS	SHARE
Wheat/Atta	414.13	20.49	435.22	22.45	383.46	17.93
Rice	325.17	16.09	330.89	17.06	316.85	14.81
Pulses and Pulse products	253.36	12.54	255.02	13.15	250.95	11.73
Tobacco	22.09	1.09	37.29	1.92	-	-
Footwear	88.82	4.40	83.45	4.30	96.62	4.52
Clothing	468.65	23.19	451.66	23.29	493.21	23.06
Education	448.43	22.19	345.52	17.82	598.03	27.96
TOTAL	2020.65	100.00	1939.05	100.00	2139.12	100.00
Total Households	9004		5334		3670	

Note: Expenditure in Rs. And Share in percentages.

Table 3: Average Monthly Household Expenditure and Budget share in Delhi

COMMODITIES	TOTAL EXPENDITURE	SHARE	EXPENDITURE BY TOBACCO USERS	SHARE	EXPENDITURE BY NON-USERS	SHARE
Wheat/Atta	425.59	18.09	438.93	17.26	421.04	13.86
Rice	242.72	10.32	240.57	9.46	243.32	8.01
Pulses and Pulse products	266.75	11.34	277.97	10.93	262.92	8.65
Tobacco	13.51	0.57	52.99	2.08	-	-
Footwear	153.16	6.51	141.26	5.55	157.23	5.17
Clothing	721.32	30.66	665.57	26.17	740.37	24.37
Education	529.95	22.52	725.78	28.54	1213.59	39.94
TOTAL	2353	100.00	2543.07	100.00	3038.47	100.00
Total Households	946		241		705	

Note: Expenditure in Rs. and Share in percentages.

Given a fixed budget of any household, the concept of crowding out states any amount that is spent on tobacco will result in reduction of expenditure on certain other goods. Considering the

'food' items, approximately 60% and 40% of the total household expenditure is spent on food consumption in UP and Delhi resp. which reflects the extent of poverty in India. Food expenditure is considerably lower among the tobacco non-consuming households in both the states suggesting it is least compromised good. Share of household budget spent on 'education' decreases drastically when we move from tobacco non-consuming households to those who consume it in both the states. The welfare implication here we can conclude is children may bear the cost of tobacco consumption by their family members by way of cheap quality education or in some cases no schooling at all. It also suggests an intergenerational effect of tobacco consumption by adults on the education of their children. While it is true that, given the budget of a household, any amount that is spent on tobacco will certainly result in reduction of expenditure on certain other goods it is of great interest to know where exactly the households compromise or which are the commodities that tobacco consumption crowds out. A rich household may not compromise on, say, the education of children because someone in the household consumes tobacco. However, a poor household may

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compromise. We explore this aspect by first computing simple averages of commodity-wise expenditure shares in order to identify some stylised facts on household expenditure patterns of tobacco consuming and non-consuming households. More rigorous econometric modeling of the consumption patterns of these sets of households follow later.

The differences in consumption expenditures that we observed for certain items above do not control for *household specific characteristics* such as household demographics and other socio-economic characteristics of households. Moreover, there is endogeneity involved in purchase decisions. One has to control for these to examine the crowding out effects properly. We need to also check whether preferences of tobacco consuming and non-consuming households are fundamentally different**.** *Is tobacco consumption separable from the consumption of other goods?* These questions lead us to more robust econometric analysis of household consumption patterns in the subsequent sections. A conditional demand model, conditional on the consumption of tobacco, is estimated to (i) test whether tobacco users and non-users have different preferences over the other commodities and (ii) statistically examine the nature of crowding out of other goods due to tobacco spending.

METHODOLOGY AND RESULTS

Testing for Separability

Theoretically, when we observe large proportion of zeros against the consumption of tobacco in a cross sectional household consumer expenditure survey it cannot be concluded that all of them resulted from pure abstention. If we rule out the possibility of measurement errors arising from infrequent purchases that may not occur in the short span of reporting period, the only two plausible explanations for these zero consumption of tobacco are **either corner solutions**, resulting from the budget constraint, **or sheer abstention**. If the latter is the actual cause of zeros, it typically means tobacco users and non-users have different preferences. In other words, tobacco is not an argument in the utility function of non-tobacco users for whom tobacco doesn't give any utility no matter what the price is. Hence one needs to statistically test for it. In such cases where a particular good is not consumed by many of the households, the conditional demand model provides a framework that is robust with respect to corner solutions. It would be advantageous to use conditional demand functions to estimate the demand for other goods conditional on tobacco. Moreover **testing for separability within the conditional demand** approach is theoretically consistent as stated in *Restrictions on preference, Deaton and Muellbauer, 1980*. Hence we use a conditional demand model, conditional on consumption of tobacco, to estimate the crowding out effect of tobacco spending on other goods while testing whether tobacco users and non-users have different preferences over the other commodities.

As defined in *Restrictions on preference, Deaton and Muellbauer, 1980* separability while being characterized in terms of preference orderings can be written as (qG, qG), where qG is the vector in group and qG are the excluded commodities. Then for any fixed vector qG

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"conditional" orderings on the goods in the group and the position of different bundles within the group ordering will depend upon the pre seceleted values of qG. When conditional orderings on goods is independent of consumption levels outside the group, the group is said to be separable. Conditional ordering can be represented by Subulity functions for the groups VG(qG) and with N such groups, our preferences are weakly separable.

$$U = f[v1(q1) , v2(q2) , …. , vG(qG) , … , vN(qN)]$$

This implies subgroup demands will be **qi = gGi(xG,pG)** where xG is the total expenditure on group G.

For the purpose of our paper, we try to establish the same concept and put Tobacco is a separate group and check if the preference ordering of the rest of the commodities across different groups is the same or not. Let us say household preferences, given a vector of characteristics (a), can be represented by a utility function U = U(x1, ..., xn; a), where xi denotes its consumption of ith good. Given the prices of all goods, {p1, ..., pn} household maximizes its utility subject to a budget constraint. i.e.,

Max U = U(x1,…..,xn; a) s.t. ∑pixi = Y

where Y denotes total expenditure. Solution to this maximization problem will yield the normal unconditional demand curves for each goods as a function of Y and the vector of all prices denoted by P given the set of household characteristics. i.e.,

xi = h^i (p1, …., pn, Y; a) = h^i(P, Y; a)   (i = 1, …., n)

Following Pollak (1969), let us say that household's consumption of one good has been predetermined.

In our case let us say household has already decided its budget on tobacco consumption and a certain amount is been already "preallocated" for it. This effectively means that the household now has to maximize its utility subject to the expenditure in excess of the preallocated expenditure for tobacco. If tobacco is the nth good, we assume that first n−1 goods are available in the market for the prices {p1,...,pn-1} over which the household has no control and the total expenditure on these goods are given by M (M = Y − pt, where pt is the price of tobacco and t the quantity consumed). Now the utility maximization problem for the household will become

Max U = U(x1, …., xn; a)   s.t. ∑pixi = M

with the additional constraint xn = xn where xn denotes household's allotment of tobacco. The solution for this maximization problem, solving only for n − 1 goods, gives what are called conditional demand functions which can be written as:

Max U = U(x1, …., xn-1; a)   s.t. ∑pixi = M

The function gin above is the conditional demand function for the ith good conditional on the consumption of nth good (here tobacco). Thus we get the demand for the "good of interest" as a function of its own price, prices of all goods except the conditioning goods i.e. tobacco, total expenditures excess of expenditures on the conditioning goods and the quantities of the conditioning goods.

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The standard concept of demographic separability (*Deaton et al., 1989*) can be conveniently tested with conditional demand functions. **Under weak separability, the conditioning good will have only income effect.** If the parameter associated with the conditioning good is statistically significant, weak separability can be rejected. Even if the standard separability concept is not rejected, it may be the case that tobacco users and non-users have different preferences over the other commodities. Hence arise the need for a test which will tell us if the preferences of tobacco users and non-users are fundamentally different. For this purpose *Vermeulen (2003)* develops a test of separability called consumer separability as against simple demographic separability by augmenting the conditional demand function with a binary variable indicating the status of tobacco consumption.

A necessary condition for zeros on tobacco to correspond to corner solutions is that both tobacco users and non-users behave according to the demand function as given in equation above, which would, then mean that some consumers do not pre-allocate money on tobacco simply because they are constrained by budget. This can be empirically examined by testing whether the demand function depends on a binary variable d, which indicates whether positive (d = 1) or zero (d = 0) expenditures on tobacco are observed. If this conditioning binary indicator is significant in the demand for the "goods of interest" for all households (including tobacco users and non-users), it would then mean that both behave differently and would reject the null hypothesis of zeros arising from corner solutions. However, an insignificant binary indicator d is not sufficient to say that zeroes are not due to abstention. "It is possible that both smokers and non-smokers have the same (conditional) preferences on the rest of the commodity bundle (so that the null hypothesis would not be rejected), but that tobacco acts as an argument in a smokers full utility function, which is not true for non-smokers in the case of abstention" (*Vermeulen,2003*). This test can also be seen as a test of whether d is weakly separable from the consumption of other "goods of interest". Separability of xi from d (i.e., if d is insignificant) implies that if a household starts allocating money for tobacco, this only **generates an income effect and no substitution effect on the rest of the commodity bundle** (apart from substitution effects if xi is not separable from tobacco consumption t). This test of separability, though very similar in spirit, to the standard separability concept, is called consumer separability, primarily due to two reason: (1) It explicitly takes into account the fact that some commodities may be no arguments in some consumers' utility function at all; and (2) Variable d which is essentially a 'demographic'

variable inherent in tobacco consumption is, however, not a standard demographic variable as envisaged in demographic separability.

Our null hypothesis is that the three parameters associated with the binary variable d, namely **own price, price of all goods other than tobacco and total expenditure excess expenditure on tobacco, are jointly not significant.** Values in each column are the $\chi 2$ statistics from a Wald Test for the joint significance of three parameters associated with the binary variable d.

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COMMODITIES	UTTAR PRADESH	DELHI
Footwear	19.843*	28.391
Rice	58.361	89.112
Wheat	72.770	143.102
Pulse	30.242	88.913
Education	3.484	14.398

(* represents the significant values implying no

preference differentials)

It turns out that in both Uttar Pradesh and Delhi, consumer separability is rejected for most commodities. It implies that tobacco users and non-users behave differently in the sense of having different preferences. This simultaneously rejects the null hypothesis of zeroes arising from corner solutions and would conclude that abstention could probably be the reason behind zero expenditure on tobacco for a set of households. Thus, households that do not spend on tobacco have different preferences for basic commodities like rice, wheat, pulses and education as compared to households that spend on tobacco.

After establishing the fact that the tobacco consuming and non-consuming households have some difference in their preferences, we try to figure out the extent to which tobacco consuming households give up on their essential commodities to sustain their tobacco consumption requirements. This can be done by comparing the cross price elasticities and own price elasticities of our group of commodities.

ALMOST IDEAL DEMAND SYSTEM

Empirically our objective is to estimate the changes in budget shares, allocated for various goods of interest, due to changes in expenditure allocated to tobacco. (Testing for consumer separability could well be a by-product of this exercise.) Since direct price information is not available for all goods of interest, essentially we estimate Engel curves (in this context

conditional Engel curves). We use the Engel curves from *Almost Ideal Demand System (AIDS)* developed by *A. Deaton and J Muellbauer*. The prominent feature of the AIDS is that it has log income as the leading term in an expenditure share model and additional higher order income terms. While being consistent with the utility theory AIDS permits goods to be **"luxuries at some income levels and necessities at others"**. AIDS also gives an arbitrary first order approximation to any demand system and **satisfies all axioms of choice**. We have chosen this method for estimation as it has a functional form which is consistent with Household budget data as it aggregates over consumers without invoking parallel linear Engel curves.

The starting point has been the specification of a function which is in general enough to act as a second order approximation to any arbitrary direct or indirect utility function or cost functions. Thus we start with a specific class of preferences, which by **theorems of J. Muellbauer permit exact aggregation** over consumers: the representation of market demands as if they were the outcome of decisions by rational representative consumers namely, the **PIGLOG class of functions** which are represented via the cost or expenditure

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Log c(u,p) = (1-u)Log{a(p)} + uLog{b(p)}

Where, u lies between 0 & 1 so that the positively linearly Homogeneous functions a(p) and b(p) can be regarded as the costs of subsistence and bliss, respectively. Subsistence here would mean the requirement of commodities required for the basic functioning of a healthy mind and body and the sustain the minimum utility requirements, any amount of commodity consumption below the subsistence level would lead to ill effects, inefficiency and disutility. Bliss level of commodity consumption would belong to the utility requirements over and

above the subsistence levels , failure to fulfil bliss level of consumption does not lead to disutility but bliss level consumption does lead to additional utility attained. We now take up specific functional forms of a(p) and b(p) in such a way that the resulting cost function becomes a flexible functional form and has enough parameters. The aforementioned function can thus be written as :

Log c(u,p) = ά0 + ∑άklog pk + ½ ∑ ∑ γ*kj log pk log pj + β0∏k pk^βk

Where ά, β and γ are parameters. γ here represents the own and cross price elasticities. A negative significant cross price elasticity between a commodity and tobacco would mean that in order to sustain the existing tobacco consumption levels after a price rise, the individual household would give up on the commodity for which we compare the cross price elasticity. This would be a good indicator to point out our desired crowding out effect and thus we will be observing and analyzing these elasticity values carefully.

The logarithmic differentiation of the above equation gives budget share as a function of price and utility :

$$wi = ά i + \sum γij \log pj + βi\ U\ β0 \prod pk^{βk}$$

where,   **γij = ½(γ*ij + γ*ij)**

The total expenditure, x is equal to c(u,p) and this equality can be inverted to give u as a function of p and x, which is the indirect utility function. We do this for cost function and substitute the results into the budget share equation. Thus we now have the budget share as a function of x and p:

wi = ά i + ∑ γij log pk + βi log { x/P}

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Where P is indexed by

Log P = ά0 + ∑ άk log pk + ½ ∑ ∑ γkj log pk log p

Now by including the following restrictions, eq __ of the system of demand functions will **add up to the total expenditure**, will be **homogeneous of degree zero in prices** and **satisfy the slutsky symmetry**.

Restriction 1 : ∑ ά i = 1, ∑ γij = 0 , ∑ βi = 0

Restriction 2 : ∑ γij = 0

Restriction 3 : γij = γji

Given the above three restrictions, the interpretation of AIDS is (i) In the absence of changes in relative prices and "real" expenditure (x/P), the budget shares are constant. (ii) Changes in relative prices work through the term γ. Each γij represents 10^2 times the effect on the ith

budget share of a 1 percent increase in the ith price with (x/P) held constant. (iii) Changes in real expenditure operate through β coefficients, these add up to 0 and are positive for luxuries and negative for necessities. Finally we apply the aggregation theory and estimation to reach our final equation:

wi = (άi – βi logφ) + ∑ γij log pj + βi log (x/P*)

One important point to note is that in order to incorporate different tobacco commodities and their price differentials, we have sub-grouped the tobacco consuming households on the basis on their expenditure patters and given them an estimated price of the tobacco commodity suitable with their expenditure levels. These prices are then indexed together. We use the same procedure on our four different data sets namely, Uttar Pradesh – tobacco consuming households, Uttar Pradesh – non tobacco consuming households, Delhi – tobacco consuming households and Delhi – non tobacco consuming households, in order to figure out the difference in own and cross price elasticities among the households that consumer tobacco and the ones that do not. We also use the same results to point out the difference between consumption patterns of the economically better and worse off state. The following tables depict our results:

Uttar Pradesh – Households with no tobacco consumption

COMMODITY	γi1	γi2	γi3	γi4	R^2
Footwear	0.04815*	0.02062*	0.00448	0.01324	0.579
Rice	0.04077*	0.00092	-0.0067*	-0.00395*	0.5227
Wheat	-0.06228*	0.02732*	0.07652*	-0.00392	0.2921
Pulse	-0.02213*	-0.01553*	-0.05284*	-0.09357*	0.2208

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Uttar Pradesh – Households with tobacco consumption

[COMMODITY	γi1	γi2	γi3	γi4	γi5	R^2
Footwear	0.03829*	0.02052*	-0.02826	0.00657	-0.02274*	0.5124
Rice	0.03761*	-0.00325*	-0.00738*	-0.00315*	0.00112*	0.4664
Wheat	-0.04519*	0.02515*	0.12222*	0.01345*	0.00227*	0.0177
Pulse	-0.02809*	-0.00982	-0.05333*	-0.09108*	-0.01533*	0.186
Tobacco	-0.00327	-0.03267*	-0.03291*	0.07676*	0.00264	0.2466

On analyzing the results for Uttar Pradesh, we can infer that on comparing the own price elasticity of rice among the two different categories of households, we find that the households with tobacco consumption reduce the consumption of rice with a rise in its price

whereas, non-tobacco consuming households have an insignificant positive value for the parameter, which means that these households consider rice a basic necessity and do not give up the consumption of rice even if the share of budget expenditure on rice rises. It can thus be inferred that, due to tobacco consumption households face a shortage of budget for other necessary commodities and give up on rice consumption as the price of rice rises. The own price elasticity of tobacco has an insignificant value implying that a rise in the price of tobacco products will lead to no significant change in their consumption. Among the tobacco consuming households we find that a rise in the price of tobacco would lead to a fall in the consumption of clothing and pulses. This shows that tobacco users compensate for the rise in the prices of tobacco products by reducing consumption of the basic needs. This exact phenomenon is what we state as the crowding out effect of tobacco.

Delhi– Households with no tobacco consumption

COMMODITY	$\gamma i1$	$\gamma i2$	$\gamma i3$	$\gamma i4$	R^2
Footwear	0.01773	-0.02159	0.03046	0.041797	0.658
Rice	0.4554*	-0.00052	-0.03196*	0.01562	0.4408
Wheat	-0.03736*	-0.00313	0.04848	-0.06787*	0.3584
Pulse	-0.01791*	0.05575*	-0.02018*	-0.01563	0.3363

Delhi – Households with tobacco consumption

COMMODITY	$\gamma i1$	$\gamma i2$	$\gamma i3$	$\gamma i4$	$\gamma i5$	R^2
Footwear	0.02668*	0.04238	-0.03512	0.00806	-0.02728*	0.6265
Rice	0.04495*	-0.0098	-0.01667	0.05395*	-0.00632*	0.5407
Wheat	-0.04365*	-0.0073	0.01187	-0.13494*	0.01657*	0.252
Pulse	-0.02728*	0.02898	0.04043	0.00288	-0.01383	0.1501
Tobacco	-0.00351	-0.05059*	0.00757	0.05999	-0.01758	0.3451

Even in the case of Delhi, we get similar results. Tobacco tends to crowd-out basic necessities. Among the tobacco consuming households, people prefer to give up consumption of rice and clothing in order to sustain the consumption levels of tobacco. Thus, tobacco again shows a crowding out effect. Along with this, the inter-state comparison

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of tobacco consuming households show that the degree of cross price elasticities in Uttar Pradesh, the comparatively poorer state, is more than that of the degree of cross price elasticities in Delhi. This means that with the rise of tobacco prices, the effect on other basic commodities in more severe. People in the poorer state tend to give up more of other commodities for sustaining their tobacco needs than in the richer state. This proves the fact that the crowding out effect caused by tobacco is more prominent among the poorer households. Our results are in line with the   a-priori expected results. It is therefore, a matter of concern for us as we have already established that such crowding out effects have serious and grave implications.

POLICIES AND WAY AHEAD

So far we have seen the severe impacts of tobacco addiction in India which is not only affecting those who consume it but also the society as a whole. It is a grave issue which needs great attention. There exist evidences of government interventions on the local, state as well as national level but there is still a room for collective efforts of government, NGOs and society and strict policies to achieve the desired results. Hence, in this section we discuss some of the policies which could be effective in this area.

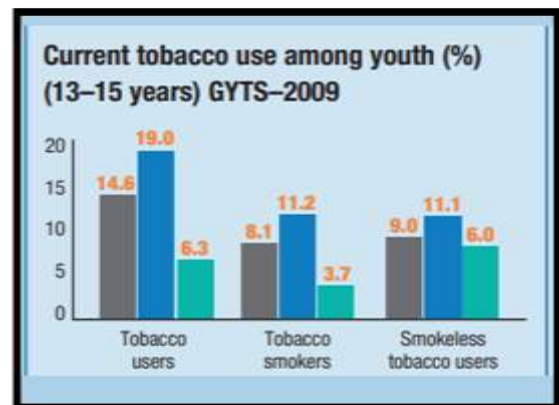## YOUTH ACCESS REGULATION: AGE VERIFICATION AND SCHOOL LEVEL COUNSELLING

In India, the tobacco use among children and adolescents is reaching pandemic levels. They are the most vulnerable to its addiction with the rising trade of tobacco and its product in the country. About 20 million children of ages 10–14 years are found to be tobacco-addicted (NSSO). To this astounding figure, about 5500 new users are added every day making two million new users every year. More than half of the adolescent smokers try to quit smoking every year with fewer than 20% being able to quit for a month. To overcome this, government can *authorize the trade* of tobacco products to prevent its overexploitation. It can *appoint legal vendors* to ensure its accessibility to only those above a certain age by *checking a valid proof of age*. But this will not be enough until the teenagers develop a *sense of self-realization* to avoid its harmful health effects. Peer pressure could be one reason of such early age addictions, but this can be solved by organizing *no smoking counseling and awareness campaigns at the school level*. *Behavioral support* in terms of advice and encouragement can motivate the people to quit tobacco. Such measures can be successful in the long run if and only if the government timely ensures *proper implementation* of the policies.

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HIGHER TAXES ON TOBACCO PRODUCTS DOMINANTLY USED IN RURAL INDIA

Under the GST regime, cigarettes are already placed in the highest tax bracket of 28% in order to reduce its consumption. Such kind of policy has been followed by many countries and shown improvements. For example, a research on *The Role of Public Policies in Reducing Smoking: The Minnesota SimSmoke Tobacco Policy Model* estimated the size of policy effects in terms of relative (percentage) reductions applied to smoking prevalence in the year the policy was implemented in Minnesota. The results from this study are mentioned in the table from which we can see such intensive tax rates would surely lead to desirable results up to some extent.

Policy	Description	Potential percentage effect[a]
Cigarette taxes		
Cigarette price	The state-level average price for a pack of cigarettes (including branded and generic), including state and federal excise taxes	For each 10% price increase: 6% reduction ages 15–17 years, 3% reduction ages 18–24 years, 2% reduction ages 25–34 years, and 1% reduction ages ≥35 years

However, majority of the tobacco consumers live in rural India who prefers relatively cheap sources such as bidis and smokeless tobacco having very low rates of tax. The federal tax on a standard can of loose smokeless tobacco is less than one-eighth of the tax on a standard pack of cigarettes. Thus to overcome this, government should *tax such cheap products prevalent in rural areas* heavily. But such tax rates might excessively crowd-out the

(Source: WHO report on teenage smokers in India)

consumption of basic needs so to prevent this, government can *raise the tax rate in particular intervals.*

LARGE ANTI SMOKING CAMPAIGNS

As the positive relationship has been established between the reduction rate of tobacco use and the intensity of a campaign, social marketing campaigns can increase the rate at which smokers try to quit and improve the chances of success. From the results depicted in the table, we can infer a reduction of about six to two percent in the tobacco use depending on the intensity of the campaigns conducted.

Picture of Akshay Kumar from an anti-smoking advertisement

Advertisement promoting health and family care over tobacco addiction.

Mass media campaigns		
Highly publicized media campaign	Campaign expenditures meeting the pre-2009 CDC minimum recommended	6% reduction
Moderately publicized media campaign	Campaign expenditures meeting 50% of the pre-2009 minimum recommended	3.6% reduction
Low-publicity media campaign	Campaign expenditures meeting 25% of the pre-2009 minimum recommended	1.2% reduction

(Source: The Role of Public Policies in Reducing Smoking: The Minnesota SimSmoke Tobacco Policy Model)

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India has already launched many anti-smoking campaigns which include prominent and influencial celebreties like Akshay Kumar. Government has made compulsory to display several *statutory warnings* in the Cinema halls, on the Television and on the cigarette packs and other tobacco products. However, such campaigns have a limited reach and are still inaccessible to most of the people living in remote areas. A major chunk of tobacco consumers in India is unaware of the ill effects that tobacco brings with it.

Thus, in order to spread awareness, government can *collaborate with NGOs and local panchayats* that are closely connected to the rural people and can easily gain their trust. It can organise *door to door campaigning, community meetings and nukkad naataks* to engage and aware more and more people at the grassroot level.

END TO ILLICIT TOBACCO TRADE

In 2018, The Federation of All India Farmer Associations (FAIFA), which claims to represent farmers of commercial crops from various states, including

Andhra Pradesh, Telangana, Karnataka and Gujarat, stated that there has been an increase in smuggled, illicit and contraband cigarettes due to higher taxation on the legal cigarette industry. A report on the same by the Times Of India in 2018 showed that there were cases of illegal manufacturing, smuggling and stock shifting between states for all major forms of tobacco such as the Cigarettes, Bidis and Gutka (smokeless tobacco). It is an obvious fact that these illegal productions would evade GST and be available at cheaper rates to the buyers.

(Source: The Times Of India)

There thus is a need for the government to *carry out large scale search operations* for such illegal producers and smugglers of tobacco with the *help of local police and intelligence* across all states. After identifying and getting hold of such individuals, *heavy penalties and long term imprisonment* should be imposed on them. This would create a fear and disincentive among others to indulge in such illegal production and smuggling in future.

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TOBACCO DE-ADDICTION CENTRES

India currently has a large number of drug and alcohol de-addiction and rehabilitation centers but there are no such initiatives for tobacco de-addiction. Initiatives can be taken up *to establish tobacco de-addiction centers* and add branches in existing rehabilitation centers. *The team of well qualified and experienced doctors and working staff must be appointed* and provided with appropriate training to carry out procedures and handle the withdrawal symptoms of their patients with utmost care and professionalism. This will help in increasing the chance of success for those who find it hard to quit such habits themselves.

Although the government is already doing its bit in this direction but we believe that it can go an extra mile with the aforementioned policy suggestions. There is a need of collective effort of the government, administration, police services, NGOs and also the citizens at individual level. We as responsible citizens of the society should also make efforts to persuade our friends, family and the youth to avoid consumption of tobacco. Every little effort at individual level along with strict policy implication will definitely lead us to our desired positive results.

CONCLUSION

India being the world's leading producer and consumer of tobacco products, after China, witnesses a death every 6 seconds. Nearly 75% of the tobacco consumers live in rural India and are mostly poor. Popularity of tobacco among those having less income at their disposal may affect the welfare of a household as consumption of tobacco can reduce the income available for basic necessities essential for the growth. Hence we attempt to examine the crowding-out effects of tobacco spending on other goods using this theory.

Using the National Sample Survey conducted for the year 2011-12, the analysis is such that though only 1.92% and 2.08% of the monthly income is spent on tobacco consumption, given less monthly income, expenditure on tobacco is proving to be very costly in both the financially divergent states, UP and Delhi resp. The tobacco consuming households spend more on food relative to the non-tobacco consuming households. The opportunity cost of its consumption is reflected in reduced expenditure on education affecting the welfare of children. Thus, we see the evidence of crowding out effects of tobacco consumption.

To estimate the effects of tobacco spending on other goods formally, the Almost Ideal Demand System (AIDS) has been applied. On analyzing the own-price and cross-price elasticity of different commodities consumed by tobacco consuming and non-tobacco consuming households in both UP and Delhi, it was found that to compensate for a rise in the prices of tobacco products tobacco users reduce the consumption of basic commodities. An inter-state comparison reflects upon the impact of crowding out on the poor relative to the wealthy households. It shows poorer households face the brunt of tobacco addiction more than the richer ones as they have enough income available for other goods.

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Thus, in India where majority of the people live in poverty, they are more prone to get addicted to tobacco and other products. It could be due to its availability in many forms and at cheap prices such as bidis, chutta, etc. It leads to a variety of negative impacts on the

tobacco consuming households in terms of welfare of the other family members, fewer resources to spend on basic goods and health hazards of course. The results of the paper also reflect on the biasness in the inter-house allocation of the resources where the women and children might suffer because of the addiction of adult members in terms of less income available for basic needs. It could be because women and children have less decision making powers in their household matters. However, we cannot fully testify such conclusions in our model due to the lack of data on who consumes how much in a household. Hence, availability of such data can be helpful in reporting such biasness and throwing more light on inter-house allocation.

For now, we are able to satisfy our theory of crowding-out empirically and formally and have found evidences of its devastating impact on the humans as it contributes to poverty, morbidity and mortality. We need various health development and awareness programmes to decrease the losses from its prevalence. Strict tobacco control policies such as counseling, awareness programmes for youth, government authorized trade, higher taxes, mass media campaigns, building behavioral and pharmacological support to those who wants to quit, etc. need to be devised and implemented.

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