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PRICE ELASTICITY OF ALCOHOL DEMAND IN INDIA

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Abstract

Using a household survey conducted in 2014, this study estimates price elasticity of demand for beer, country liquor, and spirits in India. Ordinary least square models were used to estimate the responsiveness in alcohol demand due to price change. We include a large number of control variables to adjust for potential confounding in the model. Inter-district variation in alcohol consumption is adjusted for by including district fixed-effects. Alcohol prices are negatively associated with demand for alcoholic beverages. The price elasticity of demand ranged from -0.14 for spirits to -0.46 for country liquor. Low level of education was positively associated with spirits consumption. The magnitude of elasticity varied by rural-urban, education, and gender. Results indicate a policy mix of price controls and awareness campaigns would be most effective in tackling the adverse effects of harmful drinking in India.

***Keywords*:** Price elasticity of demand, Alcohol demand, Public policy, India

***JEL Codes*:** I18, D12

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Price Elasticity of Alcohol Demand in India

INTRODUCTION

Alcohol consumption in India has been rising rapidly in the last decade. On average 30% of Indians consume alcohol, out of which 4-13% are daily consumers and more than half of those who consume alcohol are hazardous drinkers (WHO, 2012; Ray et al., 2004). The per capita consumption of alcoholic beverages in India increased by 38 percent, from 1.6 litres in 2003-05 to 2.2 litres in 2010-12 (WHO, 2012). Against the global average of 16 percent, about 11 percent of Indians were binge drinkers.[1] Excessive consumption of alcoholic beverages has been found to have a detrimental effect on health. There is overwhelming evidence to suggest that alcohol consumption is associated with a variety of disease and disability (Whiteford et al., 2010; Lim et al., 2012). Liver cirrhosis, cancers, tuberculosis, HIV, and injuries are some of the adverse health effects caused by drinking alcohol (Baan et al., 2007; Shield, Parry & Rehm, 2013). The WHO reports that excessive use of alcohol accounts for 5.9% of all deaths worldwide (WHO, 2014). In India alone, 350,000 deaths were attributed to alcohol consumption in 2010 (Lim et al., 2012). The recent data indicates that 15 people die every day or one every 96 minutes from the harmful effects of alcohol consumption in India (NCRB, 2013). In addition to adverse health impacts, alcohol use also contributes to poverty and impoverishment either due to diversion of resources away from productive use or increasing healthcare cost associated with alcohol-related problems ((Benegal, 2005; Bonu et al., 2005; Gajalakshmi and Peto, 2009; Rathod et al, 2015).

[1] Binge drinking or heavy episodic drinking is described as heavy consumption of alcohol over a short period of time.

Given the increasing evidence on the harmful effects of alcohol consumption, policymakers have resorted to either increasing alcohol prices through taxation or have put blanket bans on alcohol consumption. Alcohol consumption is prohibited in the Indian states of Gujarat, Kerala, Bihar, and Nagaland. However, either the prohibition or the price increase can be an effective policy for reducing alcohol consumption if the demand for alcoholic beverages is price sensitive and price-elastic.[2] If the consumers have inelastic demand for alcoholic products, then price control through taxation or prohibition may not be an effective policy instrument to curb the adverse effects of alcohol consumption. Prohibition is less desirable because it severely restricts freedom of individual choice and may have undesirable and unintended effects as was the case in the failed alcohol ban in the USA from 1920 to 1933 (Thornton, 1931, Mahal, 2000).[3]

Therefore, having reliable information on price elasticity of demand (PED), the percentage change in demand for alcohol resulting from a one percent increase in alcohol price) by different characteristics of drinkers (such as gender and caste) are important for formulating appropriate tax policies to decrease alcohol consumption. There is lack of credible estimates of price elasticity for alcohol beverages in India, which is important for implementing effective interventions. There have not been many estimates of price elasticities for different alcoholic beverages in India to date except Mahal (2000) and using a representative cross-section of households from five states, this paper provides additional and more reliable estimates of price elasticity of demand for beer, spirits and country liquor India.[4]

[2] Several studies have shown that alcohol price is a key determinant of consumption (Anderson et al., 2009; Wagenaar et al., 2009).

[3] The period was marked by rampant smuggling, corruption and black market.

[4] These five states account for one-third of India's population.

In high-income countries, the literature on estimation of price elasticity of demand for alcohol products is quite extensive but diverges markedly in the magnitude of elasticity estimates. Some studies indicate that alcohol demand is elastic (price elasticity is greater than one), while other studies suggest the demand to be price inelastic (price elasticity is less than one). Three recent meta analyses comparing cross-beverage elasticity have found that beer, wine, and spirits have different own-price elasticities, with beer appearing to be less elastic than wine and spirits (Fogarty, 2010; Gallet, 2007; Wagenaar et al., 2009). Gallet (2007) and Wagenaar et al., (2009) reported an average PED for alcohol of -0.5, meaning that a 20% increase in alcohol price would reduce the demand for alcohol by 10%. In UK, Meng et al. (2014) found the price elasticity estimates to range from -0.08 to -1.27 and beer was most elastic beverage.

The dearth of research on estimation of PED for alcoholic beverages in low and lower middle-income countries, including India, calls for additional research. To the best of our knowledge, we are aware of the following two studies that deals with the estimation of PED for alcohol in India. In a simulated study, Mahal (2000) found that the own price elasticity of participation in moderate to heavy alcohol consumption is 1.00 for individuals aged between 15 and 25 years and 0.50 for individuals aged 25 years and above. The estimates in Mahal (2000) are smaller than estimates for one state (Andhra Pradesh) by Reddy, Reddy, and Dheeraja (1999). Reddy, Reddy, and Dheeraja (1999) found an arc elasticity of demand for arrack (local liquor) in the range of -1.23 to -1.36, but this analysis was carried out on a very small sample of 86 moderate to heavy alcohol consumers of arrack in Andhra Pradesh.

In India, the prevalence of alcohol consumption has been on the rise and policy makers are struggling to design an appropriate tax system to reduce alcohol consumption. In several instances, higher alcohol prices has led to consumption of spurious alcohol by poor households thereby resulting in premature loss of lives. Given the complex socio-economic conditions of households and lack of credible estimates of PED for alcohol in India, findings of this study will be important to design alcohol price strategy so that harmful effects of alcohol consumption can be minimized.

MATERIALS AND METHODS

Data

The data used in this study are from the Survey of Unrecorded Alcohol in India (SURA) collected in 2014. Data collection for this cross-sectional survey was funded by the International Alliance for Responsible Drinking (IARD) in order to assess the prevalence of unrecorded alcohol drinking in India. The survey sampled approximately 1200 respondents in each of the following five states- Andhra Pradesh, Kerala, Madhya Pradesh, Maharashtra, and West Bengal. The sample was selected under a semi-purposive, multi-stage probability design, and oversampled respondents in rural areas. In the first stage, two districts were randomly selected based on the socio-economic profile of the districts in each state.[5] In the second stage, 10 urban wards/towns and 20 rural villages were selected from each district using the probability proportional to size (PPS) sampling method. Urban wards/towns and rural villages formed the primary sampling units. Finally, in stage three, 20 respondents were selected from each primary sampling unit in each

[5] Districts were stratified based on proportion of schedule caste and tribe population, female literacy rate, and percentage of households belonging to lowest wealth quintile.

district. In addition, 50 respondents were purposively sampled from two randomly selected slums in each of the sampled urban wards/towns. The overall response rate was about 85%, and there was no significant difference in response rates between the urban and rural samples.

The survey covered individuals aged 15 years or older. Among the eligible individuals in the households, the member with the most recent birth date were selected for the interview. Our initial sample included 6088 individuals. Of these respondents, 3988 (65%) respondents resided in rural areas while 2100 (35%) respondents resided in urban areas. The survey included questions about past and current drinking and about the frequency and quantity of alcohol use in the past year. Of the total sample, 38.6% were current drinkers, 53.6% were lifetime abstainers, and 7.8% were former drinkers.

Detailed questions about the drinking habits, patterns, and beverage type were asked to current drinkers only. The survey collected information on the socio-economic and demographic characteristics of the respondents, such as age, gender, caste, marital status, income, and family size. Price information was collected for the "most consumed drink (MCD)." Using the information in beverage-specific alcohol consumption module, the most consumed drink is identified as the beverage with highest consumption by volume (quantity x frequency). Price and quantity data on the MCD were used to estimate price elasticity of demand for different types of alcoholic beverages. We restrict the analyses to the sample of respondents who reported beer, spirit, and country liquor as their most consumed drink. Price information about homemade alcohol drinks was missing for a large number of homemade alcohol respondents, therefore, homemade drinkers were excluded from the analysis.

Estimation

The standard approach to estimate price elasticity of demand is to quantify the empirical relationship between price and alcohol demand, after adjusting for socio-economic characteristics of the respondents including income. Socio-economic characteristics are able to capture differences in tastes and preferences across individuals. The linear relationship between price and demand is transformed into logarithmic (log) form, and the estimated model can be represented by the following equation for each beverage:

$$Log\ (Quantity_{ids}) = \alpha_1 + \beta_1 \log(Price_{ids}) + \gamma_1 X_{ids} + \eta_d + \epsilon_{ids} \quad (1)$$

where $Quantity_{ids}$ is the dependent variable measuring quantity consumed of each beverage (beer, spirit, country liquor) by respondent *i* in district *d* and state *s*; the main independent variable is log of price of each beverage; X_{ids} is a vector of socio-economic and demographic characteristics of the respondents that can potentially affect alcohol demand (for example, age and gender of the respondent, education level of the respondent, monthly income of the respondent, whether respondent lives in the rural area); η_d represents district fixed effects so that time invariant characteristics of district that may affect alcohol demand can be adjusted for; and finally ϵ_{ids} is the idiosyncratic error terms in individual-level alcohol consumption, which are uncorrelated with other covariates included in the model. Standard errors are clustered by district to adjust for the possibility that residuals are not independent and identically distributed.

In Eq. (1), β_1 is price elasticity of demand for beer, spirit, and country liquor. In econometric models, where both the dependent and the independent variables are log-transformed, the regression parameter (β_1) is interpreted PED. The magnitude of β_1 shows the percentage change in alcohol demand for a specific beverage by respondent *i*, in response to a percentage change in price of that specific beverage:

$$\beta_1 = \frac{\delta[\log(Quantity_{ids})]}{\delta[\log(Price_{ids})]} = \frac{\%\Delta(Quantity_{ids})}{\%\Delta(Price_{ids})} \quad (2)$$

Some prior studies have used average alcohol price or community-level price instead of beverage-specific actual price paid by individuals (Aayagari et al., 2013; Goryakin, Roberts, & McKee, 2016). Alcohol prices are aggregated due to unavailability of individual-level data on actual price paid by the respondents and to reduce measurement error in individual prices. For comparison, we also estimate average price elasticity by estimating a pooled model that combines the sample of beer, spirit, and country liquor drinkers. For normal goods, the negative relationship between price and demand means that the value of β_1 will be a negative number, meaning that individuals may reduce the demand or shift their consumption to a substitute drink as a result of increase in price.

RESULTS

Sample characteristics

Table 1 shows the summary statistics of the variables used in the analysis for current drinkers only. We define current drinking status in terms of whether an individual has consumed alcohol in the past 12 months. Using drinking frequency, number of drinks, and size of the drink, we estimate annual consumption of each beverage in litres. The annual consumption is transformed in natural log. The average log price of alcoholic

beverages ranged from 5.32 to 6.44. Distilled spirits are the most expensive drink type. The majority of current drinkers are male (91%) and the average age of current drinkers is 41 years. About two-fifths of current drinkers are illiterate, and about 60% of the respondents who are current drinkers live in rural areas. Close to two-fifths of the analytical sample earns less than 4000 rupees (equivalent to $65) per month. The average daily alcohol consumption is 25 grams of pure ethanol in rural areas and 30 grams of pure ethanol in urban areas.

Price elasticity of demand

In Table 2, we report the results on price elasticities of demand for beer, country liquor, and spirits from the ordinary least square method for current drinkers. Each column reports results from separate regression models. In general, the results in Table 2 indicate that an increase in price has a small negative effect on alcohol demand. The estimated PED for beer and country liquor are -0.33 and -0.46, respectively. The elasticity estimates for beer and country liquor are statistically significant and are consistent with estimates reported in the USA and other developed countries and are well within the range of previous estimates (Wagenaar *et al*., 2009). The magnitude of -0.33 means that a 1% increase in the price of beer is associated with 0.33% reduction in beer consumption. The PED for spirits is 0.139. However, it is not significantly different from zero. The absolute value of all elasticities is less than one, indicating that alcohol demand is not very sensitive to price change. Male and age are positively associated with alcohol demand, but the coefficients are statistically insignificant except for spirits drinkers. Education is positively associated with spirits demand: illiterate individuals consume more spirits than literate

individuals. Household monthly income is positively associated with demand while rural households have lower alcohol demand compared to urban households.

Elasticities by drinkers' characteristics

In figures 1-3, we analyze the heterogeneity in the impact of price on alcohol demand. In figure 1, we report own-price elasticity of alcohol demand by rural vs urban residents. PED is higher for rural drinkers compared to urban drinkers except for spirits demand. The elasticities for beer and spirits are not statistically significant in urban areas, while country liquor demand responds significantly to price change in urban areas. Rural drinkers seem to be most responsive to price than the urban drinkers, and the magnitude of response is highest for country liquor followed by beer. The higher elasticity of country liquor may be due to the availability of substitute drinks, which may result in switching behavior by drinkers.

In figure 2, we report the elasticity estimates by gender, and there is no inter-gender differential in PED by gender. Most estimates of alcohol price elasticity are insignificant, except for males who are drinking country liquor. For beer demand, the elasticity among female drinkers is positive but is insignificant. The analysis of female beer drinkers lack power due to small sample size. There are only 21 female beer drinkers, which is not sufficient to have a separate analysis by gender. Small sample size and lack of power may be the causing the unexpected positive sign.

The estimated own-price elasticities of alcohol demand vary by education; three out of six are statistically significant. The estimates range from -0.13 (spirits drinkers with

less than a university education) to -0.58 (country liquor drinkers with at least a university education; figure 3). There is no consistent pattern; the demand for beer is more elastic for drinkers with less than university education, while spirit drinkers with at least university education are very responsive to spirit price. Insignificant differences were found for the elasticity estimates for country liquor drinkers by education levels.

DISCUSSION

The estimates of price elasticity of alcohol demand are of importance when the goal of policymakers is to control the price of alcohol through taxation to reduce alcohol consumption. This study is one of a handful of studies to estimate PED in India against the backdrop of rising alcohol consumption. Prices do seem to affect behavior. However, the effect size is modest and small. Among three alcoholic beverages, spirit consumption is least elastic (-0.14) while consumption of country liquor is most elastic (-0.46). The elasticity estimates have important policy implications in the context of a recent ban on alcohol consumption in a few states in India. If alcohol demand is not very price responsive, then prohibition may not be a good strategy to limit consumption as it may lead to the emergence of black market, smuggling, and consumption of illicit beverages.

Our estimates compare well with findings in other countries. In a recent meta-analysis, about 26% of all studies had own-price elasticity of beer that was either insignificant or less than 0.2 (Fogarty, 2010). The majority of the studies in this meta-analysis were from high-income countries, which may not compare well to a middle-income country like India. In a recent study in China, a middle-income country, the price elasticity of demand for beer was estimated to be -0.036 and was statistically insignificant

(Tian and Liu, 2011). Furthermore, we find some evidence of heterogeneous impacts of price change on alcohol consumption. The elasticity estimates varied by rural-urban, gender, and to some extent by education levels of the drinkers though no consistent pattern emerged across different types of alcoholic beverages.

This study is not free from limitations, and the most important one is the cross-sectional and non-experimental nature of the data. The negative relationship between price and alcohol demand is merely an association between the two variables and should not be understood to have a causal interpretation. Although our models include several confounding variables and district fixed effects, the model still suffers from omitted variable bias and endogeneity. Second, we are unable to estimate the cross-price elasticity of demand in order to understand the switching and substituting behavior of drinkers. The number of switchers is very small and therefore, the sample lacks the power to estimate the cross-price elasticity of demand. Third, the frequency, quantity of drinks, and price were self-reported by the respondents. This self-report may suffer from measurement error as respondents tend to underreport alcohol consumption.

Our findings contribute to the debate on the effectiveness of demand- versus supply-side interventions to limit alcohol consumption. Price control is a supply-side policy instrument. Our results suggest a modest negative association between price and demand implying that drinkers are not very responsive to price change. In this case, price controls alone may not be effective in reducing the adverse impacts of alcohol consumption, rather it should be complemented with demand side intervention such as educating the population about the impact of harmful alcohol consumption. A policy mix of supply and demand side programs will go a long way in addressing the issue of

increasing alcohol consumption in India.

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Table 1: Socio-economic characteristics of respondents, current drinkers only

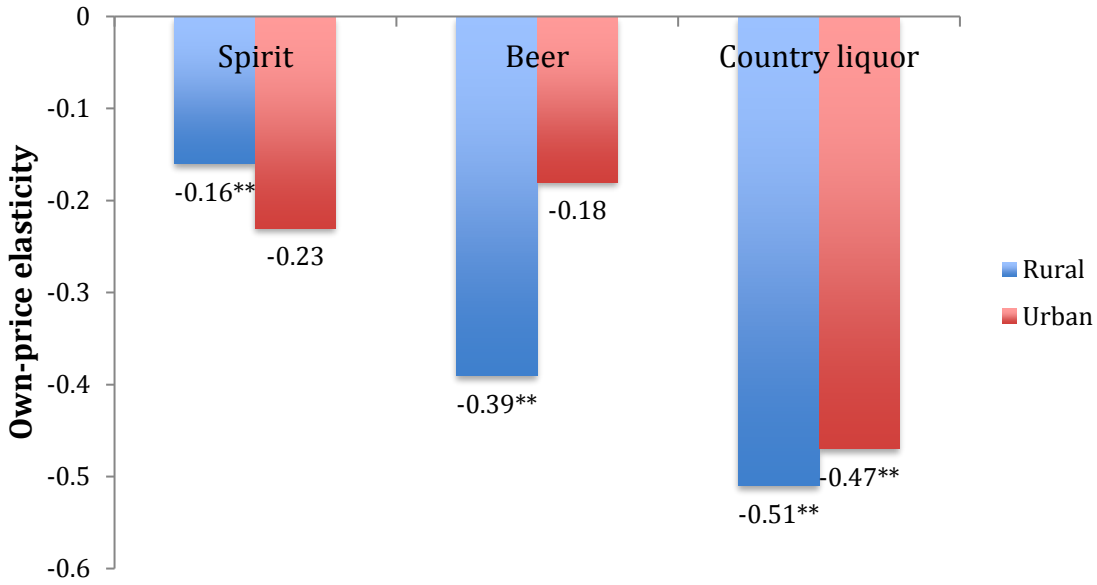
Variables	Mean	Standard deviation
Independent variables		
Log of annual beer consumption (in litres)	2.26	2.14
Log of annual country liquor consumption (in litres)	2.07	2.02
Log of annual spirit consumption (in litres)	1.97	2.10
Dependent variables		
Log of beer price	5.32	0.68
Log of country liquor price	5.36	0.79
Log of spirit price	6.44	0.79
Male	0.91	0.28
Age (years)	40.85	13.37
Illiterate	0.42	0.49
Income groups (Rupees)		
Less than 2000	0.14	0.35
2000-4000	0.23	0.42
4000-6000	0.20	0.40
6000-8000	0.15	0.36
8000-10000	0.11	0.31
10000-12000	0.06	0.25
More than 12000	0.10	0.30
Rural	0.60	0.49
Number of districts	13	
Number of states	5	

Table 2: Determinants of alcohol consumption by beverage type (in logs of annual consumption in litres, ordinary least square model

	Beer	Country Liquor	Spirit
Variables	(1)	(2)	(3)
Log price per litre	**-0.330***	**-0.459***	**-0.139**
	(0.197)	**(0.204)**	**(0.093)**
Male	0.625	0.150	1.222***
	(0.450)	(0.129)	(0.285)
Age	0.00852	0.0175	-0.003
	(0.00773)	(0.0137)	(0.004)
Education (illiterate)	0.142	-0.0908	0.329**
	(0.200)	(0.203)	(0.137)
Monthly income (in Rupees			
Reference group: Less than Rs. 2000			
Rs.2001-4000	0.484	0.422**	0.207
	(0.324)	(0.181)	(0.300)
Rs. 4001-6000	0.487*	0.680	0.424
	(0.232)	(0.380)	(0.327)
Rs. 6001-8000	0.828**	1.042***	0.631*
	(0.336)	(0.281)	(0.327)
Rs. 8001-10000	1.223***	1.258**	0.894**
	(0.293)	(0.453)	(0.289)
Rs. 10001-12000	0.628**	1.665**	0.687**
	(0.267)	(0.546)	(0.235)
More than Rs. 12000	1.712***	1.221***	0.835**
	(0.500)	(0.272)	(0.277)
Rural	-0.158	-0.731***	-0.594***
	(0.159)	(0.196)	(0.0945)
Observations	413	521	933
R-squared	0.54	0.26	0.38

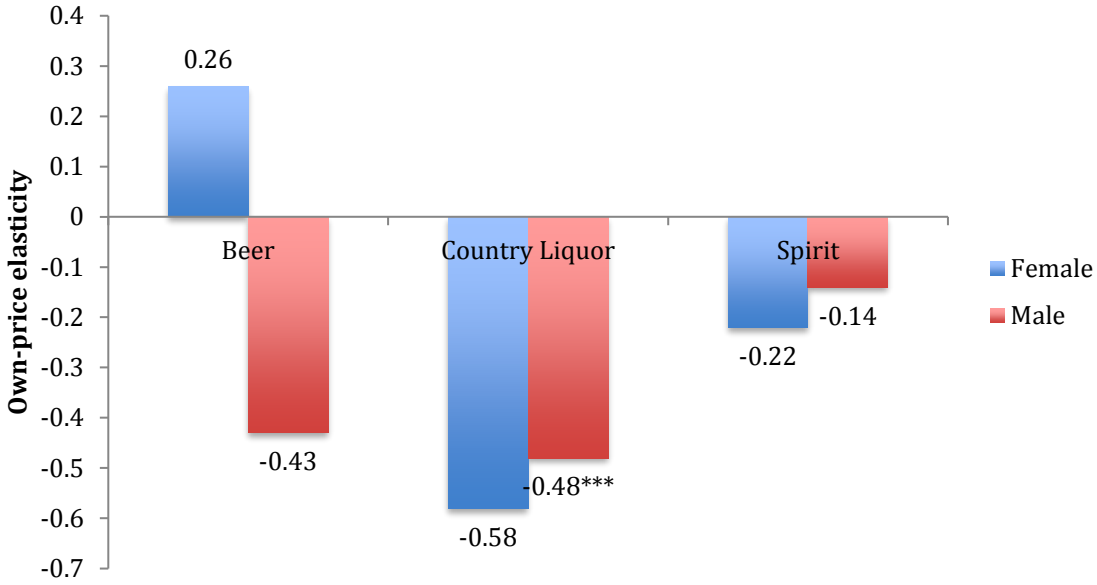
Notes: Robust standard errors clustered by district are reported in parentheses. All columns include district fixed effects. Sample includes only current drinkers.
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Price elasticities of demand by rural-urban



Note: ** denotes significance at 5%

Figure 2: Price elasticities of demand by gender



Note: *** denotes significance at 1%