

Price Elasticity of Arrack and Beer Use in Sri Lanka

RESET Alcohol Initiative in Sri Lanka

Priyanka Jayawardena

FINAL REPORT



INSTITUTE OF POLICY STUDIES OF SRI LANKA

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1 INTRODUCTION

The adverse health effects of alcohol use are well established and confirmed by numerous sources. Drinking alcohol contributes to the development of over 200 diseases, injuries, and various other health conditions. Alcohol consumption has been found to increase the risk of many non-communicable diseases (NCDs) including liver cirrhosis, some cancers and cardiovascular diseases. According to the World Health Organization (WHO), harmful use of alcohol results in 3 million deaths every year and 5.1% of the global burden of disease and injury, as measured in disability-adjusted life years (DALYs) (WHO, 2022). Furthermore, alcohol-related conditions are chronic illnesses with long term suffering that cause financial strains due to increased health costs.

Excessive alcohol consumption not only takes a toll on individuals but also imposes costs on the community in which they reside (Leifman & Trollid, 2020). The cost of alcohol abuse is borne not only by heavy users but also by the government and those who do not abuse alcohol (Alcohol and Drug Foundation, 2023). Moreover, the fiscal toll of alcohol use even more apparent when considering specific factors. Such direct and indirect costs of alcohol amounted to LKR. 119.66 billion (equivalent to 8.2 per cent of Sri Lanka's government revenue) in 2015 (World Health Organization, 2017); this was higher than the government revenue earned from alcohol excise taxes in the same year, which was LKR 105.23 billion (MOF, 2016).

Global research and country experiences have shown that increasing the price of alcoholic beverages through taxation is one of the most cost-effective policies to lower drinking levels and alcohol-attributable harm (WHO, 2017). This has been recognized as a "best buy" intervention by WHO, delivering greater health impacts in reducing illness, disability and premature death than other policy options. Further, the taxation of alcoholic beverages plays a crucial role in revenue generation for the government. In Sri Lanka also, tax rates on alcoholic beverages have been increased in successive budgets primarily to raise revenue and also to reduce health burden.

According to the STEP survey 2021, around 20.7% of adults currently use alcohol in Sri Lanka (Ministry of Health and Department of Census and Statistics, 2021). A better understanding of the price elasticities of alcohol products can provide valuable information for the government to make informed policy decisions, including demand responsiveness to price changes and tax revenue. Further, alcohol consumers react to alcohol price increases, by switching from more expensive products or brands to cheaper products or brands when one becomes more affordable relative to another. Thus, when deciding alcohol taxes authorities should take into account price elasticity of demand, to make alcohol beverages less affordable, in order to reduce consumption and prevalence. In this context, estimating elasticities is an indispensable step for determining tax rates.

Arrack and beer are the dominant beverages, comprising 90% of the total annual sales in Sri Lanka (Leifman & Trolldal, 2020). Given that, the focus of the study is to estimate the price sensitivity of arrack and beer. Further, this study investigates the price sensitivity of arrack and beer consumption by different income groups and urban/rural sector households. We hope that the findings of this study will help guide the fiscal policy changes in the country.

Accordingly, this study focuses to study the following areas

- Evaluate alcohol expenditure and its implications on household budget allocation
- To assess price sensitivity of alcohol consumption own-price elasticities are estimated for arrack and beer. The overall price elasticity includes the estimates of prevalence and intensity elasticity.

2 LITERATURE REVIEW

2.1 Alcohol Taxation

Global research and country experiences have shown that increasing the price of alcoholic beverages through taxation is one of the most cost-effective policies to lower drinking levels and alcohol-attributable harm (WHO, 2017). This has been recognized as a “best buy” intervention by WHO, delivering greater health impacts in reducing illness, disability and premature death than other policy options. Aligned with these global policies, many countries actively employ alcohol taxation as a pivotal policy measure.

The alcohol taxation and pricing policy serves as a foundational framework for augmenting tax revenue and curtailing alcohol consumption (WHO, 2017). A demonstrable correlation exists between the increase in the price level of alcohol (attributed to tax hikes) and consumption reduction (Alcohol and Drug Foundation: Position Paper Alcohol Taxation, 2023). Recognized as a valuable tool, alcohol taxes are instrumental in reducing heavy alcohol consumption and safeguarding public health (Gehrsitz et al., 2020). In certain contexts, the tax on alcohol is colloquially referred to as a “sin tax” (Alcohol Taxes, 2019).

Governments are urged to leverage alcohol taxation as a primary means to influence alcohol prices (SAFER - Pricing Policies, n.d.). Alcohol consumption is more profoundly impacted by alcohol taxes than general sales taxes, as changes in alcohol taxes directly alter alcohol prices relative to other goods that are not subject to the same excise taxes. These taxes typically take the form of excise taxes based on volume rather than price (Saffer et al., 2022), thereby influencing the overall pricing of alcoholic beverages. In a study conducted by (Sornpaisarn, Kaewmungkun, & Rehm, Assessing Patterns of Alcohol Taxes Produced by Various Types of Excise Tax Methods—A Simulation Study, 2015), it was identified that different tax methods produced different tax burdens per unit of ethanol for different alcoholic beverages. The tax burden produced by the ad valorem tax (based on price) resulted in a lower tax burden for low perceived-quality alcoholic beverages. The specific tax (based on quantity) method showed the same tax burden for both low and high-perceived-quality alcoholic beverages. However, high perceived quality beverages benefited from a lower tax burden per beverage price. Lastly, the combination tax method resulted in a lower tax burden for medium-perceived-quality alcoholic beverages. Accordingly, to achieve the global target and the Sustainable Development Goal of reducing alcohol consumption worldwide, middle-income countries, especially lower-middle-income countries, should employ stricter alcohol control policies, and apply an appropriate excise tax on alcohol products with regular increases to outpace inflation (Sornpaisarn B., et al., 2020).

While all countries put some alcohol control policies in place, there were differences in the number and strength of the policies applied, commensurate with trends in consumption. In particular, three of the countries which were most successful in reducing consumption and harm (Malaysia, Philippines, and Sri Lanka) applied more effective tax methods based on specific excise taxation alone or in combination with another taxation method, applying higher taxation rates and regularly increasing them over time (Sornpaisarn B. , et al., 2020). Despite its widespread implementation, the subject of alcohol taxation continues to be a topic of debate. Varied viewpoints have resulted in differing assessments of the suitability and efficacy of this taxation (Kenkel & Manning, 1996). The matter of alcohol taxation can be examined from various perspectives, encompassing its effects on public health, revenue generation, economic efficiency, equity, and employment (Alcohol and Drug Foundation: Position Paper Alcohol Taxation, 2023).

2.2 Impact of Alcohol Taxes on Consumption

Much research has found the effectiveness of alcohol taxing and pricing on alcohol consumption and related harm (WHO, 2017). An elevation in alcohol prices, often brought about by increased taxes, has been traditionally linked to a negative correlation with alcohol consumption (Kumar, 2017). This implies that as the price rises, the demand for alcoholic beverages tends to decrease, aligning with the principles of the law of demand.

In a study conducted by Selvanathan & Selvanathan (2006), in 43 countries (24 developed and 19 developing countries) reveals on average alcohol consumption is at an increase of 0.82% across countries. One main reason is that alcohol is not considered as harmful as tobacco. Nominally, a moderate level of alcohol is not considered to be harmful while even smoking at a minor level is considered to be harmful. On the other hand, the relative consumption of alcohol has reduced by 1.1% per annum on average across the world. This is in relation to the increase of prices at 0.4% per annum.

Further, the study (Selvanathan & Selvanathan, 2006) indicates that alcohol is a necessity in most of developed countries while it is a luxury for developing countries. It reveals that price elasticity for alcohol is inelastic for all the developed and developing countries considered in the study, including Sri Lanka. On average the price of alcohol in developing countries has increased at twice the rate of the price increase in developed countries. In all the countries considered in this study, prices have increased at 9.6% of annum. On average countries spend about 3.2% of their income on alcohol (Selvanathan & Selvanathan, 2006).

Taxation on alcohol serves as a crucial strategy to curb alcohol consumption, depending on the price elasticity of demand and the pass-through effect during tax increases (Gehrsitz et al., 2020). Price elasticity of demand gauges the change in alcohol consumption resulting from a 1% price alteration, while the pass-through represents the ratio of price increase to tax increase. Studies generally reveal that alcohol demand is more responsive to price (Chaloupka et al., 2002), with tax increases affecting both moderate and heavy drinkers equally (Gehrsitz et al., 2020). Notably, a study in the US found that 25% tax increase could lead to a 9.2% reduction in alcohol consumption (Daley et al., 2012).

Further, it has been observed that the impact of changes in alcohol prices tends to be more effective in the long run than in the short term (Xu & Chaloupka, 2011). Gallet's research indicates a long-term neutral price elasticity of demand for all alcoholic beverages at -0.82 (Gallet, 2007). By increasing taxes, alcohol prices rise, potentially leading to a decrease in consumption and therefore many alcohol-related issues (Elder et al., 2010), such as driving accidents, alcohol-induced crimes, liver cirrhosis, and other mortality linked to alcohol (Xu & Chaloupka, 2011).

While a tax-induced reduction in alcohol consumption is anticipated, it is not always realized. This discrepancy is attributed to the categorization of alcohol tax rates into three product classes: spirits, wine, and beer (Gehrsitz et al., 2020). Consequently, consumers may alter their purchasing habits in response to tax hikes, minimizing the intended effects. Several studies support this notion, indicating that changes in beer prices, for instance, can significantly influence arrack sales (Leifman & Trolldal, 2020).

The extent to which alcohol consumption responds to price changes can be encapsulated by the price elasticity of demand. Generally, the elasticity hinges on consumers' willingness to shift their preferences to substitute goods and services in response to price fluctuations (Kenkel & Manning, 1996). A notable example is the increase of excise taxes in Illinois in 2009, where prices for wine and spirits experienced an increase, while beer prices remained unchanged. This led to increased beer sales and reduced demand for spirits and wine (Gehrsitz et al., 2020). The intricate interplay of spirit, wine, and beer taxes suggests a certain degree of substitutability among these alcohol classes. Consequently, varied tax increases prompt substitutions that mitigate the overall decline in alcohol consumption (Gehrsitz et al., 2020). Furthermore, industry data challenges the efficacy of alcohol excise taxes in curbing heavy drinking, attributing this to the availability of low-cost and substitute products (Alcohol and Drug Foundation: Position Paper Alcohol Taxation, 2023).

2.3 Price Elasticities of Alcohol

The significance of price including the tax effects as a determinant of alcohol consumption follows the traditional economic theory. The key indicator to assess their effectiveness is price elasticity. According to research review studies carried out in high income countries by Wagenaar, (2009) and Elder et al (2010), the mean price elasticity for beer ranges -0.46 to -0.5, followed by -0.64 to -0.69 for wine, -0.79 to -0.80 for spirits, and -0.51 to -0.77 for total sales (see Table 1). A few studies have been conducted for developing countries too. A systematic review conducted by (Sornpaisarn B. , Shield, Cohen, Schwartz, & Rehm, 2013) observed twelve studies on alcohol prices and/or taxation on alcohol sales in Low and Middle-Income countries. Meta-analyses have revealed estimates of average price elasticity for beer as -0.5, -0.79 for other alcoholic beverages (including wine and spirits), and -0.64 for total sales. One of the 12 reviewed studies comprised a cross-country analysis by (Selvanathan & Selvanathan, 2005). This cross country analysis comprised 43 countries, including Sri Lanka as one of the 19 considered developing countries. The total estimated price elasticities for developed, developing countries, and Sri Lanka were -0.44, -0.57 and -0.472 respectively. In developing country context, another cross-sectional study from five states in India in 2014, estimated price elasticities by beverage type -0.14 for spirits, -0.33 for beer, and -0.46 for local spirits (Kumar, 2017).

Table 1 : Alcohol Price Elasticity (selected studies)

Author's Name and Year	Methodology	Countries	Price Elasticity of Demand
Selvanathan & Selvanathan, 2005	Cross-country analysis for the period of 1984-1996	24 developed and 19 developing countries including Sri Lanka.	Price elasticity for alcohol Sri Lanka : -0.472 Developing : -0.57 Developed : -0.44 All countries : -0.50
Gallet (2007)	A meta-Analysis	132 studies across 24 countries	Beer - 0.36 Wine - 0.70 Spirits - 0.68
Wagenaar et al (2009)	A meta-Analysis of 1003 estimates from 112 studies	High-Income countries	Beer - 0.46 Wine - 0.69 Spirits - 0.80 Total - 0.51
Elder et al (2010)	Systematic review	High-Income countries	Beer - 0.50 Wine - 0.64 Spirits - 0.79 Total - 0.77
Fogarty (2010)	A meta-analysis	20 countries	Beer - 0.33 Wine - 0.55 Spirits - 0.76
Nelson (2013)	A meta-Analysis (Based on estimates obtained from 112 primary studies)		Beer - 0.30 and - 0.50 Wine - 0.45 and 1.00 Spirits - 0.55 and 1.00 Total - 0.5
Sornpaisarn et al (2013)	The systematic review and a meta-analysis based on the 12 studies	LMIC Thailand, Russia, China, India, Kenya, Tanzania, Turkey In this study (Selvanathan & Selvanathan, 2005) it covered 43 countries.	Beer - 0.50 Wine - 0.79 Spirits - 0.79 Total - 0.64
Kumar (2017)	OLS	India	Spirits - 0.14 Country liquor - 0.46

Håkan Leifman Björn Trollidal, 2020	This paper studies the effect of changes in income, as well as prices of beer and arrack, on alcohol sales in Sri Lanka during the period 1981-2017.	Sri Lanka	Price elasticities not significant (Arrack -0.14; beer -0.28) However, changes in the price of beer were significant, with a lag structure -- price elasticity was -1.05 for beer A significant cross-price effect of changes in the price of beer on arrack sales were found as well.
Guindon et al (2022)	A Systematic umbrella review	6 umbrella reviews, 7 meta-analyses, 3 meta-regressions, and 14 narrative reviews, including two reviews that specifically focused on LMIC.	Beer - 0.3 Wine - 0.6 Spirits - 0.65 Total - 0.5 and - 0.8

2.4 Effect of Alcohol Taxes on Government Revenue

Taxes specifically levied on alcoholic beverages serve the dual purpose of generating tax revenue and controlling consumption. A substantial portion of government revenue is obtained through alcohol taxation, though the extent of this revenue varies among countries (Kenkel & Manning, 1996).

In comparison to customs duties and general taxes, excise duty is considered the most effective tool for government revenue generation. Alcohol taxation constitutes a substantial element in the tax revenue mix of any country, with excise taxation being the oldest form of revenue generation (Taxation of Alcohol, n.d.).

According to a recent study conducted by the University of Strathclyde's Fraser of Allander Institute (FAI) and the Institute for Alcohol Studies (IAS), raising alcohol taxes could positively impact the UK economy. The research, reveals that higher alcohol taxes could contribute to increased national income and employment if the additional revenue were strategically invested in public (Higher Alcohol Taxes Would Boost the Economy, 2019).

2.5 Alcohol Taxation in Sri Lanka

Sri Lanka is one of the most successful countries among the middle income South East Asian applying more effective tax methods based on specific taxation while applying higher tax rates and regularly increasing them overtime (Sornpaisarn B. , et al., 2020). The specific taxation method (an excise tax method) involves applying taxes based on the alcohol content of the alcoholic beverages. The study suggest that the regular increase in alcohol taxes will reduce alcohol consumption.

Arrack and beer are the two predominant beverage types in Sri Lanka accounting for 90% of the total sales annually (Leifman & Trolldal, 2020). Sri Lankan alcohol prices are high in relative terms especially compared to high-income countries (Leifman & Trolldal, 2020). They have analysed the possible effects of income and prices on sales using a time series analysis for the period of 1981-2017. The study has not revealed any immediate significant impact of price or income on sales. However, when the price series of beer was considered with a lag structure, there was a significant effect on sales. Further a significant cross-price effect in the price of beer on arrack sales. This suggests that tax increases of both beverages should be made simultaneously to prevent substitution.

3 BACKGROUND

3.1 Alcohol Consumption in Sri Lanka

Non-Communicable Diseases (NCDs) are a main health burden in the country. NCDs have gained significant prominence in Sri Lanka's health landscape, accounting for **83% of deaths**. This growing concern is evidenced by around 100,000 premature deaths annually attributed to NCDs (WHO, 2020). Alcohol misuse being a key contributing factor (Alcohol and Drug Information Centre, 2021). Harmful alcohol consumption is a major risk factor for various issues including drunken driving accidents, domestic violence, mental health concerns, and financial strain. Annually, around 20,000 Sri Lankans lose their lives due to alcohol-related health complications, placing a considerable burden on the country's healthcare system (Pallewaththa et al.). Furthermore, domestic violence linked to alcohol use is notably high (Alcohol and Drug Information Centre, 2021).

Alcohol consumption in Sri Lanka is primarily comprised of beer, arrack, toddy, and kassippu as the main alcoholic beverages (Alcohol and Drug Information Centre, 2021). Legal alcoholic beverages in Sri Lanka include hard liquor and soft liquor. Hard liquor encompasses various types of arrack and locally made foreign liquors, while beer is the primary form of soft liquor. Additionally, toddy production from coconut, palmyrah, and kithul trees is prevalent. Among these, arrack and beer stand as the most favored choices among users, accounting for approximately 90% of total annual sales. Notably, arrack is the most consumed (27.7%) type of alcohol (Pallewaththa et al.).

3.2 Household Level Alcohol Consumption

Based on the Household Income and Expenditure Survey (HIES) of 2019, around 9% of households in Sri Lanka use alcohol.¹ This reveals that alcohol plays a notable role in the lives of a significant segment of the population. Even more striking is the financial commitment made by these alcohol-user households. On average, these households allocate nearly LKR 6,000 each month for alcoholic beverages, constituting a noteworthy 8% of their total monthly budget (see Table 2).

When we delve deeper into the specific preferences of these alcohol consumers, a conspicuous preference for arrack becomes evident: 73% of them opt for arrack, a potent local spirit that holds a prominent place in Sri Lanka's drinking culture. Approximately 18% opt for the more globally popular choice of beer (see Table 2).

It is worth noting that traditional alcoholic beverages, like Toddy and Kasippu, have a relatively lower prevalence among alcohol-consuming households. Around 6% of these households choose to use Toddy, a traditional palm wine, while a similar percentage opt for Kasippu, a locally brewed spirit. This observation underscores the continuing relevance of traditional beverages in certain pockets of the population, albeit on a smaller scale compared to mainstream options.

¹ Based on HIES 2019 data, 8.7% of households incurred expenditure related to alcoholic beverages.

Table 2 : Household Level Alcohol Consumption

Alcoholic beverage	Monthly Expenditure on Alcohol	Number of Alcohol Consumer HHs	As a % of Alcohol user HHs
Arrack	5,862	362,456	73
Beer/Stout	3,441	91,233	18
Toddy	2,655	28,104	6
Kasippu	4,592	31,516	6
Whisky/Brandy	16,220	12,094	2
Gin	2,781	1,106	0
Wine	4,482	950	0
Other alcohol	7,876	4,900	1
All alcohol	5,868	494,270	

Source : Constructed based on HIES 2019

A noteworthy observation in the realm of alcohol consumption is the significant representation of more affluent households among its consumers. Over 50% of alcoholic beverage consumer households are from the 4th and 5th wealth quintiles, highlighting the pronounced association between affluence and alcohol use. Conversely, only around 10% of alcohol consumers come from the poorest quintile, underscoring the apparent economic disparity in this regard.

This socioeconomic divide becomes even more distinct when we delve into the specific choice of alcoholic beverage. Beer consumption, for instance, is notably lower among individuals in the bottom 40% wealth group segment, with 65% of beer consumers being part of the wealthier top 40% bracket, as revealed in Table 3. These statistics shed light on the economic differences of alcoholic beverage preferences.

Furthermore, the type of alcoholic beverage consumed often exhibits regional variations, with a clear divide between urban and rural settings. Traditional alcoholic beverages find greater favor in rural and estate sectors. For instance, toddy is more prevalent in the estate sector, reflecting its cultural significance in these areas. In contrast, Kassippu, a locally brewed spirit, is predominantly consumed in the rural sector, showcasing the diversity in alcohol consumption patterns across different regions. This interplay of wealth, choice of beverage, and regional preferences paints a comprehensive picture of the landscape of alcohol consumption in Sri Lanka.

Table 3 – Alcohol Consumer Households, by Household Characteristics

Household characteristics	Number of Alcohol Consumer Households						Distribution of Alcohol Consumer Households %					
		Arrack	Beer	Toddy	Kasippu	Other liquor	Alcohol	Arrack	Beer	Toddy	Kasippu	Other liquor
Urban	82,294	54,393	23,960	1,791	2,532	5,698	16.6	15.0	26.3	6.4	8.0	30.5
Rural		252,632	61,733	20,011	26,466	12,729	70.1	69.7	67.7	71.2	84.0	68.2
Estate	65,676	55,431	5,540	6,301	2,518	229	13.3	15.3	6.1	22.4	8.0	1.2
Poorest 20%	55,058	38,137	5,407				11.1	10.5	5.9			
2nd Quintile	84,767	65,745	8,484				17.1	18.1	9.3			
3rd Quintile	93,368	71,102	17,901				18.9	19.6	19.6			
4th Quintile		94,237	24,976				24.8	26.0	27.4			
Richest 20%		93,234	34,465				28.0	25.7	37.8			
All		362,456	91,233	28,104	31,516	18,656	100.0	100.0	100.0	100.0	100.0	100.0

Source : Constructed based on HIES 2019

Note : Due to small sample sizes quintile breakdowns are not given for Toddy, Kasippu, and other liquor

3.3 Alcohol Beverage Household Expenditure

Parallel to the prevalence of alcohol consumption, there is a large discrepancy in average monthly alcohol spending between wealth groups. Notably, more affluent households allocate approximately twice as much for alcohol compared to their economically disadvantaged counterparts. However, even among households with limited financial resources, spend nearly LKR 4,000 per month, representing 10% of their overall budget, to satisfy their alcoholic preferences (see Table 4). This significant expenditure on alcohol invariably exerts pressure on other critical areas of expenditure, such as education, healthcare, and housing, potentially impacting the overall spending of these households (see Table 4).

When assessing the spending patterns by beverage type, a clear trend emerges, whereas arrack is widely used across all wealth groups. Among households belonging to the 2nd to 4th wealth quintiles, around 80% of alcohol spending is for arrack. Notably, the wealthiest quintile exhibits a broader spectrum of alcoholic choices, encompassing not only arrack but also beer and a range of other liquors, such as wine and whiskey. This signifies a greater diversity in beverage selection, it is likely partly from the greater purchasing power of the wealthier consumers. In contrast, the most economically disadvantaged segment of the population opts for traditional alcoholic beverages toddy and kasippu, highlighting the cost-effective alternatives for arrack as well as enduring popularity of traditional alcoholic beverages within their socioeconomic backgrounds.

Table 4 - Average Monthly Alcoholic Beverage Expenditure and Budget Shares

Household (HH) Expenditure Group	Average Monthly Alcoholic Beverage Expenditure (LKR)						Budget Share of Spending		
	Alcohol	Arrack	Beer	Toddy	Kasippu	Other liquor	Alcohol	Health	Education
Urban	7,157	4,077	1,032	112	258	1,677	5.8	1.9	5.2
Rural	5,727	4,333	618	141	340	295	8.4	1.8	3.1
Estate	4,995	4,397	227	252	89	30	10.9	0.8	2.5
Poorest 20%	3,306	2,375	346	278	188	119	10.1	0.9	2.2
2nd Quintile	3,945	3,107	219	268	331	19	9.6	0.9	3.1
3rd Quintile	4,919	3,999	458	154	298	11	10.1	1.6	3.1
4th Quintile	6,193	5,103	669	105	266	50	9.8	1.6	3.2
Richest 20%	8,417	5,284	1,095	67	331	1,640	6.1	2.1	4.1
All	5,868	4,299	635	151	293	490	7.9	1.7	3.6

Source : Constructed based on HIES 2019

Note : Considered only alcohol related spending reported households in the HIES 2019 data

4 DATA AND METHODOLOGY

4.1 Methodology

Considering the mix of alcohol users and non-users in the HIES data, we applied the two-part model to estimate the alcohol price elasticities. We applied the methodology to alcohol, developed in the (World Health Organization, 2010) (Economics of Tobacco Toolkit : economic analysis of demand using data from the Global Adult Tobacco Survey (GATS). Accordingly, two equations were estimated separately – prevalence of alcohol use in the first part and intensity of alcohol in the second model, conditional on alcohol user. The first equation estimates having an alcohol user in a household as a function of the variables by using the entire sample. The second regression uses log-linear regression on only part of the sample—households with alcohol users—to estimate the demand for alcohol.

Part I: Decision to Alcohol Use

Probit model estimate the probability of having a alcohol user in a household and measure this likelihood after controlling the relevant variables used in the demand model. The dependent variable is a dichotomous variable with values of 1 for households with alcohol users and 0 for households without alcohol users.

$$pr(\text{Alcohol user} > 0) = \Theta(\beta_0 + \beta_1 P + \beta_2 I + \beta_{3i} X_i + \varepsilon_i)$$

Where P is the price of alcohol, I household income, X_i 's are socio-economic and demographic attribute variables.

Part II: Modelling Intensity of Alcohol Use

Then estimate the price elasticity of alcohol consumption conditional on households with alcohol users by using log-linear regression estimation techniques.

$$\ln y = \alpha_0 + \alpha_1 P + \alpha_2 I + \alpha_{3i} X_i + \varepsilon_i$$

Where $\ln y$ the natural logarithm of the average quantity of alcohol use by a person and the vector of socioeconomic and demographic covariates used in first part.

Then determine the overall price elasticity by summing together the price elasticity of participation (from the first regression) and the price elasticity of consumption (from the second regression).

$$\text{Total Price Elasticity of Alcohol} = \text{Prevalence Elasticity of Alcohol} + \text{Intensity Elasticity of Alcohol}$$

Endogeneity of Alcohol Price

Following (Huque, Abdullah, Hossain, & Nargis, 2023), a consumption-weighted price for each alcoholic beverage was estimated at the psu level, to minimize the endogeneity of alcohol price. The weight is defined as the relative share of household level alcoholic beverage consumption to total psu level consumption. The weighted price was calculated by multiplying the household level alcohol price with the corresponding consumption weight. The psu average of consumption weighted prices was assigned to both alcohol user and non-alcohol user households residing in a specific psu.

4.2 Data Description

The study uses the Household Income and Expenditure Survey (HIES) - 2019 data for price sensitivity analysis of alcohol products. The HIES conducted by the Department of Census and Statistics (DCS) is a nationally representative survey of around 20,000 households. It provides information on consumption expenditure of more than 400 commodities, including alcohol products - arrack, beer, whisky, gin, wine, toddy etc. at the household level. To capture the seasonal variations in income and expenditure, data is collected for 12 consecutive months. Accordingly, the HIES-2019 was carried out from January 2019 to December 2019.

HIES alcohol consumption data

In HIES data, there are around 1,724 households that have recorded liquor expenditure. It records the weekly household-level liquor expenditure by liquor category. Accordingly, a summary on the available liquor categorization and the number of liquor-consumer households by each beverage type are given in Table 5.

Table 5: A Summary of HIES Alcohol Consumer Data by Alcoholic Beverage Types

Alcoholic beverage	Number of alcohol consumer hhs
Toddy	115
Arrack	1,263
Kasippu	106
Beer/Stout	322
Whisky/Brandy	34
Gin	3
Wine	3
Other	15

Source: Constructed based on HIES 2019 data

4.3 Challenges and Limitations

There are many data limitations regarding the data availability in HIES. The main data issue is that the HIES provides only weekly expenditure for liquor data while quantity is not available. Thus, we have estimated the quantity based on the HIES reported beverage expenditure and market prices. Measurement error could arise as prices were derived from information on household expenditures. Furthermore, the HIES data is reported at household-level consumption, not at the individual level, which is another limitation.

Further, it would be challenging to disaggregate alcohol expenditure data to match the excise duty format. For instance, Arrack is broadly mentioned within the HIES categorizations while there are specific *Arrack* types such as *Special Arrack* and *Molasses, Palmyrah, Coconut & Processed Arrack* for taxation purposes as mentioned in the government excise Gazette notifications. Similarly, *Beer/Stout* is considered one category in HIES, while beer with absolute strength of 5% and below and above 5% are separately considered for taxation. Further, *Whiskey/Brandy, Gin, and Wine* are mentioned as different categories in HIES, while they are considered in-depth, whether imported or locally produced, for taxation in the Gazette

notifications. Specifically, although Wine is considered one category in HIES, it is considered *locally produced Wine* and *imported Wine* for taxation. Hence, there are limitations in capturing expenditure data for specific liquor types, as mentioned in the gazette notifications for taxation and vice versa.

4.4 Scope of the Study

Considering the data availability of the HIES 2019 data we have considered the arrack and beer for this analysis. We have identified the following socio-economic and demographic attribute variables as covariates in the elasticity analysis.

Table 6 : Description of Variables

Variables	Obs	Mean	Min	Max
Arrack user household (HH)	19,911	6.3%	0.0	1.0
Beer user HH	19,911	1.6%	0.0	1.0
Arrack quantity (liter bottles)	1,263	0.796	0.3	8.0
Beer quantity (330ml cans)	322	4.259	0.3	37.0
Consumption weighted arrack price	6,395	1,330.597	221.2	2,975.0
Consumption weighted beer price	2,168	286.584	32.7	727.3
Log of total household expenditure	19,910	10.749	8.2	14.5
Log of family size	19,911	1.288	0.0	2.7
Proportion of males in the HH	19,911	48%	0.0	1.0
Number of adults	19,911	2.932	1.0	12.0
Age of the head of the HH	19,911	54.193	15.0	97.0
Household max education level	19,911	11.049	0.0	17.0
Male sector of employment (base category: public)	19,911	0.116	0.0	3.0
Private	19,911	0.463	0.0	5.0

Employer	19,911	0.020	0.0	2.0
Self Employed	19,911	0.321	0.0	4.0
Males occupation (base : professionals)	19,911	0.091	0.0	4.0
Technicians	19,911	0.066	0.0	3.0
Clerks	19,911	0.024	0.0	2.0
Sales workers	19,911	0.105	0.0	3.0
Agricultural workers	19,911	0.167	0.0	4.0
Craft workers	19,911	0.156	0.0	4.0
Machine operators	19,911	0.106	0.0	3.0
Elementary workers	19,911	0.200	0.0	4.0
Army	19,911	0.005	0.0	2.0
Ethnic group (base : Sinhala)	19,911	71.3%	0.0	1.0
Tamil	19,911	17.0%	0.0	1.0
Indian Tamil	19,911	2.7%	0.0	1.0
Moor	19,911	8.5%	0.0	1.0
Burger	19,911	0.4%	0.0	1.0
Access to electricity	19,911	98.7%	0.0	1.0
Region (base category : urban)	19,911	16.1%	0.0	1.0
Rural	19,911	79.6%	0.0	1.0
Estate	19,911	4.3%	0.0	1.0
Wealth groups				
Poorest 20%	19,910	17.2%	0.0	1.0
2nd quintile	19,910	18.8%	0.0	1.0
3rd quintile	19,910	20.0%	0.0	1.0
4th quintile	19,910	21.1%	0.0	1.0
Richest 20%	19,910	22.9%	0.0	1.0

Source: Constructed based on HIES 2019 data

5 RESULTS

Understanding of both prevalence and intensity elasticity of arrack and beer consumption provides valuable insights into the intricate factors influencing consumer choices and consumption patterns, offering clear and impactful insights for policymakers. It provides comprehensive understanding on relationship between price changes and alcohol demand to formulate effective strategies for managing the alcohol consumption in the socio-economic context of Sri Lanka. This section discusses the prevalence and intensity price elasticity estimates of the arrack and beer in Sri Lanka.

The prevalence elasticity estimates for arrack clearly demonstrate the significant impact of price on the decision to use arrack (see Table 7). The data reveals a compelling prevalence elasticity value of -1.15, underscoring the sensitivity of arrack use to changes in its price. This indicates that increasing the arrack price will lead to control the entering new arrack users.

However, the intensity of use of arrack shows a different story, as consumers exhibit less responsiveness to price fluctuations intensity elasticity for arrack was -0.02. Further, the effect of price on intensity of arrack was statistically insignificant. The reasons behind this could be average weekly consumption of arrack was around 0.8, equating to less than one bottle (see Table 6). This low consumption level provides crucial context to the lack of significant estimates in arrack intensity elasticity. Moreover, the limited consumption scale implies that efforts aimed at reducing the intensity of arrack use may not yield substantial effects, given the minimal room for intensity adjustments within the existing consumption patterns.

Finally, the total of these elasticity estimates provides valuable insights for policymakers seeking effective strategies to manage and regulate arrack use in Sri Lanka. The comprehensive assessment of arrack consumption, encapsulated in the total elasticity estimate of -1.17, paints a clear picture of the substantial impact that pricing has on the demand for this beverage. This figure, derived from the combined effects of both prevalence and intensity elasticity estimates, signifies a high degree of responsiveness in consumer behavior to changes in arrack prices. Specifically, a 10% increase in the price of arrack is projected to result in an average 11.7% reduction in arrack demand in Sri Lanka.

The behavior of beer consumers in Sri Lanka diverges from the pronounced sensitivity observed in arrack consumption in response to price changes. The prevalence elasticity of beer, stood at -0.35, is considerably lower, accounting approximately one third of the prevalence elasticity observed in of arrack. This suggests that accessibility and affordability of beer, particularly in its 330 ml can format, which renders it a more budget-friendly option in contrast to the pricing dynamics of arrack.

Conversely, the dynamics shift when examining the intensity of beer consumption, where consumers display an intensified responsiveness to price variations. The intensity elasticity for beer stood at -1.2, signaling a substantial level of sensitivity. This suggests that the quantity of beer consumed is significantly influenced by price changes, possibly indicating that beer consumers tend to adjust the volume of their consumption in response to price increases.

The price sensitivity analysis of beer consumption in Sri Lanka estimates that total elasticity for beer -1.56, offering a clear and impactful insight into the relationship between price changes and beer demand. This figure, derived from the sum of prevalence and intensity elasticity

measures, underscores the substantial responsiveness of beer consumers to price changes. In practical terms, a 10% increase in the price of beer is anticipated to result in an average 15.6% reduction in beer consumption.

Table 7: Prevalence and Intensity Elasticity of Arrack and Beer

	Prevalence elasticities	Intensity elasticities	Total elasticities
Arrack	-1.154***	-0.019	-1.173
Beer	-0.347***	-1.213***	-1.560

Source: Constructed based on HIES 2019 data

Note : *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

These findings shed light on the dynamics of consumer behavior with respect to alcohol consumption and highlight the varying degrees of price sensitivity for arrack and beer in Sri Lanka. Overall, high prevalence elasticity of arrack strongly implies that increasing the price of arrack can be a potent tool in regulating its consumption patterns. Consequently, an increase in the price of arrack could serve as an effective deterrent, curtailing the initiation of new arrack users and contributing to overall control over its prevalence. Similarly, the robust total elasticity of beer accentuates the potency of pricing as a determinant factor in shaping consumer behaviors and underscores the potential for economic interventions to regulate and moderate beer consumption patterns. These findings underscore the significance of pricing as a determinant factor in shaping behaviors related to arrack and beer consumption and highlights its potential role as a lever for policy interventions aimed at moderating the prevalence and intensity of arrack and beer consumption in Sri Lanka.

Price Sensitivity Analysis of Arrack and Beer by Wealth Groups

We have constructed two wealth groups, designating the top two wealth quintiles as the high-wealth group and the three bottom quintiles as the low-wealth group.

Table 8: Prevalence and Intensity Elasticity of Arrack and Beer by Wealth Groups

	Prevalence elasticities	Intensity elasticities	Total elasticities
Low-wealth group (60%)			
Arrack	-1.402***	-0.009	-1.411
Beer	-0.406**	-1.106***	-1.512
High-wealth group (40%)			
Arrack	-0.943***		-0.983
Beer	-0.338**	-1.309***	-1.647

Source: Constructed based on HIES 2019 data

Note: *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

The study of arrack price sensitivity analysis provides valuable insights into the dynamics of pricing and how it affects various socioeconomic groups. As expected, the prevalence elasticity of arrack shows a higher sensitivity among low-wealth groups compared to their wealthier counterparts. This suggests that increasing arrack prices could be an effective strategy in controlling the influx of new arrack users, particularly within the low-income demographic. However, when delving into arrack intensity elasticity, a different trend emerges. It appears that higher arrack prices are more likely to result in a reduction of consumption among wealthier groups. This could be attributed to the limited room for intensity adjustments within the existing consumption patterns of low-wealth groups, where arrack consumption quantities are already considerably small. Despite this, the overarching total price elasticity for arrack consumption indicates that low-wealth groups exhibit a greater sensitivity to price increases. In essence, this implies that policy measures targeting price adjustments could have a more pronounced effect on curbing arrack consumption within economically disadvantaged communities.

Similar to arrack, beer exhibits higher prevalence elasticity among low-income groups. This suggests that changes in beer prices have a positive impact on controlling the initiation of new beer users especially among lower income communities. However, when examining intensity elasticity and total elasticity, a contrasting pattern emerges. It appears that the responsiveness to changes in beer prices is more significant among individuals with higher incomes. This observation might be attributed to the fact that beer consumers are predominantly from wealthier socioeconomic groups. The disparity in elasticity trends between low and high-income groups underscores the complex dynamics influencing consumer behavior based on economic factors.

6 CONCLUSION

In conclusion, the global evidence and the limited estimates specific to Sri Lanka suggest that higher taxes, have the potential to substantially reduce consumption and mitigate the adverse consequences of problem drinking. The responsiveness of individuals to price, as reflected in the price elasticities of arrack and beer, underscores the effectiveness of pricing as a tool to shape consumer behaviors. Specifically, increasing the price of arrack can serve as a potent deterrent, preventing the initiation of new users and contributing to overall control over its prevalence. The robust total elasticity of beer further emphasizes the role of economic interventions in regulating and moderating beer consumption patterns. These findings highlight the pivotal role of pricing as a determinant factor in shaping behaviors related to arrack and beer consumption, emphasizing its potential as a lever for policy interventions aimed at moderating the alcohol consumption in Sri Lanka.

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Institute of Policy Studies of Sri Lanka

100/20, Independence Avenue, Colombo 7, Sri Lanka.

Tel: +94 11 2143100 | Fax: +94 11 2665065

Email: ips@ips.lk

Website: www.ips.lk