# Demand for tobacco products in Bangladesh

Nasiruddin Ahmed [1], Tanvir Ahmed Mozumder,[1] Md. Tariq Hassan,[2] Rumana Huque[3]

[1]Economics, BRAC Institute of Governance and Development (BIGD), Brac University, Dhaka, Bangladesh
[2]VAT Policy, National Board of Revenue (NBR) Bangladesh, Dhaka, Bangladesh
[3]Economics, University of Dhaka, Dhaka, Bangladesh

**Correspondence to**
Dr Nasiruddin Ahmed, BRAC Institute of Governance and development (BIGD), Brac University, Dhaka-1212, Bangladesh; ahmed.nasiruddin@gmail.com

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## ABSTRACT

**Background** Tobacco tax increase is considered as one of the most effective means to reduce tobacco consumption and its consequences. An increase in taxes, which results in an increase in the price of tobacco products, reduces consumption. Historically, a number of studies estimated the responsiveness of quantity demanded to a change in price—the price elasticity of demand—of tobacco products in Bangladesh. However, the government's stronger commitment to reducing tobacco use, rising standard of living, rapidly changing cultural norms due to globalisation, and the substantial fall in tobacco use seen in GATS 2017 necessitate an updated measure of price elasticity of tobacco use, which will allow for more accurate answers to questions of tobacco tax policy in the country. This study endeavours to fill this gap in the literature on demand for tobacco products in Bangladesh.

**Objective** To estimate the price elasticity of demand for tobacco products, namely cigarettes, *biris* and smokeless tobacco (SLT) products with the 2016 household income and expenditure survey data in Bangladesh.

**Methods** We used the Deaton model (1997) to estimate the price elasticities of demand for tobacco products using the Household Income and Expenditure Survey (HIES) 2016 dataset of the Bangladesh Bureau of Statistics. The HIES 2016 surveyed 46 076 households spread over 2304 primary sampling units across the country. We have calculated own price elasticities of demand for tobacco products by expenditure groups and by regions (rural and urban).

**Results** The estimates of own-price elasticity of demand for cigarette, *biri* and SLT products are −1.03, −1.34 and −0.30, respectively. The results show that rural households are more responsive to changes in the prices of cigarettes than urban households. Households with low expenditure are found to be more responsive to changes in the price of cigarettes than the households with high expenditure. This suggests that increases in cigarette prices at the lower end would effectively reduce cigarette consumption among the people having low expenditure and improve health equity.

**Conclusions** Our results suggest that the demand for smoking tobacco products is responsive to price changes. Therefore, substantial increase in the prices of tobacco products through taxation will result in significant reduction in tobacco use, particularly among the low expenditure households, while increasing government revenue.

## INTRODUCTION

Tobacco use is a leading cause of death, disease and disability around the world. Currently, there are 37.8 million (35.3%) adults consuming tobacco products (cigarette, *biri*, smokeless tobacco (SLT) or other tobacco products) in Bangladesh.[1] Although the overall prevalence of tobacco use declined by 18.5% from 2009 to 2017, the consumption of cigarettes remained almost unchanged from 14.2% of adults in 2009 to 14.0% in 2017. In the same period, the prevalence of SLT use declined marginally among women from 27.9% of adults to 24.87%. The prevalence of SLT products is particularly alarming, as Bangladesh ranks second in 34 high SLT burden countries.[2]

The high rates of tobacco use in Bangladesh impose increasing health, financial and economic costs on the country. In 2018, about 126 000 deaths in the country were attributable to tobacco related diseases, which represented 13.5% of all deaths in the year. The overall economic cost of tobacco use was estimated at BDT 305.7 billion (US$3.6 billion), which was 1.4% of GDP in 2018.[3]

In an effort to curb tobacco use and its costs, the Government of Bangladesh has committed to making a 'Tobacco Free' Bangladesh by 2040. Evidence suggests that the most effective tool in reducing tobacco use is an excise-tax-led increase in tobacco prices.[4 5] However, the complex multi-tiered *ad valorem* excise tax system, currently maintained in the country, has resulted in large variation in prices within a tobacco product as well as between the three major products. Moreover, the affordability of tobacco products has also evolved over time. Nargis *et al*[6] observe that from 2009 to 2015, cigarettes and *biri* have become more affordable over time, whereas there is no change in the affordability of SLT products.

Although a number of studies have previously estimated the response of tobacco use to changing prices (the price elasticity of demand) of tobacco products for Bangladesh (discussed later), recent developments and trends mentioned earlier necessitate an updated measure of the price elasticity to ensure precise answers to tobacco tax policy questions. Also, recent studies of Bangladesh, India and Pakistan using household survey data have found elastic response to price change of tobacco products. In this backdrop, the present study attempts to estimate the own-price elasticities of demand for tobacco products in Bangladesh by expenditure groups and by regions.

The analysis in the present paper can be directly compared with the 2018 paper by Del Carmen *et al*[7] who applied quadratic AIDS model using the HIES 2016 data to estimate conditional price elasticity of tobacco demand. A major limitation in the methodology applied by Del Carmen *et al* is that they do not take into account the impact of brand-choice, called 'quality-effect', and measurement error in the recorded price available in the dataset. We build on their work in three ways:



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(1) by explicitly correcting for quality effect and measurement error; (2) by using both smoking as well as non-smoking households, that is, providing an unconditional measure of elasticity; (3) including SLT products in our analysis.

## LITERATURE REVIEW

Nineteen studies reviewed in this paper have highlighted the existence of a strong relationship between tobacco taxation and tobacco consumption in South Asia, Africa and Southeast Asian countries. This section reviews seven papers on price elasticity estimates of tobacco products in Bangladesh. Ali *et al*[8] estimated the own-price elasticity of cigarettes at −0.27 using time-series data from 1970 through 2000. Guindon *et al*[9] found that price elasticity of cigarette is insignificant. Nargis *et al*[10] used International Tobacco Control (ITC) Survey, 2009 and 2010 data and their elasticity estimates were −0.66 for cigarettes and −0.22 for *biris*. In 2012, Barkat *et al*[11] estimated the price elasticities of cigarette consumption using annual time-series data from 1981 through 2004. Their elasticity estimates were −0.41 for cigarettes in the short run and −0.57 for cigarettes in the long run. It is for the first time that Nargis *et al*[12] estimated the price elasticities across income groups using a housing index on ITC Survey, 2009 and 2010 data. The estimated overall price elasticity was −0.49 for cigarettes with −0.75 for the lowest-income group, −0.40 for the medium-income group and −0.36 for the high-income group. Nargis *et al* estimated the price elasticity of Zarda using two-step regression analysis based on the data from the ITC Bangladesh Wave 3 Survey. The price elasticity of lower price brands of Zarda is estimated at −0.64 and of higher price brands at −0.39, and the cross-price elasticity of Zarda with respect to cigarette price at 0.35. In 2018, Del Carmen *et al* used HIES 2016 data using Quadratic AIDS model. Their overall elasticity estimates show that the demand for cigarettes is elastic (−1.3) with −1.36 for the first poorest decile and −1.23 for the richest decile.

For India, three papers on price elasticity estimates have been reviewed. John[13] used the Deaton model with the National Sample Survey (NSS) data from July 1999 to June 2000 and found the price elasticity estimates at −0.34 for cigarettes, −0.92 for *biri* and −0.87 for leaf tobacco. Using the NSS data conducted in 1993/1994, 1999/2000 and 2000/2005 and pooled NSS data, Guindon and Nandi[14] estimated the price elasticity of cigarettes at −1.03 and that of *biri* at −0.94. Selvaraj *et al*[15] estimated price elasticity across income groups in India using the 2011–2012 consumer expenditure survey data. Their results show that the elasticity estimates of cigarettes were −0.83 and −0.26 for the lowest and the highest income groups, respectively. The lowest income group was found to be more responsive to *biri* price (−0.43) change than the highest income group (−0.08). The lowest income group were found to be more responsive to price change of leaf tobacco (−0.56) than the middle-income group (−0.45).

For Nepal, Karki *et al*[16] used household-level data and estimated the price elasticity of cigarette at −0.89. In Pakistan, Mushtaq *et al*[17] used time-series annual data from 1981 to 2009 and their elasticity estimate was −1.17 for cigarettes in the long run. Another study by Nayab *et al*[18] used the Deaton model with the household survey data 2015–2016 and found that the demand for cigarette was responsive to price change (−1.07) while the demand for chewed tobacco was inelastic (−0.55). For Sri Lanka, Arunatilake[19] estimated price elasticities across income groups using survey data 1999/2000. The demand for cigarette was found to be inelastic (−0.53) with −0.24 for the richest quintile and from −0.55 to −0.64 among the other four quintiles.

Apart from South Asia, this paper also reviews the estimates of price elasticities of demand for cigarettes from four African countries, namely South Africa, Tanzania, Uganda and Zambia. Using two-part model with household survey data (2008–2011), Mukong and Tingum[20] found the demand for cigarettes inelastic in South Africa. However, Kidane *et al*[21] used a two-part demand equation model and found total elasticity estimate of cigarettes elastic (−1.732). Using the Deaton model with household survey data of Uganda, Chelwa and van Walbeek[22] found inelastic demand for cigarettes in Uganda. For Zambia, Stoklosa *et al*[23] used the 2012 and 2014 waves of the ITC Zambia survey and found inelastic demand for FM and RYO cigarettes. In an East Asian country, namely China, Chen and Xing[24] used the Deaton model and the two-part model with the urban household income and expenditure survey 1999–2001 data and found that the overall price of cigarettes is inelastic. Most of the studies obtained inelastic demand for tobacco products. Five studies (28% of the papers reviewed) found elastic response to change in cigarette prices. All the studies found inelastic demand for SLT products. This paper builds on the previous studies on the demand for tobacco products in South Asia, Southeast Asia and some African countries. The price elasticities of demand for tobacco products of these selected countries are presented in table 1.

## METHODS

The present study uses the Deaton model (1987,[25] 1989,[26] 1990[27] and 1997[28]) to estimate own-price elasticities of demand for tobacco products in Bangladesh. The Deaton model is based on the theory of consumer behaviour where households are assumed to choose both quantity and quality so that expenditure on a good reflects quantity, quality and price. The model uses the spatial variation in prices to estimate a system of price elasticities.

To estimate price elasticities, we have used the following two equations, which link the budget shares and unit values of multiple tobacco products to household expenditures, other household characteristics and the prices of commodities:

$$w_{Gic} = \alpha_G^0 + \beta_G^0 lnx_{ic} + \gamma_G^0.Z_{ic} + \sum_{H=1}^{N} \theta_{GH} ln\rho_{Hc} + \left(f_{Gc} + \upsilon_{Gic}^0\right) \quad (1)$$

$$\ln UV = \alpha_G^1 + \beta_G^1 lnx_{ic} + \gamma_G^1.Z_{ic} + \sum_{H=1}^{N} \psi_{GH} ln\rho_{Hc} + \upsilon_{Gic}^1 \quad (2)$$

In the first equation, $W_{Gic}$ is the budget share of good G in the budget of household *i* living in cluster C. In equation 1, the budget share of the household is taken to be a linear function of the logarithm of total household expenditure, x, a vector of household characteristics, Z, and the logarithm of N prices where N is the number of commodities. The term $f_{Gc} + \upsilon_{Gic}^0$ can be thought of as an error term with both cluster and idiosyncratic components. Equation 2, which is observed only for households that record positive purchases, relates the logarithm of unit value to the logarithm of total household expenditure, x, a vector of household characteristics, Z, and the logarithm of N prices where N is the number of commodities. The coefficients $\beta_G^0$ and $\beta_G^1$ represent the elasticity of quantity demanded with respect to total expenditure and quality elasticity, respectively. The total expenditure elasticity can be calculated from

$$\varepsilon_x = 1 - \beta_g^1 + \beta_g^0 / w_g \quad (3)$$

where $w_g$ is the mean budget share of the g-th product.



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**Table 1** Price elasticities of demand for tobacco products in selected countries

| Country | Source | Product | Own-price elasticities |
|---|---|---|---|
| **South Asian countries** | | | |
| Bangladesh | Ali *et al* (2003)[8] | Cigarettes | −0.27 |
| | Barkat *et al* (2012)[11] | Cigarettes | ▶ −0.41 short run<br>▶ −0.57 long run |
| | Del Carmen *et al* (2018)[7] | Cigarettes | −1.3 (−1.36 for the first poorest decile and −1.23 for the richest decile) |
| | Guindon *et al* (2003)[9] | Cigarettes | ▶ Insignificant |
| | Nargis *et al* (2011)[10] | Cigarettes | −0.66 |
| | | *Biri* | −0.22 |
| | Nargis *et al* (2014)[12] | Cigarettes | −0.49, (−0.75, the low-income group; −0.40, the medium income group; −0.36, the high-income group based on housing index) |
| | Nargis *et al* (2014)[12] | Zarda | ▶ −0.64, lower priced Zarda<br>▶ −0.39, higher priced Zarda |
| India | Guindon *et al* (2011)[14] | Cigarettes | −1.03 |
| | | *Biri* | −0.94 |
| | John (2008)[13] | Cigarettes | −0.34 |
| | | *Biri* | −0.92 |
| | | Leaf tobacco | −0.87 |
| | Selvaraj *et al* (2015)[15] | Cigarettes | ▶ −0.83, the lowest income group<br>▶ −0.26, the highest income group |
| | | *Biri* | ▶ −0.43, the lowest income group<br>▶ −0.08, the highest income group |
| | | Leaf tobacco | ▶ −0.56, the lowest income group<br>▶ −0.45, middle income group |
| Nepal | Karki *et al* (2003)[16] | Cigarettes | −0.89 |
| Pakistan | Mushtaq *et al* (2011)[17] | Cigarettes | −1.17, long run |
| | Nayab *et al* (2018)[18] | *Biri* | −1.22 |
| | | Cigarettes | −1.07 |
| | | Chewed tobacco | −0.55 |
| Sri Lanka | Arunatilake (2002)[19] | Cigarettes | −0.53, (−0.29, the richest quintile and −0.55 to −0.64 among the other four quintiles) |
| **Other countries in the world** | | | |
| China | Chen and Xing (2011)[24] | Cigarettes | −0.82 |
| South Africa | Mukong and Tingum (2018)[20] | Cigarettes | ▶ −0.43, economy brand<br>▶ −0.69, mid-priced brand |
| Tanzania | Kidane *et al* (2015)[21] | Cigarettes | −1.732 |
| Uganda | Chelwa and van Walbeek (2019)[22] | Cigarettes | ▶ −0.26 for lower priced cigarette<br>▶ −0.33 for higher priced cigarette |
| Zambia | Stoklosa *et al* (2019)[23] | Cigarettes | ▶ −0.20 for factory made (FM)<br>▶ −0.03 for roll your own (RYO) |

The budget share of a household depends on the response of total demand to price changes, including purchasers and non-purchasers alike. On the other hand, unit value is observed only for households that record positive market purchases. The Deaton model is estimated in three stages. In the first stage, equations (1) and (2) are estimated by ordinary least squares (OLS) one by one after cluster means are subtracted. The effects of household characteristics are purged from the budget share and unit value. Any residual variation in unit value and covariance with budget share residuals are assumed to reflect measurement error, and the first-stage regression residuals give an empirical estimate of these errors.

In the second stage, the effects of the budget and the household characteristics are netted out, and cluster averages of the corrected budget shares and unit values are calculated. Variance–covariance matrices for the estimated parameters and elasticities are obtained by bootstrapping. At the third and final stage, applying the weak separability assumption, the quality and price effects are removed. At this stage, we use the errors-in-variables estimator rather than OLS. The symmetry restrictions are added to increase the precision of the estimates of the parameters.

In order to estimate the price elasticities of demand for tobacco products, we need information about the prices of the various tobacco products. But the disaggregated data on prices to estimate the elasticities are not available in Bangladesh. Hence, the unit values are obtained by dividing the household expenditure on a commodity by the quantity purchased of the commodity to infer about prices. Deaton points out two drawbacks of using unit value as a proxy for price. First, unit values are affected by the choice of quality. As unit values are computed by dividing household expenditures by physical quantities, they do not take into account the nature of heterogeneity of the commodity. Second, because unit values are derived from the reported expenditures and quantities, there is the probability of measurement error in both expenditure and quantity, which is transmitted to the unit value. Deaton's approach of two-equation system of budget shares and unit values attempt to correct for the choice of quality and measurement error by adopting a weak separability assumption.[29]



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Using HIES 2016 data, we present the symmetry constraint estimates of own-price elasticities of demand for cigarettes, *biri* and SLT together with bootstrapped SEs, obtained by using Deaton's approach from 1000 replications of the bootstrap using the cluster-level data. The estimates of own-price elasticities of demand for cigarettes, *biris* and SLT products are presented using the following three categories, namely (1) overall demand, (2) rural/urban clusters and (3) household expenditure quintiles. The price elasticity of household expenditure quintiles (poorest 60% and richest 40%) was estimated using the subsample of first three quintile and remaining two quintiles separately with HIES, 2016 data.

## Data

The study uses the data from the HIES 2016 conducted at 5-year intervals by the BBS to estimate own-price elasticities of demand for cigarette, *biri* and SLT products. The HIES 2016 sample size comprises a total of 46 076 households. Among these households, for some of the households where basic characteristics variable were missing in the dataset. We found that in total 45 252 households have all the information we need and ran our analysis using these 45 252 observations only. About 55% of the households consumes tobacco products while the rest 45% are non-consuming households. On an average, a household spends about 5% of its total monthly expenditure on tobacco products. We divided the sample into two groups—the first three expenditure quintiles (60%) and the fourth and fifth quintiles (40%)—and then ran the model on each subsample.

The expenditure value is given in Bangladesh Taka (BDT). The unit values of cigarette and *biri* are considered as per stick whereas the unit value of SLT is per gram. The socioeconomic characteristics of household considered in regression in equations 1 and 2 are log of household monthly expenditure, log of household size, log of yearly expenditure, household head's education (years of education), ratio of total adults (age 15+) in the household and ratio of male in the household (table 2).

**Table 3** Testing the spatial variation hypothesis

| | F statistics | P value | $R^2$ | N |
|---|---|---|---|---|
| Cigarette | 4.00 | 0.00 | 0.45 | 12 811 |
| *Biri* | 4.95 | 0.00 | 0.59 | 6952 |
| SLT | 4.79 | 0.00 | 0.49 | 12 191 |

SLT, smokeless tobacco.

### Identifying assumption of the Deaton model

The main identifying assumption behind the Deaton model is that prices vary across geographical space. The validity of this assumption can be tested using ANOVA. The results of the ANOVA exercise are presented in table 3:

We report the test results for all three tobacco products in table 3. For all the tobacco products, the price variation in clusters is significant at 1% level. The values of $R^2$ show that at least 45%, 59% and 49% of price variation in cigarette, *biri*, SLT can be explained by cluster variation, respectively.

## RESULTS

Table 4 shows the estimated coefficients of unit value and budget share regression. The coefficient of ln x in unit value regression gives the expenditure elasticity of quality. The expenditure elasticity of quality for cigarette is 0.147. This implies that increasing the household expenditure by 100% would raise the average expenditure on cigarette by 14.7%. The expenditure elasticity of quality for SLT products is −0.74. It is possible that the unit price of SLT decreases as amount bought increases. The estimated coefficients of the logarithm of household size are negative and statistically significant in all cases. It suggests that increases in household size work like reduction in per capita income. With total household expenditure and other household characteristics remaining the same, an increase in household size has a significant effect of decreasing the average price paid by a household.

**Table 2** Variables used to estimate price elasticity

| **Survey data** | | | |
|---|---|---|---|
| Sample size | | | 45 252 |
| Rural sample | | | 31 500 |
| Urban sample | | | 13 752 |
| No of clusters | | | 2304 |
| No of rural clusters | | | 1594 |
| No of urban clusters | | | 694 |
| | **Cigarettes** | ***Biri*** | **SLT** |
| **Variable** | **Mean (SD)** | **Mean (SD)** | **Mean (SD)** |
| Budget share and unit values of tobacco products | | | |
| Share of the household expenditure on a tobacco product to monthly food expenditure (budget share) | 0.02 (0.04) | 0.006 (0.18) | 0.002 (0.005) |
| Ratio of the household expenditure on a tobacco product to its quantity purchased (unit value) | 2.96 (1.71) | 0.62 (0.615) | 0.027 (0.063) |
| Household characteristics | | | |
| Average food expenditure in a month | 6780.78 (4461.54) | | |
| One-year total expenditure | 172 393.7 (162 963.8) | | |
| No of members in a household | 4.04 (1.55) | | |
| Household head's education year | 4.26 (4.61) | | |
| Ratio of males in the household | 0.49 (0 .19) | | |
| Ratio of adults in the household | 0.71 (0.21) | | |

SLT, smokeless tobacco.



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**Table 4** Results of the unit value and budget share regression

| | Unit value regression | | | Budget share regression | | |
|---|---|---|---|---|---|---|
| **Variables** | **Cigarette** | ***Biri*** | **SLT** | **Cigarette** | ***Biri*** | **SLT** |
| Ln x | 0.147*** (0.0126) | 0.0310* (0.0162) | −0.740*** (0.0217) | 0.0168*** (0.0006) | −0.00073*** (0.00024) | −0.00027*** (0.000074) |
| Ln household size | −0.130*** (0.0142) | −0.0426** (0.0189) | −0.00315 (0.0238) | −0.007*** (0.0007) | 0.0027*** (0.00028) | −0.00007 (0.00008) |
| Ln yearly expenditure | 0.0516*** (0.00578) | −0.000594 (0.00722) | 0.00627 (0.0104) | −0.00332*** (0.0003) | −0.0016*** (0.00012) | −0.00003 (0.00003) |
| Head's education | 0.0157*** (0.000958) | 0.0078*** (0.00157) | −0.00456** (0.00183) | −0.0004*** (0.00005) | −0.00044*** (0.00002) | −0.00008*** (0.000006) |
| Adult ratio | −0.074*** (0.0208) | −0.0445* (0.0270) | 0.104*** (0.0390) | −0.0064*** (0.00108) | 0.0017*** (0.000434) | 0.0027*** (0.000130) |
| Male ratio | −0.0223 (0.0224) | −0.020 (0.0294) | 0.016 (0.0385) | 0.014*** (0.00107) | 0.006*** (0.000430) | −0.0015*** (0.000129) |
| Constant | −0.46*** (0.0865) | −0.802*** (0.111) | 1.610*** (0.146) | −0.08*** (0.004) | 0.0190*** (0.00160) | 0.00363*** (0.0005) |
| Observations | 12 746 | 6922 | 12 133 | 45 252 | 45 252 | 45 252 |
| $R^2$ | 0.49 | 0.644 | 0.66 | 0.177 | 0.244 | 0.232 |

***, **, * indicate statistically significant at 1%, 5% and 10% levels, respectively.
SLT, smokeless tobacco.

In the budget share regression, the estimated positive and statistically significant coefficient for cigarette shows that the share of household budget allocated to cigarettes tends to rise as household expenditure rises. On the other hand, the estimated negative and statistically significant coefficients for *biri* and SLT products mean that the household budget shares allocated to *biri* and SLT products tend to fall as household expenditure increases.

### Own-price elasticities of demand

The overall results in table 5 suggest that all the estimates have negative signs, as expected. The estimates show that the demand for cigarette and *biri* are elastic. On the other hand, the demand for SLT product is inelastic. Based on the household expenditure quintiles, our results also show that households belonging to the first three quintiles are more responsive to changes in the prices of cigarettes than the households of the fourth and fifth quintiles. This is expected as the households with low expenditure are likely to respond more to changes in the prices of cigarettes than the households with high expenditure. However, the estimates from the low and high expenditure households for *biri* are similar and they are both statistically significant. This means that the low and high expenditure households both respond to changes in the price of *biri* in a similar way. We find that this pattern is consistent with existing evidence that observes decline in *biri* demand due to changing preference and structural changes, even for the low expenditure households.

It is evident that the estimates of own-price elasticities of demand for cigarettes and *biris* of this paper are substantially larger than most of the existing evidence. This is explained in terms of a different method (the Deaton model), large and more recent data used in this paper than most of the past studies. Using HIES 2016 data allows us to control for detailed household characteristics that previous studies are unable to control for. The large sample size, which is nationally representative and provides detailed information on household characteristics, makes our paper more attractive compared with others. In addition, there have been marked changes in pattern of tobacco use in the last decade. Therefore, there was a need for an updated estimate of price elasticity which takes all the major tobacco products into account.

The price elasticity estimates are in line with the results of the three recent studies (Del Carmen *et al* for Bangladesh; Guindon *et al* for india; Nayab *et al* for Pakistan).[18] All these three studies have used large household survey data and found elastic response to the price change of cigarettes. It is pertinent to mention that although Del Carmen *et al* have used the HIES 2016 data, it uses the quadratic almost ideal demand system (AIDS) model to estimate price elasticities. While this paper has used the Deaton model which purges the quality of choice and measurement error arising from unit values, there is the probability that the unit values used in the AIDS model may be plagued by the choice of quality and measurement error. Moreover, we have estimated unconditional elasticity as compared with conditional price elasticity of demand by Carmen *et al*

## DISCUSSION

We found that the overall consumption of smoking tobacco products responds significantly to price changes; however, the response varies by types of tobacco products. The increase in the prices of cigarettes and *biris* leads to more than proportionate reduction in their consumption, while the increase in the price of SLT products leads to much less than proportionate



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**Table 5** Own-price elasticities of demand for tobacco products, HIES 2016

| | Rural/urban | | | Expenditure quintiles | |
|---|---|---|---|---|---|
| | Overall | Rural | Urban | Low (q1–q3) | High (q4–q5) |
| Cigarette | **−1.03***** (0.02) | **−1.38***** (0.023) | **−0.89***** (0.033) | **−1.23***** (0.03) | **−0.83***** (0.034) |
| *Biri* | **−1.34***** (0.02) | **−1.26***** (0.02) | **−1.55***** (0.49) | **−1.20***** (0.03) | **−1.30***** (0.07) |
| SLT | **−0.30***** (0.016) | **−0.32***** (0.018) | **−0.32**** (0.02) | **−0.21***** (0.02) | **−0.31***** (0.03) |

Figures in parentheses indicate bootstrapped SEs. ***, ** and * indicate statistically significant at 1%, 5% and 10% levels, respectively.
SLT, smokeless tobacco.

reduction in the consumption of SLT products. However, our results show relatively high price elasticity of cigarette compared with previous studies (Nigar *et al*). This may be due to the fact that majority of the consumers come from the lower expenditure group and are relatively more responsive to price changes. A similar exercise in Pakistan also finds high price elasticities for cigarette (Nayab *et al*), while Del Carmen *et al* have generated similar results for Bangladesh. According to Del Carmen *et al*, by jointly modelling the demand for various tobacco products, one considers responses for a larger population compared with the more restricted population of cigarette consumers. This explains why the estimated own-price elasticities are higher than in other studies. However, the changing dynamics of the cigarette market and the change in consumers' behaviour in Bangladesh in the recent past need to be considered in this context. The rapid growth in low-price cigarette sales in Bangladesh led to a dramatic increase in the market share of these brands, and there had been brand substitution from higher-price to low-price cigarettes due to widening price differential between brands.[30] This large lower price cigarette market combined with growth of per capita income and change in preference of the former *biri* smokers also led to product substitution from *biri* to low-price cigarettes (Nigar *et al*). Despite tax and price increase, this downward substitution resulted in constant rate of cigarette smoking among adults rather than to reduce or quit smoking (Nigar *et al*).[31] However, one of the limitations of the study is that the HIES data did not permit us to estimate own-price elasticity and cross-price elasticity by price tiers of cigarettes.

We found that the price elasticity of cigarette consumption is significantly higher among lower expenditure population than their rich counterparts. This implies that cigarette tax policy can be reformed to increase cigarette prices at the low-tiered cigarettes, which would effectively reduce cigarette consumption among low expenditure people and improve health equity. Increasing the prices of tobacco products, in addition to reducing tobacco use and tobacco attributable death, is also expected to increase tax revenue.

## What this paper adds

- This is the first analysis of tobacco demand in Bangladesh using the Deaton model with nationally representative household survey (HIES 2016) data.
- The paper estimates the own-price elasticity of demand for tobacco products by expenditure groups and by regions.
- The important policy implication is that enhancing the cigarette prices at the lower end would effectively reduce cigarette consumption among the low expenditure households and improve health equity.
- The results of the paper are highly relevant to tobacco control policies in Bangladesh using price and tax measures.

Our research has several limitations. The most significant is the lack of adequate information. Our estimates are calculated based on household-level data that do not have adequate information on the characteristics of the consumer. Our data did not have tier-based price information. The price elasticities we have calculated is on overall cigarette price. Household data did not have information of the market price of the product. McKelvey[32] shows that Deaton's method does not adequately deal with the issue of quality shading that appears to be prevalent in many settings. Our research used variation in unit value as a substitute of market value. Gibson and Rozelle[33] find that there are significant bias using unit value as a proxy of market price even after correcting. However, despite the limitations, this study indicates that imposition of specific tax has the potential to disincentivise tobacco companies to manipulate prices and increase the overall tax collections.

## CONCLUSIONS

On the whole, our results suggest that increasing the prices of cigarettes, *biris* and SLT products would lead to a significant reduction in tobacco use while increasing government revenue and bringing change in the existing tobacco taxation structure. Introducing a specific tax component for all tobacco products would serve the dual purpose of reducing tobacco consumption and enhancing government revenue.

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**Data availability statement** Data are available in a public, open access repository. We have used Household Income & Expenditure (HIES) 2016 data. To get access to this dataset, one needs to purchase these data from Bangladesh Bureau of Statistics (BBS)

**ORCID iD**
Nasiruddin Ahmed http://orcid.org/0000-0003-0807-797X



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