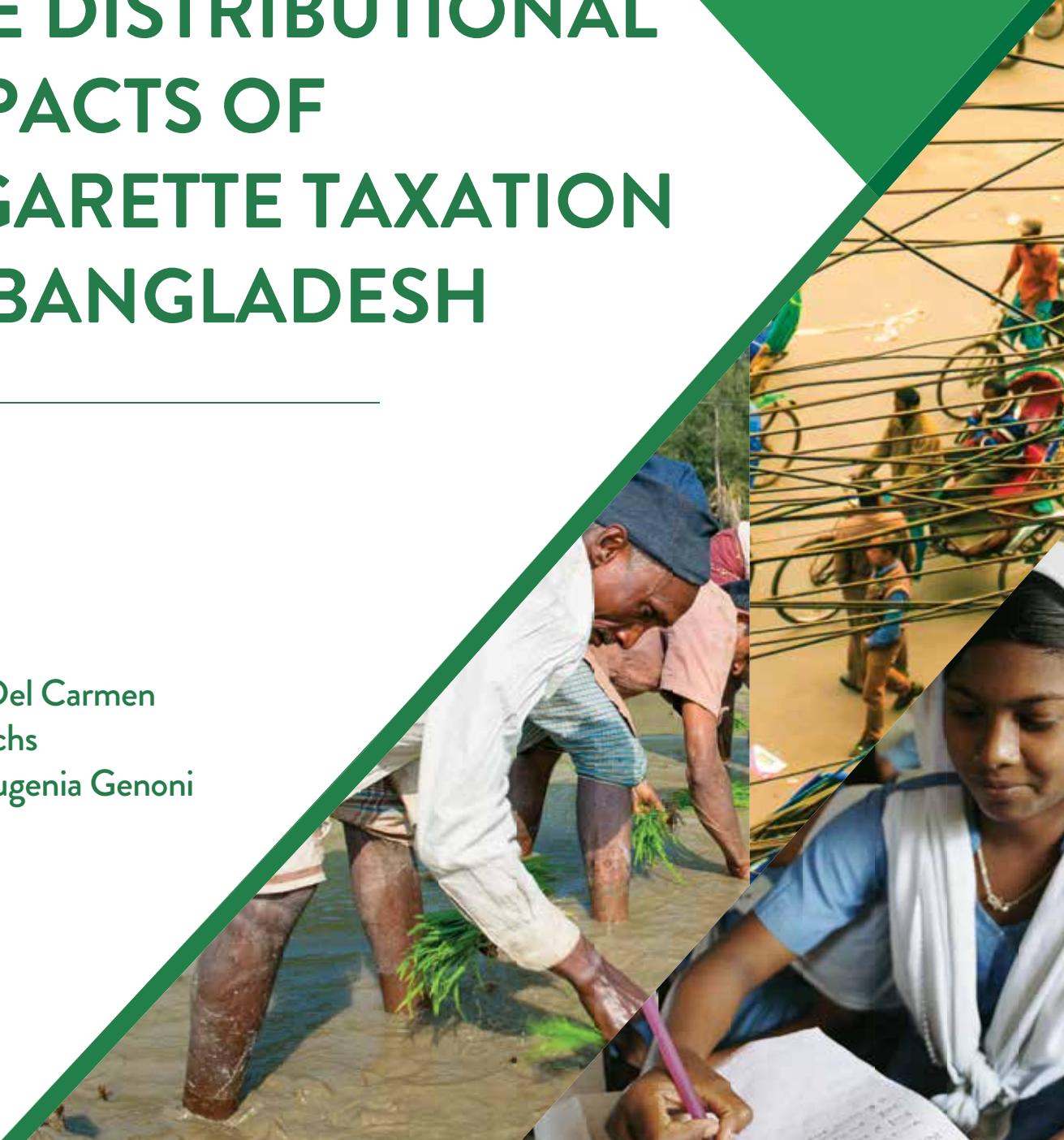




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ABSTRACT

Despite the obvious positive health impacts of tobacco taxation, an argument raised against it is that poor households bear the burden of the increased prices because of their higher share of spending on tobacco. This note includes estimates of the distributional impacts of price rises on cigarettes under various scenarios using the Household Income and Expenditure Survey (HIES) 2016/17. One contribution of this analysis is to quantify the impacts by allowing price elasticities to vary across consumption deciles. This shows that an increase in the price of cigarettes in Bangladesh has small consumption impacts and does not significantly change the poverty rate or consumption inequality. These findings stem from relatively even cigarette consumption patterns between less and more well-off households. These results hold even if one considers some small substitution through the use of bidis, which are largely consumed by the poor. The short-term consumption impacts are also negligible compared with the estimated gains because of savings in medical costs and the greater number of productive years of life.

JEL Codes: H23, H31, I18, O15

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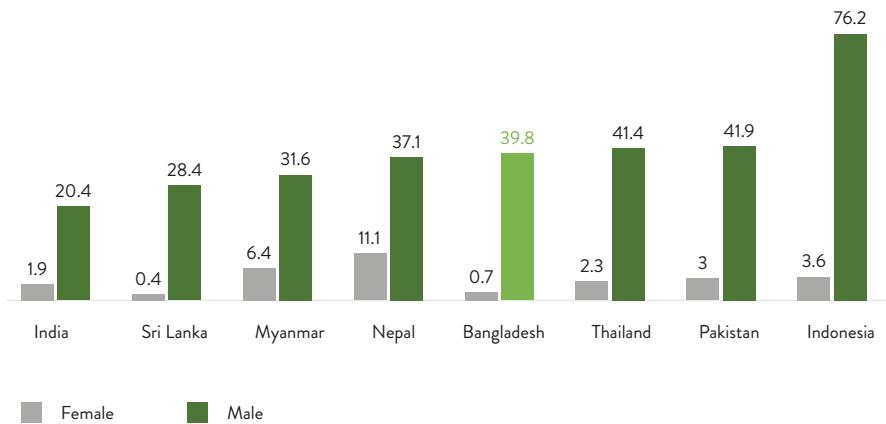
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1. INTRODUCTION

Bangladesh is one of the largest consumers of tobacco in the world. Approximately 4 in 10 adults (46 million adults) use some form of tobacco, whether smoked (for example, cigarettes and bidis) or smokeless (for instance, betel, betel nut, tobacco leaf, and so on).² Tobacco consumption in Bangladesh varies by gender. Men are significantly more likely than women to smoke (40 percent of men versus 1 percent of women above the age of 15).³ The prevalence of smokeless tobacco use is similar among men and women (about 30 percent).⁴ Smoking is widespread in Bangladesh, but comparable with the prevalence rates in other countries in the region (figure 1).

Figure 1. Prevalence of Smoking Any Tobacco Product, Individuals Ages ≥ 15 Years



Source: WHO 2015a.

Information on households from the Household Income and Expenditure Survey (HIES) 2016/17 confirms the high rates of tobacco consumption (both smoked and smokeless). In 2016, approximately 65 percent of households had consumed some type of tobacco product during the month previous to the interview. Comparing across time, the share of households consuming tobacco has been decreasing during the last decade. Using previous rounds of the HIES and comparable measures, one may see that the share of households consuming tobacco was 82 percent in 2005, 71 percent in 2010, and 68 percent in 2016. Yet, this has been accompanied by an increase in the share of households consuming cigarettes from about 23 percent in 2005 to 30 percent in 2016.

² Bidis are popular hand rolled tobacco products smoked in South Asia..

³ Note that the true smoking prevalence among women may be greater than estimated because evidence suggests that women (and those who proxy-respond for them in surveys) tend, for social reasons, to underreport risky behaviors..

⁴ Data on tobacco consumption vary in terms of coverage, period, and quality. These numbers come from the 2009 Global Adult Tobacco Survey Bangladesh.

The high rates of tobacco consumption in Bangladesh impose an increasing health and economic burden on the country. A 2004 epidemiological study found that 1.2 million tobacco-related illnesses and nearly 57,000 deaths attributable to smoking were reported each year (WHO 2007). More current information shows that approximately a quarter of all deaths among men ages 25–69 in Bangladesh are attributable to smoking (Alam et al. 2013). The overall economic cost of tobacco use has been estimated at Tk 110 billion (US\$1.85 billion) or over 3 percent of gross domestic product (GDP) (WHO 2007).

The government has undertaken efforts to tackle tobacco consumption. It was among the first to sign (June 2003) and ratify (June 2004) the World Health Organization's Framework Convention on Tobacco Control, the world's first public health treaty, which urged governments to adopt comprehensive policies to limit tobacco use. The country's participation in the framework convention has led to advances in tobacco control policy, in particular through the 2005 Smoking and Tobacco Usage Act. The new law restricted smoking in certain locations, though health care facilities, educational facilities, sport venues, and taxis were the only 100 percent smoke-free environments in Bangladesh at the time.⁵ Warning labels on cigarette packages and the limited advertising of tobacco products were also mandated as part of the 2005 law. According to the 2009 Global Adult Tobacco Survey and the International Tobacco Control Bangladesh Survey, tobacco consumption rose between 2009 and 2012, despite the government's actions to restrain it. Among the negatives of the Smoking and Tobacco Usage Act were the low levels of enforcement of non-tax measures, including the advertising ban and smoke-free public places, and relatively low levels of implementation of the warning labels. In April 2013, the National Assembly passed the Tobacco Control Law Amendment Bill and Rules to close many of these loopholes. A major contribution of the amendment was the requirement that packages contain pictorial warnings. In addition, smokeless tobacco was included under the definition of tobacco; restaurants and indoor workplaces were included among completely smoke-free environments; the fines for noncompliance were raised; advertisements at points of sale were banned; and the sale of tobacco to minors was prohibited.

Although tobacco taxation has been recognized as one of the most effective strategies to reduce smoking, the tobacco tax structure has helped make cigarette prices in Bangladesh among the lowest in the region and in the world despite some of the highest tax rates (table 1). There is a variety of taxes on tobacco products in Bangladesh. These include supplementary duties on cigarettes, bidis, and chewing and pipe tobacco, duties on imported tobacco products and on tobacco leaf, and a 15 percent value added tax on all tobacco products.⁶ Cigarettes are classed into four brand tiers, commonly known as

⁵ Smoking is also restricted in restaurants, bars, and workplaces. However, these offer designated smoking areas.

⁶ The value added tax is applied to the retail price.

slabs in Bangladesh, and the ad valorem excise tax rate is based on the administered retail price, which varies across these four price categories. However, the gaps between brands in the different tier categories create incentives for smokers to substitute less expensive brands in response to price increases and for manufacturers to position brands between price slabs to avoid paying higher taxes (ITC Project 2014). To minimize tax evasion, continuous tier structures were introduced in 2015, allowing brands to be set to a more well-defined tier. By 2017, the lower tier was divided into two new slabs: local brands and international brands. Since July 2017, cigarette excise tax rates have varied between 52 percent for the low-priced category and 65 percent for the premium tier.⁷ In addition, the tier structure has been gradually shifted toward unified rates. In 2010, the difference between the bottom and top tiers was 25 percentage points; by 2017, it had dropped to 12 percentage points.

Table 1. Cigarette Prices and Taxes, Bangladesh and Selected Countries

Country	Cigarettes		Bidi		Chewing Tobacco	
	Price	Taxes, % of retail price	Price	Taxes, % of retail price	Price	Taxes, % of retail price
India	9.2	43	0.65	20	-	-
Sri Lanka	19.6	62	-	-	-	-
Nepal	5.7	26	-	-	-	-
Bangladesh	3.4	77	0.41	23	1.35	54
Thailand	7.1	74	-	-	-	-
Pakistan	2.2	60	-	-	-	-
Indonesia	5.2	57	-	-	-	-

Source: WHO 2015b, 2017.

Note: The table shows the prices for the most widely sold brands in international purchasing power parity U.S. dollars. Cigarette prices are standardized to packs of 20. Bidi prices are standardized to 20 pieces. Chewing tobacco prices are standardized to 20 grams. Taxes are calculated for the most widely sold brands. For Bangladesh, the brand of cigarette reported in the 2017 WHO Report (for year 2016) was not the most widely sold brand. The price of the most widely sold brand was less than half of the price reported in the table.

Similarly, the taxes on bidis differentiate between filtered and unfiltered products. The taxes are estimated based on a predetermined tariff value per pack, not the retail price. The tax rate rose from 20 percent in 2011 to 30 percent in 2017 for nonfiltered bidis; for filtered bidis, it increased from 25 percent to 35 percent. This tariff-value-driven tax base

⁷The low-priced category was designed to protect cheaper domestic brands and poorer household consumers

actually reduces the effective rate of the supplementary duty and the value added tax. For instance, in 2011, the average retail price for a pack of 25 bidis was Tk 6.0, while the tariff value was Tk 3.2 and Tk 3.4 per pack for nonfiltered and filtered bidis, respectively (Ahmed 2012). Thus, the effective tax rate of the supplementary duty was reduced to 10.5 percent in 2011, not the established 20.0 percent. Bidi manufacturers in South Asia have avoided many of the local and international tobacco regulations and taxes enforced on factory-made cigarettes. Hence, bidis are sold cheaply at various prices and in packaging with poorly visible health warnings (Jha 2015; Kostova et al. 2014; Sankaran, Hillamo, and Glantz 2015). Duong et al. (2017) find that, even though bidis have significantly less tobacco content than cigarettes, they are at least as harmful as cigarettes in terms of cardiorespiratory health and mortality. Moreover, bidi smokers in South Asia are typically among the poorest and most vulnerable. In 2017, the minister of finance proposed eliminating the bidi tariff system and fix prices at Tk 15.0 per pack; nonetheless, parliament reduced the price to Tk 12.5.⁸

In sum, the current taxation system has neither discouraged consumption nor maximized revenue in Bangladesh. In the last decade, cigarette consumption, particularly the consumption of the cheaper brands, has expanded significantly. Since 2011, the volume in the low segment rose by an average of 26 percent, causing the market share to increase. Currently, the market share of the low segment accounts for nearly 77 percent of total volume, from 51 percent in fiscal year 2010–11; yet, it represents only 40 percent of the total revenue from cigarettes (World Bank 2017).

As the government considers tobacco-tax reform, particularly in the case of cigarettes, one argument that has been raised against the reform is that tobacco taxation is regressive because low-income households assign a larger share of their budgets to tobacco products. This note relies on information from the HIES 2016/2017 to (1) describe recent tobacco consumption patterns among households and (2) shed light on the distributional impacts of an increase in the price of cigarettes.

The study is structured as follows. Section 2 presents the data and some descriptive statistics. Section 3 describes the methodology. Sections 4 and 5 present the estimation results, and section 6 concludes

⁸ "Economy," *Morning News Flash*, July 2, 2017, Shanta Securities, Dhaka, Bangladesh, <http://print.thefinancialexpress-bd.com/2017/07/02/176701>.

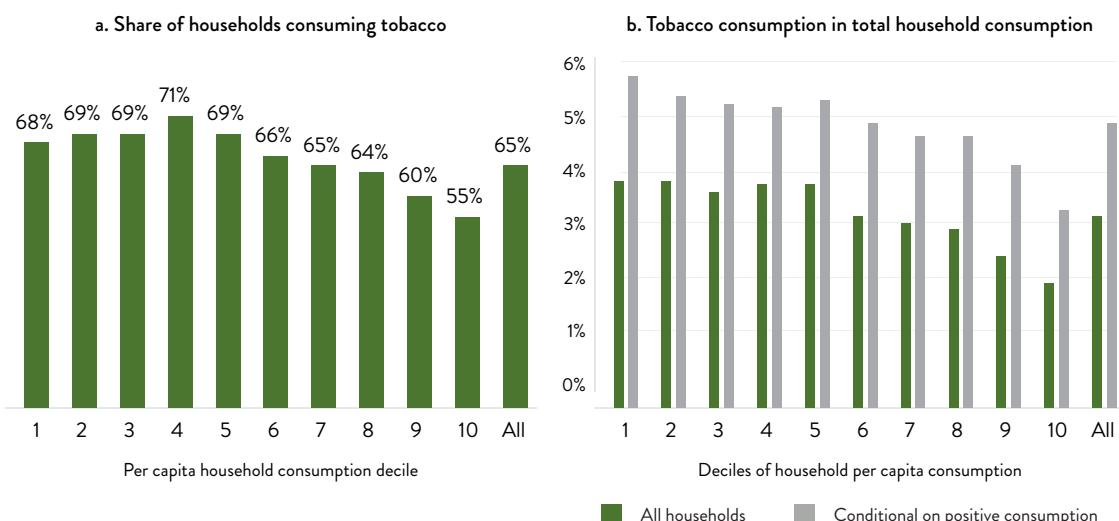
2. DATA

This paper relies on the HIES 2016/17, a comprehensive, nationally representative survey collected between April 2016 and March 2017. The survey involved interviews among 46,000 households and gathered detailed information about household expenditure patterns, including on various tobacco products. The survey allows households to be categorized into consumption deciles from the poorest to the richest, thus permitting the simulation of the distributional impacts of a potential reform.

Approximately 65 percent of households reported in the HIES 2016/17 that they consumed tobacco products; 42 percent consumed smoked tobacco; and 45 percent consumed smokeless tobacco products. Many households consume exclusively either smoked tobacco (21 percent) or smokeless tobacco products (23 percent). An average of about 3 percent of total household consumption is allocated to tobacco products.

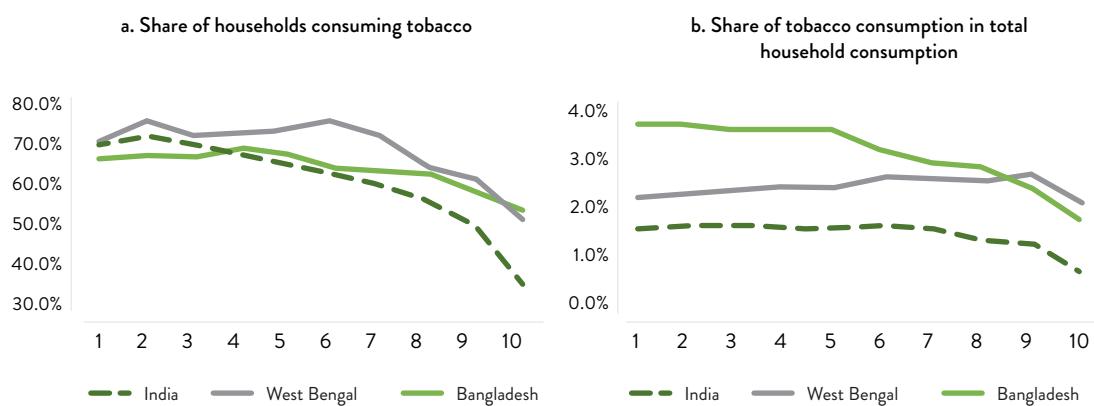
If one compares across consumption deciles (from the poorest 10 percent of households to the richest 10 percent), one finds that consumption patterns vary, though not dramatically (figure 2). The share of households consuming tobacco is not particularly different among the bottom 50 percent of the distribution, and it only declines slightly at higher consumption levels; across all deciles, more than one household in two consumes tobacco. Similarly, the share of tobacco expenditures in total consumption is 3.7 percent among the bottom 50 percent and about 3 percent among deciles 6–8, and it declines to 2 percent among the top decile.

Figure 2. Tobacco Consumption, by Per Capita Consumption Decile



To obtain a sense of how different the consumption patterns are relative to the patterns in other countries in the region, one may compare Bangladesh with India, a neighboring country with similar tobacco products, particularly bidis. Information from the India Consumption Expenditure Survey, 2011–12 reveals that the socioeconomic gradient for consuming tobacco is steeper in India than in Bangladesh (figure 3). Among the poorest deciles, the share of households consuming tobacco is similar, but, among the richest decile, a higher share of households consume tobacco in Bangladesh (55 percent) than in India (36 percent). The share of total consumption assigned to tobacco products is also substantially lower in India than in Bangladesh. However, similar to Bangladesh, there is a small gradient in the share of the budget assigned to tobacco products across deciles. These differences become smaller between Bangladesh and the state of West Bengal, highlighting the greater similarity of cultural and consumption patterns in the latter region of India.

Figure 3. Tobacco Consumption, by Per Capita Consumption Decile, Bangladesh, India, and West Bengal



Source: Calculations based on data of the Bangladesh HIES 2016/17 and the India National Sample Survey and Consumption Expenditure Survey, 2011–12.

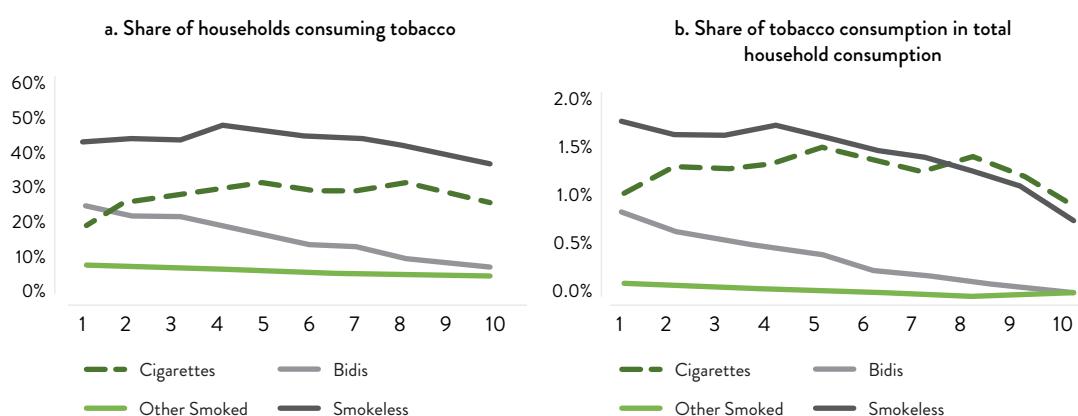
Note: Tobacco includes cigarettes, bidis, tobacco leaf, gul, betel leaf, betel nut, zorda, lime, khoer, rolled betel leaf, and other smoked or smokeless products. Consumption deciles are defined based on household consumption per capita. The consumption aggregate includes similar broad food and nonfood components; however, they may not be fully comparable due to the differences in survey design, data collection, and methodologies in computing the aggregate.

By type of product, one finds additional differences in consumption patterns across deciles (figure 4). The share of households consuming cigarettes is at 26–30 percent for almost the entire distribution, except the poorest decile, among which the share of households consuming cigarettes is significantly lower (19 percent). Meanwhile, bidi consumption clearly declines as household resources increase. While a quarter of the poorest households consume bidis, this is only true of 6 percent of the richest households. For smokeless products, consumption is similar, except among the top deciles. This is consistent with other studies describing the socioeconomic gradient in tobacco use; the gradient is not seen in cigarette consumption,

but is noticeable in the consumption of bidis and smokeless products (Barkat et al. 2012). On average, the consumption of smokeless products accounts for the largest share, 1.4 percent of the total household budget. Cigarettes follow at an average expenditure share of 1.3 percent. The cigarette budget share is even across the distribution.

The median quantity of cigarettes consumed was 152 a month per adult man age 15 years or older; the corresponding number of bidis was 348 per month per adult man (figure 5).⁹ Assuming daily smoking, this is equivalent to an average of 5 cigarettes and 12 bidis per adult man per day. These household figures are consistent with data on individuals from the Global Adult Tobacco Survey among adult men (Barkat et al. 2012). The poorest decile consumed about 30 fewer cigarettes per adult man relative to the richest decile (132 compared with 152 cigarettes per adult man per month). However, among deciles 4–10, the median quantities were similar. One may see the opposite pattern in the case of bidis, that is, the richest consume slightly fewer bidis.

Figure 4. Tobacco Consumption, by Type of Product and Per Capita Consumption Decile

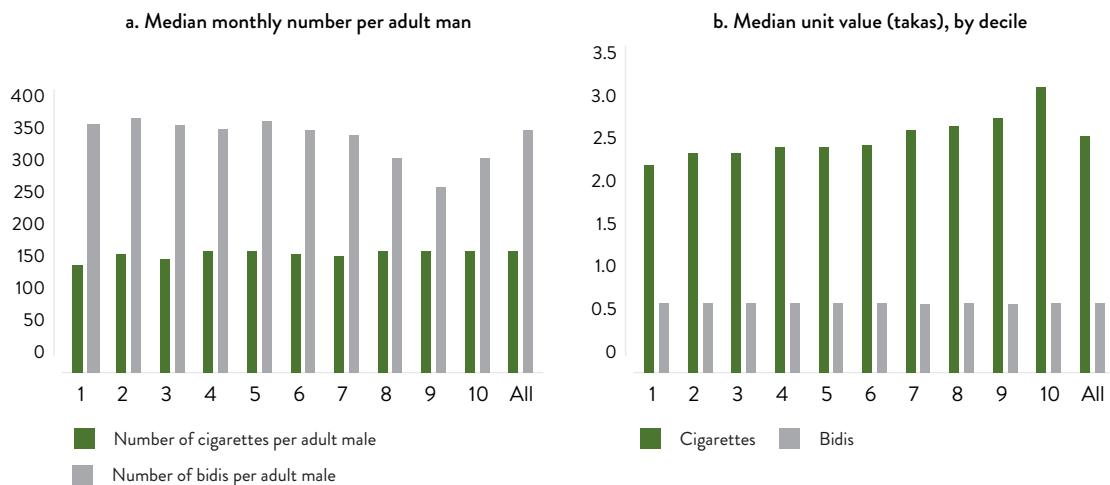


Source: Calculations based on data of the HIES 2016/17.

Note: Consumption deciles are defined based on household consumption per capita deflated spatially to control for differences in prices across areas

⁹The data do not allow the identification of the household members who are smoking; so, these results should be interpreted with care.

Figure 5. Quantities and Unit Values, Per Capita for Cigarette and Bidi Consumption, by Decile



Source: Calculations based on data of the HIES 2016/17.

Note: Consumption deciles are defined based on household consumption per capita deflated spatially to control for differences in prices across areas. Median unit values (per cigarette) are obtained by dividing the total amount consumed or total household budget allocated to purchase tobacco products by the number of units consumed.

The median cost was Tk 2.6 per cigarette and Tk 0.5 per bidi, which highlights the significantly lower cost of bidis.¹⁰ The median unit values for cigarettes align with the retail price for a 10-stick pack published by the National Board of Revenue, Ministry of Finance, Bangladesh. For 2016–17, the price for the low-tier was Tk 23 for 10-stick packs. Comparing unit values, one finds that there is a difference of Tk 1 per cigarette between the poorest and richest decile (Tk 2.2 versus Tk 3.2), while the unit values of bidis do not vary across the distribution.

One key takeaway from this description is that tobacco consumption is quite widespread across households in Bangladesh and that there is not a major difference in the budget shares spent on tobacco across the consumption distribution. Total tobacco consumption is quite similar across the bottom 80 percent of the population and only smaller among the richest 20 percent. In terms of cigarette consumption, only the poorest 10 percent (households in extreme poverty) tend to consume fewer cigarettes, yet spend a similar budget share relative to the richer deciles. The similarity in consumption patterns is important in assessing the distributional impacts of a potential tax reform.

¹⁰ This cost is the median of the unit values reported in the survey, which is obtained by dividing the total amount consumed or total household budget allocated to purchase tobacco products by the number of units consumed.

3. MEASURING THE DISTRIBUTIONAL IMPACT OF A PRICE RISE ON CIGARETTES

This section describes the partial equilibrium approach used to simulate the impact on welfare proxied by household consumption because of an increase in the price of cigarettes. This approach is used to evaluate the first-order effects of a change in prices. It relies mainly on household expenditure patterns. The focus is on the impacts of a rise in the price of cigarettes because this has been the focus of the potential reform of tobacco taxes.

To assess the distributional impact of the increase in the price of cigarettes, the simulation allows for differences in the responses across consumption deciles to reflect the fact that poor households likely have different price elasticities relative to households with more resources. The different elasticities, combined with the initial consumption patterns across deciles, explain whether a price reform will be more regressive, more neutral, or more progressive.

The loss of real consumption arising from the price increases in a product i is obtained as follows:

$$(\omega_{ij} + \Delta\omega_{ij}) * \frac{\Delta p_i}{p_{i,0}}, \quad (1)$$

where ω_{ij} is the share of product i in total household expenditure for a household in a decile j ; $p_{i,0}$ is the initial price; Δp_i is the price increase; and $\Delta\omega_{ij}$ is the change in the consumption of the good that depends on the price elasticity of the product.¹¹

To estimate the variation in cigarette consumption after the price increase, the model considers the change in prices (Δp_i), the tobacco price elasticity (ε_j) for decile j , and the share of cigarette expenditure in period 0 (ω_{ij}). The change in expenditure for each household in each decile is presented as a share of total expenditure and averaged by decile to quantify the overall impact, as follows:¹²

$$\Delta \text{Expenditure}_{i,j} = ((1 + \Delta P)(1 + \varepsilon_j * \Delta P) - 1) * \frac{\omega_{ij0}}{\text{Tot expenditure}_{j0}} \quad (2)$$

¹¹ For a detailed discussion of the methodology, see Coady et al. (2006); Kpodar (2006)..

¹² Another expression might be $\Delta \text{Expenditure} = \Delta C \Delta P + \Delta C_0 + \Delta P C_0$.

Cigarette price elasticities by decile

The literature on the demand elasticities to changes in the taxes on and prices of tobacco has largely focused on high-income countries. However, recent research also provides estimates for low- and middle-income countries. Behind the estimates is a variety of methodologies and data sources. However, the overall evidence suggests that the demand for tobacco products is more responsive to price in low- and middle-income countries than in high income countries. Table 2 summarizes selected examples.

Table 2. Tobacco Price Elasticities, Low- and Middle-Income Countries

Country	Price elasticities	Source
China	-0.50 to -0.64, cigarettes	Hu and Mao (2002)
Nepal	-0.88, cigarettes	Karki, Pant, and Pande (2003)
India	-0.35, cigarettes -0.91, bidis -0.88, leaf tobacco	John (2008)
	-1.03, cigarettes -0.94, bidis	Guindon et al. (2011)
	-0.83, the lowest income group; -0.26, the highest	Selvaraj, Srivastava, and Karan (2015)
Morocco	-0.51 to -0.73 short run, cigarettes -1.36 to -1.54 long run, cigarettes	Aloui (2003)
South Africa	-0.5 to -0.87	Boshoff (2006); Reekie (1994); van der Merwe and Annet (1998); van Walbeek (2000)
	-0.53 to -1.5 long-run price, tobacco elasticities -1.39 and -0.81, the poorest and richest income quartile, respectively	van Walbeek (2000), (2002)
Bangladesh	-0.27, cigarettes	Ali, Rahman, and Rahaman (2003)
	-0.5 short run, cigarettes -0.7 long run, cigarettes	Guindon, Perucic, and Boisclair (2003)
	-0.43 to -0.66, cigarettes -0.22 to 0.64, bidis	Nargis, Ruthbah, and Fong (2010); Nargis et al. (2014)
	-0.41 short run, cigarettes -0.57 long run, cigarettes	Barkat et al. (2012)
	-0.49, cigarettes (-0.75, the poorest group; -0.40, the medium group; -0.36, the richest group based on the housing index)	Nargis et al. (2014)

Few studies attempt to obtain elasticity estimates across income groups. On Bangladesh, Nargis et al. (2014) estimate total price elasticities of demand using data from wave 1 (2009) and wave 2 (2010) of the International Tobacco Control Bangladesh Survey. They find that the price elasticity of cigarette consumption is higher among people of lower socio-economic status based on a housing index (-0.75 for the poorest group, -0.40 for the medium group, and -0.36 for the richest group). A similar pattern is found in India and South Africa.

In countries with a variety of tobacco products, the impact of changes in cigarette prices also depends on the potential substitution by other tobacco products. In the case of Bangladesh, it may be important to assess the potential substitution of bidis, which are also smoked, are significantly cheaper, and are widely consumed by the poor. Anecdotal evidence and cultural features suggest that, once a person starts smoking cigarettes, they will not go back to consuming bidis. Although this may be true among the large majority, there is limited evidence of the extent of this substitution across consumption deciles, particularly among extreme poor households. To complement the existing price elasticity estimates, price elasticities for cigarettes and other tobacco products across consumption deciles are estimated using the HIES 2016/17. Specifically, a system of demands is estimated using a quadratic almost ideal demand system (AIDS) (Banks, Blundell, and Lewbel 1997; Deaton and Muellbauer 1980; Mas-Colell, Whinston, and Green 1995). For trackability, the focus is on estimating a set of demands for five tobacco products (cigarettes, bidis, betel leaf, betel nut, and rolled betel leaf). A few products that are consumed by fewer than 4 percent of households are not included (tobacco leaf, gul, and other smoked tobacco, khoer, lime, and other smokeless products). The models incorporate a set of demographic controls, as well as a control for urban and rural location.

To estimate the demand system and the price elasticities, one needs information about the prices of the various tobacco products. However, disaggregated data on prices to estimate the elasticities are not available. The HIES 2016/17 unit values obtained by dividing the total values reported by quantities may be used to infer information about prices. As Deaton (1997) points out, unit values not only capture information about prices, but are also affected by household choices on quality. In addition, unit values are measured with errors because they involve a calculation based on a ratio between values and quantities. Partially to address this concern, median values are calculated for the unit values across districts separated by urban and rural areas. This exploits the fact that the survey is representative across districts and provides a reasonable number of observations to calculate the median values.¹³

¹³ In the cases where the number of observations was less than 30, the medians of the full districts are used.

The quadratic AIDS estimates indicate that the price elasticity for cigarettes is -1.3 . Comparing across deciles, one finds, similar to previous research results, that the elasticities are larger among the poorest (-1.36 for the first decile and -1.23 for the richest deciles). The average price elasticity for bidis is -1.22 , and there is not a clear gradient across deciles.

The quadratic AIDS own-price elasticities are higher than those estimated in the literature on Bangladesh. One disadvantage of this approach is that the elasticities are estimated using a cross-section with information on household consumption. In addition, this approach does not rely on time variation in prices to identify the elasticities. Another caveat derives from the use of unit values as the source of price information. However, one advantage of this approach is that it models simultaneously the demand for various tobacco products and also considers cross-price effects in the impact analysis. By jointly modeling the demand for various tobacco products, one considers responses for a larger population (65 percent of households consuming tobacco), compared with the more restricted population of cigarette consumers (29 percent).¹⁴ This also explains why the estimated own-price elasticities are higher than in other studies: this estimation captures variations across households that do not include cigarette smokers. In this sense, the estimates are more closely aligned with estimates produced using models that attempt to measure longer-term elasticities, such as those of Aloui (2003) for Morocco and van Walbeek (2002) in South Africa (table 2). Yet, the estimates are still higher than those previously generated on Bangladesh; these elasticities are thus used as an upper bound in the analysis.

In terms of cross-price elasticities, there is limited evidence for comparison. John (2008) finds evidence that bidis and cigarettes are complements rather than substitutes in India and that most cross-price elasticities across tobacco products are statistically insignificant. Guindon et al. (2011) find that poor and rural households in India substitute bidis for cigarettes, while richer households tend to consume them together as complements. Elasticity estimates based on HIES data also point to small cross-price elasticities. The cross-price elasticities for cigarettes and bidis are about 10 percent and show almost no variation across deciles. This is consistent with the anecdotal evidence indicating that, culturally, there is not much substitution back to bidis from cigarettes, but that, among some households, there may be a small switch back to bidis if cigarette prices rise substantially.¹⁵

Table 3 summarizes the elasticity estimates across deciles used in the simulations. Three scenarios are compared. The first scenario assumes that households do not respond to the changes in prices, which implies a zero-price elasticity for cigarettes. The second scenario

¹⁴The approach still conditions the sample on households that consume some form of tobacco. This exclusion would downward bias the estimated elasticities.

¹⁵The HIES does not allow consumption to be separated by the type of cigarettes. Therefore, we cannot estimate cross-price elasticities by cigarette brands. This is a drawback of the analysis, as there has been significant downward switching to low-tier cigarette brands in the last decade, suggesting substitution of cheaper cigarette brands for expensive ones.

relies on estimates produced by Nargis et al. (2014) using individual data from wave 1 (2009) and wave 2 (2010) of the International Tobacco Control Bangladesh Survey. The last scenario relies on the quadratic AIDS model based on HIES 2016/17 that considers cross-price effects between cigarettes and bidis.

Table 3. Quadratic AIDS Own-Price Elasticity Estimates, by Decile

Decile	Cigarettes	Cigarettes	Scenario 3: Quadratic AIDS model ^a			
			Cigarettes	Cross-elasticity bidis/cigarettes	Bidis	Cross-elasticity bidis/cigarettes
1.00	0.00	-0.75	-1.36	-0.11	-1.14	0.04
2.00	0.00	-0.75	-1.33	-0.11	-1.26	0.10
3.00	0.00	-0.75	-1.33	-0.10	-1.18	0.07
4.00	0.00	-0.52	-1.29	-0.09	-1.26	0.10
5.00	0.00	-0.40	-1.33	-0.11	-1.19	0.08
6.00	0.00	-0.40	-1.27	-0.08	-1.18	0.07
7.00	0.00	-0.39	-1.24	-0.07	-1.21	0.11
8.00	0.00	-0.36	-1.25	-0.08	-1.18	0.08
9.00	0.00	-0.36	-1.25	-0.08	-1.27	0.10
10.00	0.00	-0.36	-1.23	-0.08	-1.29	0.20
Average	0.00	-0.50	-1.29	-0.09	-1.22	0.10

Note: Consumption deciles are defined based on household consumption per capita deflated spatially to control for differences in prices across areas. The regressions control for household demographics and urban or rural location. The prices are approximated by the median unit values in a district across rural or urban areas.

a. Calculations based on data of the HIES 2016/17.

The three scenarios provide upper- and lower-bound estimates of the impacts of a change in the price of cigarettes. Using these bounds allows one to assess the sensitivity of the results to errors in the estimation of the elasticity. Even though the model presented here is not dynamic, another way to motivate the bound analysis is to think about shorter- and longer-term responses from the short-run impact without response to a higher-response, longer-term impact.

4. DISTRIBUTIONAL IMPACTS OF A CIGARETTE PRICE INCREASE

This section summarizes the results at three levels of cigarette price increases: 25 percent, 50 percent, and 75 percent. These price changes reflect several types of tax reforms that could include eliminating the existing tiered structure and introducing a uniform, specific excise tax. Discussing specific changes in the tax structure and rates is outside the scope of this note.

Consumption changes that arise from an increase in cigarette prices are estimated for each decile based on the three elasticity scenarios presented in table 3: (1) the nonresponse case, in which price elasticities are assumed to be zero; (2) the medium-response scenario, in which the average elasticities of Nargis et al. (2014) are used; and (3) the high-response scenario in which quadratic AIDS elasticities are used that are greater than –1 and include changes in consumption arising because of changes in the consumption of bidis.

The results of the simulations are summarized in table 4. They measure the average percentage change in household consumption deriving from the price change, by decile.¹⁶ In an extreme scenario where there is no response to the price increase (complete pass-through), the impact across deciles is small. Assuming a price change of 50 percent, the estimated loss arising from a rise in household expenditures would be –0.5 percent for the first and richest deciles. If one allows for some level of response (the medium scenario) for a price change of 50 percent, one finds that the bottom deciles experience a loss of –0.4 percent, compared with –0.2 percent among the richest decile. In the high-response scenario, the impact translates into a gain because households reduce their cigarette consumption more than proportionately. For instance, at a 50 percent price increase, the gain for the poorest decile is 0.5 percent, compared with 0.4 percent for the top decile.

¹⁶ All simulations assume no changes in the consumption of nontobacco items.

Table 4. Simulations of a Price Increase on Cigarettes

<i>percentage change in consumption</i>									
	25% cigarette price increase			50% cigarette price increase			75% cigarette price increase		
Decile	Complete pass-through	Medium	High	Complete pass-through	Medium	High	Complete pass-through	Medium	High
1	-0.3	-0.2	0.2	-0.5	-0.4	0.5	-0.8	-0.6	1.0
2	-0.3	-0.2	0.2	-0.7	-0.5	0.6	-1.0	-0.7	1.2
3	-0.3	-0.2	0.2	-0.7	-0.5	0.6	-1.0	-0.7	1.2
4	-0.3	-0.2	0.2	-0.7	-0.4	0.6	-1.0	-0.5	1.3
5	-0.4	-0.2	0.2	-0.8	-0.3	0.7	-1.1	-0.5	1.5
6	-0.3	-0.1	0.2	-0.7	-0.3	0.6	-1.0	-0.4	1.2
7	-0.3	-0.1	0.2	-0.6	-0.2	0.5	-1.0	-0.4	1.1
8	-0.4	-0.1	0.2	-0.7	-0.3	0.6	-1.1	-0.4	1.2
9	-0.3	-0.1	0.2	-0.6	-0.2	0.5	-0.9	-0.3	1.1
10	-0.2	-0.1	0.1	-0.5	-0.2	0.4	-0.7	-0.3	0.8

The impacts on consumption presented in table 4 suggest that the magnitude of the direct impact is small. Even in an extreme case where consumers do not change their levels of consumption of cigarettes and prices increase by 75 percent, the average loss in consumption does not exceed 1.1 percent of total consumption. Table 5 summarizes the impacts in terms of the national upper poverty rate and consumption inequality measured by the Gini coefficient. Overall, there is no statistically significant impact on these indicators.

Table 5. Changes in Poverty and Inequality

		Upper poverty rate	Gini coefficient
Baseline		24.3%	0.31
25% cigarette price increase	Complete pass-through	24.6%	0.31
	Medium	24.5%	0.31
	High	24.1%	0.31
50% cigarette price increase	Complete pass-through	24.8%	0.31
	Medium	24.7%	0.31
	High	23.8%	0.30
75% cigarette price increase	Complete pass-through	25.0%	0.31
	Medium	24.8%	0.31
	High	23.4%	0.30

5. ADDING THE HEALTH IMPACTS OF A CIGARETTE PRICE INCREASE INTO THE EQUATION

The simulations presented so far focus on the direct impact of an increase in cigarette taxes on consumption. However, by reducing tobacco consumption, tobacco taxation can also generate longer-term monetary gains because of the improved health of the population. A large body of literature has documented the economic gains associated with reduced tobacco consumption and a healthier population. This section attempts to monetize some of these gains across deciles to highlight that the monetary impacts of a healthier population largely exceed the direct impacts on consumption. The focus is on two types of gains. First, the savings because of reduced medical costs are considered. The most recent comprehensive estimates of the economic cost of smoking in Bangladesh refer to 2004 (WHO 2007). According to these estimates, the annual direct health care cost attributable to tobacco-related illnesses was Tk 50.9 billion (approximately US\$990 million in 2016 prices).

Second, the income gains derived from the increased number of working years are considered. Verguet et al. (2015) analyze the health effects of a price increase in China and conclude that a 50 percent rise in prices would result in 231 million life years gained over 50 years and would have a significant impact among the poor. Pichón-Riviere et al. (2014) estimate that tobacco use in Chile would reduce life expectancy by nearly 4.0 years among women and 4.3 years among men. Alam et al. (2013) estimate that deaths among men ages 25 to 69 years result in an average loss of seven years of life per smoker in Bangladesh. Estimates using data on 2016 indicate approximately 3 million total years of life lost because of premature mortality attributable to smoking.¹⁷

Table 6 summarizes back-of-the-envelope estimates of the savings in medical expenses and gains in consumption arising from the increase in working years across consumption deciles. The savings are monetized to represent a percentage change in household consumption. The methodology is presented in Fuchs and Meneses (2017, 2018). For medical costs, the exercise distributes the total cost directly attributed to tobacco illnesses across deciles based on the share of tobacco consumers in each consumption decile. To estimate

¹⁷ GBD Results Tool (database), Global Burden of Disease Study 2016, Global Health Data Exchange, Institute for Health Metrics and Evaluation, Seattle, <http://ghdx.healthdata.org/gbd-results-tool>.

the increase in working years, the years of life lost because of smoking are distributed across deciles proportionately to the number of households that smoke tobacco. Subsequently, the income gain is approximated by increasing consumption proportionally to the number of working years gained and averaged across deciles.

Table 6. Simulations Adding Savings in Medical Costs and Increases in Income Because of More Working Years

<i>Percentage change in consumption, increase of 25% in the price of cigarettes</i>									
	<i>Medium elasticity</i>				<i>High elasticity</i>				
Decile	Consumption effect	Savings in medical costs	Gains due to more working days	Total effect	Consumption effect	Savings in medical costs	Gains due to more working days	Total effect	
1	-0.2	0.5	2.7	3.0	0.2	0.8	5.0	5.9	
2	-0.2	0.4	3.8	3.9	0.2	0.6	6.7	7.6	
3	-0.2	0.3	4.2	4.3	0.2	0.6	7.4	8.2	
4	-0.2	0.2	3.1	3.2	0.2	0.5	7.8	8.5	
5	-0.2	0.1	2.8	2.8	0.2	0.5	9.2	9.9	
6	-0.1	0.1	2.7	2.6	0.2	0.4	8.4	9.0	
7	-0.1	0.1	2.7	2.6	0.2	0.3	8.6	9.1	
8	-0.1	0.1	2.8	2.7	0.2	0.3	9.7	10.1	
9	-0.1	0.1	2.7	2.6	0.2	0.2	9.3	9.7	
10	-0.1	0.0	2.5	2.4	0.1	0.1	8.5	8.8	

The results show that, compared with the direct consumption effects, the gains in health associated with reduced cigarette consumption in response to a price increase are substantially larger in magnitude. The main gains arise from the increased years of life, which translate into more years working. In a scenario of a 25 percent price increase and medium elasticity, these gains are about 3 percent of consumption. The highest direct consumption losses occur in a scenario with high response and a 75 percent price increase. The increased number of productive years because of a 25 percent rise in the price of cigarettes is on the order of 20 times larger than the direct consumption impacts in a medium-response scenario and

45 times larger in a higher-response scenario. These results are useful in highlighting that the short-term losses because of tobacco taxes are much smaller in order of magnitude than the economic benefits because of better health.

Yet, these estimates must be interpreted with care because they are subject to several caveats. First, the estimate of medical costs was calculated 14 years ago and therefore may not reflect the current situation. Second, the estimates are based on a series of assumptions about access to medical care by the population (for example, that 25 percent of people experiencing a disease caused by tobacco would seek inpatient care) and focus on only eight tobacco-related diseases. Third, the previous simulations centered on cigarette consumption, while the medical costs are calculated for all tobacco products. Finally, the simulations are not able to model individual behavioral responses to increases in tobacco prices and do not consider smoking histories; they only rely on differences in the share of households consuming cigarettes by decile and the different price elasticities.

The health benefits of reducing tobacco consumption presented in table 6 accrue only from complete abstinence, which would be reflected in a reduction in smoking prevalence and number of smokers. However, the elasticities estimated here include both the effect on smoking prevalence and the effect on cigarettes smoked per day among continuing smokers. The epidemiological evidence indicates that continuing smokers do not experience tangible health gains in terms of avoiding diseases or gains in life years. To address this concern, the literature has generally used only the effect on smoking prevalence, which is broadly half the total price elasticity according to the literature (IARC 2011). Even if one reduced the price responses by half, the estimates are significantly larger than the direct impacts in consumption.

6. CONCLUSION

Despite the obvious positive health impacts of tobacco taxation, an argument raised against taxation is that poor households bear much of the burden of the increased prices because they spend more on tobacco. This note summarizes estimates of the distributional impact of increases in the prices of cigarettes based on a partial equilibrium approach using the HIES 2016/17.

The note highlights that tobacco consumption is widespread across households in Bangladesh. In 2016, approximately 65 percent of Bangladeshi households had consumed some type of tobacco product during the month before the interview; 42 percent had consumed smoked tobacco; and 45 percent had consumed smokeless tobacco products. About 29 percent of households consumed cigarettes. The poorest 10 percent (households in extreme poverty) were less likely to consume cigarettes (19 percent).

There is little difference in the budget shares spent on tobacco across the consumption distribution. About 3 percent of total household consumption was allocated to tobacco products. Focusing on cigarettes, the budget share is similar across the consumption distribution (1.3 percent on average). The similarity of consumption patterns is important in assessing the distributional impacts of a potential tax reform.

Overall, this note shows that an increase in the price of cigarettes has small consumption impacts and does not significantly change the poverty rate or consumption inequality. These results stem from the fact that poor households are slightly less likely to consume cigarettes and that cigarette budget shares are relatively even across the consumption distribution.

Assuming an extreme case whereby households do not change their cigarette consumption because of an increase in cigarette prices (complete pass-through), there are small impacts in terms of consumption, poverty, and inequality. For instance, in a scenario in which prices increase by 50 percent, the average consumption loss would be 0.6 percent and similar across deciles. The official upper poverty rate would increase slightly, but this increase is not statistically significant. There is also no impact on consumption inequality measured using the Gini.

Assuming households reduce cigarette consumption because of higher prices, the impacts become even smaller. Indeed, in a high-response scenario in which elasticities are larger than -1 and include some substitution by bidis, the impacts translate into gains because households reduce their consumption of cigarettes more than proportionately. In this

upper-bound case, poverty would fall by about a half percentage point, but the change is not statistically significant. There are no changes in consumption inequality.

The short-term consumption impacts are also small compared with the estimated gains because of savings in medical costs and the greater number of productive years of life. In particular, the increased number of productive years associated with a 25 percent rise in the price of cigarettes is on the order of 20 times more than the direct consumption impacts in a medium-response scenario and 45 times more in a higher-response scenario.

The results presented focus on changes in the price of cigarettes. The link with a specific reform and revenue impacts is outside the scope of this paper and will be addressed in future research. A reform in cigarette taxation that has been advocated by partner organizations for tobacco control would involve (1) the introduction of a specific excise tax replacing the current ad valorem system with a mixed system (a mix of ad valorem and specific excise taxes), (2) greater reliance on specific excise taxes, and (3) a gradual transition to a uniform structure.

This reform implies a greater increase in price for low-tier brands, which are largely consumed by low-income smokers. This argument has been used in Bangladesh against the reform and in favor of the persistence of the multitiered tax structure. However, the HIES does not identify the type of cigarettes smoked by households so that one might directly address this concern. Nonetheless, the results presented here highlight that tobacco taxation is likely to have a small impact on overall consumption and poverty, even if, in some scenarios, the relative impact could be greater among poorer consumers because of the greater consumption of lower-tier cigarettes. This is the result of the combination of the smaller share of poor households consuming cigarettes and the higher response of these households to the change in prices.

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ANNEX 1 – ESTIMATION OF QUADRATIC AIDS ELASTICITIES

We consider a set of consumer demands for a set of k tobacco products and ingredients for which the consumer has budgeted Tk m . Specifically, the k goods include cigarettes, bidis, betel leaf, betel nut, and rolled betel leaf. A few products that are consumed by fewer than 4 percent of households are not included (tobacco leaf, gul, and other smoked tobacco, khoer, lime, and other smokeless products).

The quadratic AIDS model of Banks, Blundell, and Lewbel (1997) is based on an indirect utility function that leads to a system of demands expressed in expenditure shares.

Let q_i denote the quantity of good i consumed by a household; p_i the price of good i ; and $w_i = \frac{p_i q_i}{m}$, the expenditure share for good i :

$$w_i = \alpha_i + \sum_{j=1}^k \gamma_{ij} \ln p_j + \beta_i \ln \left\{ \frac{m}{a(p)} \right\} + \frac{\lambda_i}{b(p)} \left[\ln \left\{ \frac{m}{a(p)} \right\} \right]^2 \quad \text{for } i=1\dots k \quad (\text{A1.1})$$

where $\ln a(p)$ is

$$\ln a(p) = \alpha_0 + \sum_{i=1}^k \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^k \sum_{j=1}^k \gamma_{ij} \ln p_i \ln p_j \quad (\text{A1.2})$$

and $b(p)$ is the Cobb-Douglas price aggregator:

$$b(p) = \prod_{i=1}^k p_i^{\beta_i} \quad (\text{A1.3})$$

All lowercase Greek letters are parameters to be estimated, except α_0 , which is set to slightly less than the lowest value of $\ln m$, in this case 1.5.

The set of expenditure share equations is estimated using the command quails in Stata (Poi 2012). As part of the model, some demographic controls are incorporated, including household size; the number of men ages more than 15; the age, gender, religion, and educational attainment of the household head, and whether the household is in a rural or urban area. The results are robust to the inclusion of additional demographic and geographic controls. After the parameters are estimated, the quails postestimation commands allow the estimation of own-price and cross-price elasticities for all goods and different population groups. Uncompensated price elasticities are estimated for individual observations in the data and are summarized by decile using the household survey weights.

Table A1 presents the estimated coefficients from which the elasticities presented in table 3 have been calculated.

Table A1. Quadratic AIDS model

Number of observations	29,971					
Number of demographics	7					
Alpha_0	1.5					
Log-likelihood	16517					
	Coeffi- cient	Standard Error	z	P> z	[95% Conf. Interval]	
Alpha						
Cigarettes	-0.19	0.03	-5.57	0.00	-0.25	-0.12
Bidis	-0.03	0.03	-1.02	0.31	-0.08	0.03
Betel leaf	0.09	0.02	5.41	0.00	0.06	0.13
Betel nut	0.18	0.02	12.13	0.00	0.15	0.21
Rolled betel leaf	0.94	0.04	22.92	0.00	0.86	1.02
Beta						
Cigarettes	0.16	0.01	20.18	0.00	0.15	0.18
Bidis	0.16	0.01	20.78	0.00	0.14	0.17
Betel leaf	-0.08	0.01	-14.30	0.00	-0.09	-0.07
Betel nut	-0.06	0.00	-13.19	0.00	-0.07	-0.05
Rolled betel leaf	-0.18	0.01	-21.97	0.00	-0.20	-0.16
Gamma						
Cigarettes-cigarettes	-0.15	0.01	-16.62	0.00	-0.17	-0.13
Bidis - cigarettes	0.00	0.01	0.60	0.55	-0.01	0.02
Betel leaf - cigarettes	0.03	0.00	7.06	0.00	0.02	0.03
Betel nut - cigarettes	0.00	0.00	1.21	0.23	0.00	0.01
Rolled betel leaf - cigarettes	0.12	0.01	15.13	0.00	0.10	0.13
Bidis-bidis	-0.10	0.01	-14.63	0.00	-0.11	-0.09
Betel leaf - bidis	0.01	0.00	1.94	0.05	0.00	0.01
Betel nut - bidis	0.03	0.00	9.93	0.00	0.02	0.03

Gamma (continued)						
Rolled betel leaf - bidis	0.06	0.01	9.74	0.00	0.05	0.08
Betel leaf- betel leaf	-0.04	0.00	-16.76	0.00	-0.05	-0.04
Betel nut- betel leaf	-0.03	0.00	-15.46	0.00	-0.04	-0.03
Rolled betel leaf- betel leaf	0.05	0.00	12.54	0.00	0.04	0.05
Betel nut- betel nut	0.00	0.00	-1.48	0.14	-0.01	0.00
Betel nut- Rolled betel leaf	0.00	0.00	1.14	0.25	0.00	0.01
Rolled betel leaf- Rolled betel leaf	-0.23	0.01	-20.30	0.00	-0.25	-0.21
Lambda						
Cigarettes	0.01	0.00	10.62	0.00	0.01	0.01
Bidis	-0.02	0.00	-17.03	0.00	-0.02	-0.01
Betel leaf	-0.01	0.00	-17.07	0.00	-0.01	-0.01
Betel nut	-0.01	0.00	-15.02	0.00	-0.01	-0.01
Rolled betel leaf	0.02	0.00	27.54	0.00	0.02	0.02
Eta						
Cigarettes: Household size	-0.01	0.00	-8.99	0.00	-0.01	-0.01
Bidis: Household size	0.00	0.00	4.38	0.00	0.00	0.00
Betel leaf: Household size	0.01	0.00	11.46	0.00	0.00	0.01
Betel nut: Household size	0.00	0.00	11.95	0.00	0.00	0.01
Rolled betel leaf: Household size	0.00	0.00	-8.95	0.00	-0.01	0.00
Cigarettes: Number of males 15+	0.01	0.00	4.23	0.00	0.00	0.01
Bidis: Number of males 15+	0.00	0.00	-2.54	0.01	-0.01	0.00
Betel leaf: Number of males 15+	0.00	0.00	-4.43	0.00	-0.01	0.00
Betel nut: Number of males 15+	0.00	0.00	-4.17	0.00	0.00	0.00
Rolled betel leaf: Number of males 15+	0.00	0.00	2.59	0.01	0.00	0.00
Cigarettes: Education of household head	0.00	0.00	12.34	0.00	0.00	0.01
Bidis: Education of household head	0.00	0.00	-20.28	0.00	-0.01	0.00

Eta (continued)						
Betel leaf: Education of household head	0.00	0.00	-2.44	0.02	0.00	0.00
Betel nut: Education of household head	0.00	0.00	-4.17	0.00	0.00	0.00
Rolled betel leaf: Education of household head	0.00	0.00	7.09	0.00	0.00	0.00
Cigarettes: Gender of household head	-0.05	0.00	-11.49	0.00	-0.05	-0.04
Bidis: Gender of household head	-0.02	0.00	-6.29	0.00	-0.03	-0.02
Betel leaf: Gender of household head	0.06	0.00	20.66	0.00	0.05	0.07
Betel nut: Gender of household head	0.05	0.00	21.45	0.00	0.05	0.06
Rolled betel leaf: Gender of household head	-0.04	0.00	-13.69	0.00	-0.05	-0.04
Cigarettes: Age of household head	0.00	0.00	-16.71	0.00	0.00	0.00
Bidis: Age of household head	0.00	0.00	9.10	0.00	0.00	0.00
Betel leaf: Age of household head	0.00	0.00	22.21	0.00	0.00	0.00
Betel nut: Age of household head	0.00	0.00	20.07	0.00	0.00	0.00
Rolled betel leaf: Age of household head	0.00	0.00	-19.88	0.00	0.00	0.00
Cigarettes: Religion of household head	0.00	0.00	0.59	0.55	0.00	0.01
Bidis: Religion of household head	0.00	0.00	1.92	0.06	0.00	0.01
Betel leaf: Religion of household head	-0.01	0.00	-5.66	0.00	-0.01	0.00
Betel nut: Religion of household head	0.00	0.00	-3.34	0.00	-0.01	0.00
Rolled betel leaf: Religion of household head	0.01	0.00	4.62	0.00	0.00	0.01
Cigarettes: Urban/rural household	0.06	0.00	14.74	0.00	0.05	0.06
Bidis: Urban/rural household	-0.04	0.00	-17.70	0.00	-0.04	-0.03
Betel leaf: Urban/rural household	-0.02	0.00	-12.74	0.00	-0.02	-0.02

Eta (continued)						
Betel nut: Urban/rural household	-0.02	0.00	-14.38	0.00	-0.02	-0.02
Rolled betel leaf: Urban/rural household	0.02	0.00	14.78	0.00	0.02	0.03
Rho						
Household size	0.03	0.03	1.09	0.28	-0.02	0.08
Number of males 15+	0.12	0.06	1.84	0.07	-0.01	0.24
Education of household head	0.11	0.02	5.52	0.00	0.07	0.15
Gender of household head	0.34	0.13	2.61	0.01	0.08	0.59
Age of household head	0.01	0.00	2.68	0.01	0.00	0.01
Religion of household head	-0.21	0.06	-3.73	0.00	-0.32	-0.10
Urban/rural household	0.21	0.11	1.94	0.05	0.00	0.43

Source: Calculations using data from HIES 2016/17.

