THE FISCAL AND HEALTH IMPACT OF INCREASES IN THE TOBACCO TAX IN NIGERIA

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Summary
This paper follows on from a previous working paper (ICTD_WP99), on the likely impact of a change in the excise tax in Nigeria. Recent change in the policy environment necessitated the revaluation and estimation of the impact of excise tax on the Nigerian tobacco industry. In this current paper, we present a tobacco excise tax simulation model (TETSiM) for Nigeria, which incorporates the most recent tax and price changes. Other than presenting the standard economic consequences of a change in the excise tax, the model has an epidemiological module which estimates the number of premature tobacco-related deaths avoided through the interventions. We modelled four different policy interventions and compare the outcomes of the four different tax scenarios to the base scenario for prices, consumption, industry revenue, and tax revenue. We find that (1) increase in the excise tax is a win-win situation for the fiscus and for public health; (2) an increase in the excise tax increases tobacco tax revenue and decreases cigarette consumption; (3) a decrease in cigarette consumption decreases the number of deaths attributable to tobacco; and (4) the larger the increase in the excise tax, the greater will be its fiscal and public health impact. Based on the findings of this paper, we recommend larger increase in the excise tax in order to achieve significant public health and economic benefits.

Keywords: tobacco taxation, tax modelling, Nigeria, Africa.

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Abbreviations

CIF cost, insurance and freight
CISS Comprehensive Import Supervision Scheme
ECOWAS Economic Community of West African States
ETLS ECOWAS Trade Liberalisation Scheme
FCTC Framework Convention on Tobacco Control [WHO]
FOB free on board
GDP gross domestic product
NOT net-of-tax
TETSiM Tobacco Excise Tax Simulation Model

1. Introduction

The detrimental health consequences of tobacco use have been recorded over many decades. The Royal College of Physicians' report in 1962, followed by the US Surgeon-General's report in 1964, established a causal relationship between tobacco use and lung cancer [1, 2]. Since these seminal studies, thousands of scientific studies have established that smoking is not only bad for the lungs, but has a detrimental impact on nearly all organs in the body [3].

In response to the reports by the College of Physicians and the Surgeon General, many governments, especially in high-income countries, have implemented measures to discourage the uptake and use of tobacco products. These interventions include smoke-free policies, counter-advertising, warning labels on cigarette packs, the banning of tobacco advertising, promotion and sponsorship (TAPS), and, since 2012, plain packaging. Studies have shown that these interventions reduce the attraction of tobacco, and discourage its uptake [4-7]. However, the single most effective intervention is an increase in the excise tax on cigarettes [8]. Tax increases which increase the retail price of cigarettes make cigarettes less affordable, discourage their use, and improve health outcomes. As well as decreasing tobacco use, an increase in the excise tax increases government revenue.

In 2003, after three years of negotiation and an even longer period of preparation, the World Health Assembly unanimously adopted the WHO Framework Convention on Tobacco Control (FCTC) [9]. The FCTC recognises that the tobacco epidemic, which is responsible for 8 million premature deaths each year, is a global problem and requires a global response [9]. The FCTC came into force in February 2005 and has been ratified by 180 countries and the European Union. Nigeria ratified the FCTC in October 2005. By ratifying the FCTC, Nigeria committed itself to adopt evidence-based policies, as described in the FCTC, to reduce tobacco use.

In 2014 the Conference of the Parties adopted the Article 6 Guidelines to the FCTC [10]. Article 6 of the FCTC encourages Parties to use appropriate tax and price measures to reduce tobacco use. The Guidelines provide additional information to Parties about a number of aspects related to the implementation of the tax, the tax structure, and the proposed level of the tax. In particular, the Guidelines cite the 2010 WHO Technical Manual, wherein the WHO recommends that tobacco excise taxes should account for at least 70% of the retail prices for tobacco products [11]. For many countries, and in many studies, this percentage has been the target for setting the excise tax level.

This study is based on the Tobacco Excise Tax Simulation Model (TETSiM), developed at the Research Unit on the Economics of Excisable Products (REEP) at the University of Cape Town [12]. A previous version of the model and the simulation results was published as a working paper in July 2019 by the International Centre for Tax and Development (ICTD), authored by Precious Akanonu, Joseph Ishaku and Chukwuka Onyekwena, with input by members of the REEP team [13]. This paper updates some of the results and focuses more on the health outcomes.

2. The situation in Nigeria

In an international context, the smoking prevalence in Nigeria is not high. Smoking prevalence estimates differ, but, according to the 2020 *Tobacco Atlas*, about 13.7% of males and 0.6% of women in Nigeria smoked [14]. That equates to about 7.1 million males and 400 000 females. Another 2 million Nigerian adults used smokeless tobacco, particularly nasal snuff.

According to the 2020 *Tobacco Atlas*, more than 16 000 premature deaths are attributable to tobacco [14]. That equates to about 246 men and 64 women per week. Despite the fact that the smoking prevalence among men is more than 15 times as high as among women, women are over-represented

among tobacco-related premature deaths because they are much more exposed to second-hand tobacco smoke.

The challenge for Nigeria, as for many other African countries, is to keep the prevalence low, and, if possible, to reduce it further. Nigeria, like many African countries, has a young and rapidly growing population. Youth are more vulnerable to the marketing efforts of the tobacco industry. The rapid growth in average incomes means that large sections of the population have the means to purchase tobacco products. Furthermore, in contrast to many high-income countries, the regulatory environment in which the tobacco industry operates is relatively weak. The tobacco industry exploits this.

Nigeria, together with Kenya and South Africa, is one of British American Tobacco's manufacturing hubs in Africa. That creates investment and employment opportunities, but it also makes Nigerian society and government vulnerable to exploitation and economic blackmail by the tobacco industry.

Nigeria is part of the Economic Community of West African States (ECOWAS). Previously, the ECOWAS Directive on tobacco taxation prescribed that its members impose an ad valorem excise tax of between 15% and 100% of the cost, insurance and freight (CIF) value of imported products and the same percentage on the ex-factory value of domestically produced products [15]. In December 2017, the ECOWAS members adopted a new Tobacco Tax Directive [16]. The new directive increased the minimum ad valorem rate, from 15% to 50%, and removed the maximum rate. More importantly, the Directive introduced a specific component to the excise tax, initially at 0.40 USD per pack of 20 cigarettes. This change brings the ECOWAS members' excise tax structures more in line with the best practice structures proposed by the FCTC Article 6 Guidelines.

According to tax data given in the WHO's 2019 Global report on the Tobacco Epidemic, Nigeria does not follow the ECOWAS directives fully [17]. The ad valorem excise tax in 2020 was still at 20%, substantially short of the Guideline minimum of 50%. The specific excise tax was increased from 20 naira per pack in 2018, to 40 naira in 2019 and to 58 naira in 2020 [18]. The specific component of the excise tax in Nigeria is in line with the ECOWAS Directive.

3. The TETSiM model

The ICTD working paper describes the TETSiM model in detail, including the technical details [13]. The technical details are not repeated here, although in the following paragraphs we provide a non-technical review of the model.

Basically, the TETSiM model describes the tobacco market in the base period, and then allows the user to change the tax rate and a number of parameters to see how the market is likely to change. The important parameters at the outset are the retail price, consumption, and the excise tax structure and the associated values. The model can account for different market segments. In the case of Nigeria, five market segments were defined, namely premium, mid-price, and economy cigarettes (all domestically produced), imported cigarettes, and illicit cigarettes.

The TETSiM model focuses on the economic aspects of the tax change. This was the focus of the ICTD working paper. Given that effect of the tax change goes beyond economic aspect, a module of the model, which considers the health implications of the tax change was introduced in this study. Two approaches, both based on rules of thumb, but with strong empirical support, are used.

The first approach considers the relationship between the quantity of cigarettes smoked and the number of deaths. Jha (2020) estimated that, in the US and Canada, every million cigarettes smoked

was associated with one tobacco-related death[19]. In the UK about 1.3 tobacco-related deaths were associated with every million cigarettes smoked.

According to the 2020 *Tobacco Atlas*, per capita consumption of cigarettes in Nigeria was 163 cigarettes per year [14]. Given an adult population of 107 million, this implies an annual consumption of 17.4 billion cigarettes. Global Data, a different source of data, estimates the annual consumption at about 18.4 billion cigarettes [20]. Based on the Tobacco Atlas's estimate that 16 100 smokers die annually from tobacco related diseases, this implies that a million cigarettes smoked is associated with approximately 0.9 premature tobacco-related deaths (16 100/18 400). This mortality impact is fairly similar to that found for the US and Canada by Jha (2020) [19], but lower than for the UK.

This relatively low mortality impact for Nigeria is likely to increase in future. The reason is that there are several years, even decades, between when people start smoking and when they start dying from tobacco-related diseases. Compared to the US, UK and Canada, tobacco use in Nigeria is new. If, hypothetically, nobody smokes cigarettes at a certain time, and suddenly people start smoking in substantial numbers, the mortality effect might not be felt for quite a few decades. As people age, they will become more likely to succumb to tobacco-related diseases, pushing up the mortality rate. The size of the future mortality impact is open to debate, but it seems reasonable to suspect that it will be substantially higher than 0.9 deaths per million cigarettes smoked. The first reason is that the smoking population is aging, based on the argument presented above. The second reason is that, because the smoking intensity (i.e. the average number of cigarettes smoked per smoker) in Nigeria is less than the smoking intensity in the US, UK and Canada, a greater number of smokers are required to smoke a million cigarettes, and thus a greater number run the risk of dying from a tobacco-related disease.

The rule of thumb explained here allows one to estimate the immediate impact of a decrease in cigarette consumption. For example, if aggregate cigarette consumption decreases by 100 million cigarettes between last year and this year because of some intervention, and we assume one tobacco-related death for each million cigarettes smoked, the rule of thumb suggests that 100 premature deaths will be prevented this year. If the intervention permanently decreases cigarette consumption by 100 million cigarettes, then it will prevent 100 premature deaths each year for many years, even decades. As far as we can determine, the literature does not indicate an appropriate number of years (and it may differ from one country to another), but a reasonable number would probably be between 30 and 40 years, i.e. the difference between the life expectancy of ex-smokers and the median age when people started smoking.

The second approach is based more explicitly on smoking prevalence. The epidemiological literature indicates that the number of years that people smoke is a much better predictor of morbidity and mortality than the number of cigarettes that they smoke. For example, if person A smokes 5 cigarettes a day for 40 years and person B smokes 20 cigarettes a day for 10 years, they have both smoked the same number of cigarettes over their smoking "careers". However, person A runs a substantially higher risk of tobacco-related morbidity and mortality than person B. In fact, the intensity of smoking is not a particularly good predictor of a person getting a smoking-related disease, whereas the length of smoking is a much better predictor. Thus, when smokers quit smoking, they experience a much better health outcome than smokers who simply reduce their daily consumption.

A reduction in total cigarette consumption implies a combination of a reduction in smoking prevalence (i.e. the number of people who smoke) and a reduction in the smoking intensity (i.e. the number of cigarettes smoked by continuing smokers). The quitters get the real health benefit, while the health benefit for the smokers who simply reduce their consumption is very small.

It is generally accepted that approximately half of smokers will die prematurely because of smoking-related diseases [21, 22]. Smokers who quit smoking will not avoid all tobacco-related mortality, because not all the damage can be undone. However, quitters face a substantially lower risk of premature death and disability than continuing smokers (subject, of course, to age and/or whether they have already contracted a smoking-related disease). In order to account for this reduced, but not disappearing, risk, the user of the TETSiM model can set a parameter which indicates the probability of premature death for smokers who have quit. This fraction will, by necessity, be less than 0.5. Quitters (as a group) cannot have a higher mortality rate than continuing smokers. If the fraction is set at zero, it means that quitters have zero probability of dying from a tobacco-related disease (and are thus like never-smokers), which is unrealistic. In previous modelling exercises, we have typically set the fraction at 0.25 or 0.33, suggesting that people who quit still have a 25% or 33% probability of dying prematurely, because of the damage that has been done. However, in Nigeria, with its relatively young population, and thus younger cohort of smokers, this proportion is likely to be smaller, say 0.2. The user can set this percentage in the model.

In contrast to the first approach, the number of premature deaths avoided by the tobacco-control intervention is not determined in a particular year, but over the lifetime of the cohort of smokers who are affected by it. For example, if an intervention reduces the smoking prevalence by one percentage point, then that means that there will be 1.07 million fewer smokers in Nigeria (given that there are 107 million adults in Nigeria). Of these 1.07 million people, about half (i.e. 503 500) would have died prematurely from a tobacco-related disease. The other half is "lucky". Of the 503 500 ex-smokers who would have died prematurely, some will die prematurely in any case, because of the harm that has been done over an extended period. If we assume that this is 20% for Nigeria, it means that 20% of the 1.07 million, i.e. 214 000, will die prematurely, but that 289 500 (= 503 500 – 240 000) premature deaths will be averted. These averted premature statistical deaths will happen over the full lifetime of the cohort of quitters. This module of the model does not indicate *when* these premature statistical deaths are averted, other than that they are averted.

It is important to note that the "epidemiological" module of the TETSiM model is a fairly rough, population-based addition to the model. It is user driven (in that the user sets the parameters). It does not claim to compete with finely-grained and calibrated models like the SimSmoke model [23, 24]. However, we trust that it will provide some indications as to the likely public health implications of an increase in the excise tax.

3.1 The model parameters and modelling scenarios

Many of these parameters used in this model are "fixed", and are informed by published studies, and the experience and intuition of the model developers. The "fixed" parameters include the price and income elasticities, and the parameters linking consumption with health outcomes. These parameters typically do not change over time, and if they do, they typically change very slowly. Some inputs are time-dependent. These include the total adult population, smoking prevalence, per capita GDP, retail prices, and the composition of the market.

For this report, the TETSiM for Nigeria has been reprogrammed. The model is different in appearance from the version used in the ICTD Working Paper, the underlying logic is the same. The attached Excel spreadsheet has three sheets. The values in the "Inputs" sheet are entered by the user. The base scenario considers the situation in 2020. It considers five different price segments (domestic premium, domestic mid-price, domestic economy, imported, and illicit). For each of these five segments, the retail price is decomposed into *tax components* and *net-of-tax components*. The tax components include the import duty, Comprehensive Import Supervision Scheme (CISS) duty, ECOWAS Trade Liberalisation Scheme (ETLS) duty, specific and ad valorem excise taxes, and VAT. The *net-of-tax*

components are the CIF value (for imported cigarettes) and the ex-works value (for domestically produced cigarettes) and the "margin". The margin is a catch-all concept that includes distribution costs, wholesale and retail margins, and profits by the manufacturer and other service providers along the value chain).

The input sheet also requires the user to set the parameters, and to impose different hypothesised excise tax structures and levels. For example, the user can set different values for the specific and the ad valorem taxes. The model allows the user to look simultaneously at four different scenarios. It also allows the user to pre-empt the tobacco industry's responses to the tax changes, and to include these in the model. For example, the user can change the CIF or ex-works amount, or the magnitude of the margin. Experience from other countries has shown that, where a company has significant market power, as is the case with British American Tobacco in Nigeria, the industry often increases the retail price by more than the increase in the excise tax, in order to make up for the loss of sales volume. This is called "overshifting". The user can include this industry behaviour in the model by increasing the margin.

The first output sheet considers the financial implications of the changes in the input variables which are effected by the user in the "Inputs" sheet. The user should not make any adjustments in the "Outputs" sheet, because all the values presented there are calculations, based on the inputs in the "Inputs" sheet. The first part of the Output sheet considers the per-cigarette price analysis, first for the base scenario and then for the four different tax scenarios. The second part of the Output sheet considers the revenue aspects, both for the industry (i.e. looking at the net-of tax aspects of the price of cigarettes) and for the government (i.e. looking at the tax aspects of the price of cigarettes). This section again starts with a base scenario, followed by four different tax scenarios. The third part of the output sheet considers the percentage changes in the most important variables, and compares the outcomes of the four different tax scenarios to the base scenario for prices, consumption, industry revenue, and tax revenue.

The second output sheet considers the epidemiological impact of the four interventions. The variable of interest is the number of premature deaths avoided. As discussed previously, two methodologies, using quite different assumptions, are used.

Table 1 below indicates the assumptions and data used for the Input sheet, focusing on the five different market segments. Table 2 below tabulates the generic (i.e. not segment specific) inputs, as well as the epidemiological inputs.

Table 1: Base scenario inputs, by market segment

	Measurement	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit
Retail price	Naira per pack	400	300	200	180	150
CIF value	Naira per pack	80	80	80	80	80
Import duty (incl. surcharge)	Perc. of CIF value				21.4%	
CISS	Perc. of CIF value				1.0%	
ETLS	Perc. of CIF value				0.5%	
VAT	Perc. of retail excl. VAT	7.5%	7.5%	7.5%	7.5%	
Specific excise tax	Naira per pack	58	58	58	58	
Ad valorem excise tax	Perc. of CIF value	20.0%	20.0%	20.0%	20.0%	
Price elasticity of demand	Number	-0.3	-0.4	-0.6	-0.5	-0.9
Income elasticity of demand	Number	0.8	0.6	0.3	0.5	-0.5
Market share	Percentage	36%	10%	20%	24%	10%

Table 2: General and epidemiological inputs

General inputs		
Population aged 15 and older	Millions	107
Smoking prevalence	Percentage of adult (15+) population	5.60%
Cigarette consumption in 2020	Million sticks	18400
Percentage of premature deaths saved by quitting	Percentage	25%
GDP growth	Percentage	2.50%
Epidemiological inputs		
Percentage of decrease in cigarette use attributable to decrease in average consumption per smoker	Percentage	50%
Percentage of smokers that die prematurely (from smoking-related disease)	Percentage	40%
Percentage of quitters that die from smoking-related disease	Percentage	20%
Number of people that die from smoking-related disease for each million cigarettes smoked	Number	1.2

For the different tax scenarios, we assume in all four cases that the ad valorem tax increases from 20% to 50% of the CIF or ex-works value, in line with the ECOWAS directive. International best practice and

the FCTC Article 6 Guidelines clearly indicate that increasing the specific component in a mixed system is the appropriate (best practice) approach to increase the excise tax burden on cigarette products. Thus, for each of the four tax scenarios, we increase the specific tax amount from the current level of 58 naira per pack to (1) 80 naira per pack, (2) 120 naira per pack, (3) 180 naira per pack and (4) 240 naira per pack. This does not apply to illicit cigarettes, of course, as they avoid tax altogether.

We also assume that the tobacco industry increases the CIF or ex-works amount by 10% and the margin by 10% across all five market segments, and in each of the four scenarios. It is possible and even likely that the tobacco industry may adopt a different pricing strategy for the different market segments. Experience from Mauritius (Berthet Valdois *et al.*, 2019) and Cabo Verde (Van Walbeek *et al.*, 2020) shows that the tobacco industry is more likely to overshift the excise tax on the more expensive products, and more likely to undershift the excise tax on the cheaper products. These changes can be made by the user; however, the impact of different pricing strategies by the tobacco industry are not analysed in this paper.

4. Results

4.1 The economic consequences of increases in the excise tax

The Excel file is an integral part of the analysis and should be read in conjunction with this report. As an example of the results, as they are presented in the Excel file, we show the decomposition of the price of a pack of cigarettes in the base period in Table 3. All the values are derived (or taken directly) from the Input sheet. The balancing number is the *margin*, which, as discussed previously, is the sum of the distribution costs, overheads, wholesale and retail margins, and the profit earned by the manufacturer and the other companies in the value chain.

Table 3: Per-pack decomposition of the retail price of cigarettes in the baseline scenario, by market segment

Baseline scenario

Per pack analysis (Naira per pack)	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit	Weighted average
CIF/ex works value	80.00	80.00	80.00	80.00	80.00	80.00
Import duty (including surcharge)	0.00	0.00	0.00	17.12	0.00	4.11
CISS value	0.00	0.00	0.00	0.80	0.00	0.19
ETLS value	0.00	0.00	0.00	0.40	0.00	0.10
Excise tax (ad valorem)	16.00	16.00	16.00	16.00	0.00	14.40
Excise tax (specific)	58.00	58.00	58.00	58.00	0.00	52.20
Margin	218.09	125.07	32.05	-4.88	70.00	103.26
VAT value	27.91	20.93	13.95	12.56	0.00	17.94
Retail price	400.00	300.00	200.00	180.00	150.00	272.20
Consumption (millions of sticks)	6624	1840	3680	4416	1840	18400
Excise tax burden	18.5%	24.7%	37.0%	41.1%	0.0%	29.3%
Total tax burden	25.5%	31.6%	44.0%	58.3%	0.0%	39.0%

The results are self-explanatory. Note that the weighted average of the excise tax burden and total tax burden are calculated on the volume of legal cigarettes only. For the weighted averages of the other components, the numbers include the illicit market.

This information is used to perform an aggregate analysis of both industry and government revenue in the baseline. To estimate the aggregate value of a particular value, the appropriate per-pack component of the price is multiplied by the quantity. The analysis is done separately for the five market segments, and the revenue numbers are added together to give the total revenue for that specific cost/tax/value category. See Table 4.

Table 4: Aggregate expenditure on cigarettes, industry revenue and government revenue, by market segment, in the baseline scenario

Baseline scenario	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit	Total
Industry revenue (billion naira)						
CIF/ex works revenue	26.5	7.4	14.7	17.7	7.4	73.6
Margin amount	72.2	11.5	5.9	-1.1	6.4	95.0
Total	98.7	18.9	20.6	16.6	13.8	168.6
Government revenue (billion naira)						
Import duty	0.0	0.0	0.0	3.8	0.0	3.8
CISS amount	0.0	0.0	0.0	0.2	0.0	0.2
ETLS amount	0.0	0.0	0.0	0.1	0.0	0.1
Excise tax (ad valorem)	5.3	1.5	2.9	3.5	0.0	13.2
Excise tax (specific)	19.2	5.3	10.7	12.8	0.0	48.0
VAT amount	9.2	1.9	2.6	2.8	0.0	16.5
Total	33.8	8.7	16.2	23.2	0.0	81.8
Total expenditure	132.5	27.6	36.8	39.7	13.8	250.4

The total industry revenue in the baseline is estimated at 168.6 billion naira, with the contributions of the five different segments as shown. Total government revenue (from all types of tax listed here) is 81.8 billion naira. The total expenditure of 250.4 billion naira is the sum of the industry (net-of-tax) and the government (tax) revenues.

If the indicated tax revenue numbers closely reflect the actual revenues collected by the Nigerian government from the various tobacco taxes, one can conclude that the model accurately describes the reality. When this report was written we did not have access to the actual revenue numbers with which to compare the simulated numbers produced by the TETSiM model. It is possible that the actual revenue numbers are lower than the numbers given here. There could be a variety of reasons for this, including errors in the base data (e.g. that the cigarette market is smaller than the numbers indicated in the Input sheet), or (more likely) inefficiencies in the collection of the taxes. It is possible that the tax might not be collected, even though it is due, or that it is collected, but somehow gets pilfered along the way. Large differences between the simulated tax revenues and actual tax revenues should raise an alarm with the tax authorities.

We are not in a position to discuss the efficiency of the tax collection authority, because we do not have the appropriate data for such an analysis. However, even if there are substantial discrepancies between the predicted and actual revenues, the model can still be useful, because the impact of the tax interventions is presented in percentage changes, as we show below (see Table 7). If the level of

tax collection efficiency is low, but does not become worse as a result of the implementation of the proposed tax reforms, then the percentage changes (in tax revenues) will be roughly accurate. If the tax collection efficiency improves, then the percentage increases in revenue will be even higher than presented here. If the tax collection efficiency becomes worse as the taxes are increased, then the predicted increases in revenue will overstate the actual increases.

With the baseline scenario established, the next step is to impose the change in the excise tax. As an example, we show the per-pack decomposition of the price of cigarettes in scenario 3. In the Excel spreadsheet, the per-pack decomposition is shown for the other scenarios as well. In scenario 3 we hypothesise that the specific excise tax has increased to 180 naira per pack, and the ad valorem component has increased to 50% of the CIF or ex-works value. As discussed previously, we assume that the tobacco industry increases the CIF or ex-works value by 10% across all market segments (including the illicit sector), and that it increases the margin by 10%, across all market segments (including the illicit sector). The results of the per-pack analysis are shown in Table 5.

Table 5: Per-pack decomposition of the retail price of cigarettes in scenario 3, by market segment

Per pack analysis (Naira per pack)	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit	Total/ average
CIF/ex works value	88.00	88.00	88.00	88.00	88.00	88.00
Import duty (including surcharge)	0.00	0.00	0.00	18.83	0.00	4.52
CISS value	0.00	0.00	0.00	0.88	0.00	0.21
ETLS value	0.00	0.00	0.00	0.44	0.00	0.11
Excise tax (ad valorem)	44.00	44.00	44.00	44.00	0.00	39.60
Excise tax (specific)	180.00	180.00	180.00	180.00	0.00	162.00
Margin	239.90	137.58	35.25	-5.37	77.00	113.58
VAT value	41.39	33.72	26.04	24.51	0.00	29.36
Retail price	593.30	483.30	373.30	351.30	165.00	437.39
Consumption (millions of sticks)	6011	1548	2569	3230	1668	15026
Excise tax burden	37.8%	46.3%	60.0%	63.8%	0.0%	49.3%
Total tax burden	44.7%	53.3%	67.0%	76.5%	0.0%	57.7%

Comparing Table 3 with Table 5 indicates that the CIF or ex-works value has increased from 80 naira to 88 naira per pack, based on the assumption that the tobacco industry increases the CIF/ex-works value by 10%. The ad valorem excise tax has increased from 16 naira (20% of 80 naira) to 44 naira (50% of 88 naira), and the specific excise tax has increased from 58 naira to 180 naira per pack, by assumption. The VAT amount per pack of cigarettes is larger for all legal market segments, because the VAT is levied on all net-of-tax and tax components, most (or all) of which have increased. The retail price is higher for all market segments, but the percentage change differs for the various market segments (the percentage change in the price is not shown).

Unsurprisingly, the predicted consumption has decreased across all five segments, including the illicit segment. The latter finding is based on the assumption that, when the price of legal cigarettes increased, the producers of illicit cigarettes took advantage of the situation by increasing the price of illicit cigarettes as well. The latter assumption is supported by economic theory, since producers of a product (in this case illicit cigarettes) have an incentive to raise their prices when the prices of substitutes (in this case legal cigarettes) increase. However, if the users of the model feel that this does not describe the situation in Nigeria, then they can change that assumption and keep the price

of illicit cigarettes the same as they were in the baseline scenario. The magnitude of the decrease in consumption in each of the market segments is determined by four factors: (1) the magnitude of the price increase, (2) the value of the price elasticity for that market segment, (3) the GDP growth rate (as a proxy for the change in average household income), and (4) the income elasticity of demand for that market segment. The formula that calculates the new level of consumption incorporates all four these factors. Other than the third determinant (i.e. the GDP growth rate) each market segment has different values for each of these factors.

Again unsurprisingly, the excise tax burden and the total tax burden are substantially higher in this scenario than in the baseline scenario. The excise tax burden for the cheaper cigarettes is higher than for the more expensive cigarettes, because the numerator is roughly similar for each of the market segments, but the denominators are larger for the more expensive cigarettes and smaller for the cheaper cigarettes.

However, despite the more than 200% increase in the excise tax assumed in this scenario, the average excise tax burden (i.e. the excise tax as a percentage of the retail price) is still very far off the goal set by the WHO (of 70% of the retail price). In fact, it averages only about 50%. While a 200% increase in the excise tax may sound like a lot, the fact of the matter is that the current excise tax of 58 naira, together with the small ad valorem excise tax, is so low that even apparently large percentage increases in the excise tax are quite limited in their impact on the price and the excise tax burden.

In Table 6 we recalculate the revenue components for scenario 3. The revenues take cognizance of the reduced quantity and the higher per-pack tax and net-of-tax components.

Table 6: Aggregate expenditure on cigarettes, industry revenue and government revenue, by market segment, in scenario 3

Scenario 3	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit	Total
Industry revenue (billion naira)						
CIF/ex works revenue	26.4	6.8	11.3	14.2	7.3	66.1
Margin amount	72.1	10.6	4.5	-0.9	6.4	92.8
Total	98.6	17.5	15.8	13.3	13.8	158.9
Government revenue (billion naira)						
Import duty	0.0	0.0	0.0	3.0	0.0	3.0
CISS amount	0.0	0.0	0.0	0.1	0.0	0.1
ETLS amount	0.0	0.0	0.0	0.1	0.0	0.1
Excise tax (ad valorem)	13.2	3.4	5.7	7.1	0.0	29.4
Excise tax (specific)	54.1	13.9	23.1	29.1	0.0	120.2
VAT amount	12.4	2.6	3.3	4.0	0.0	22.4
Total	79.8	19.9	32.1	43.4	0.0	175.2
Total expenditure	178.3	37.4	48.0	56.7	13.8	334.2

Based on our assumptions, the government has been able to increase its revenue substantially at the expense of the tobacco industry. Whereas total industry revenue was 168.6 billion naira in the baseline scenario, this has decreased to 158.9 billion naira after the tax change. Government revenue,

on the other hand, has increased from 81.8 billion naira to 175.2 billion naira, and total expenditure on cigarettes has increased from 250.4 billion naira in the baseline scenario to 334.2 billion naira in the simulation. From a government revenue perspective, the tax increase has been very successful.

The previous analysis considered one tax scenario only, i.e. where the specific excise tax was increased to 180 naira per pack and where the ad valorem excise tax was increased to 50% of the CIF/ex-works value. The results for the economic impact of all four tax scenarios are summarised in Table 7. In each case the simulated value of the relevant variable is compared with the value in the baseline scenario. We show the five price segments, but the focus should be on the total cigarette market, shown in the last column. The impact of the tax increases (and the associated industry price responses) are shown for the following variables:

(1) industry revenue (which is the sum of the CIF or ex-works value and the margin),
(2) excise tax revenue (which is the sum of the specific and ad valorem excise taxes),
(3) total tobacco tax revenue (which is the sum of the excise tax, the import duty, other import levies, and VAT),
(4) cigarette consumption, and
(5) cigarette price (a weighted average of all price segments, including the illicit market).

Table 7: Percentage change in relevant variables for four different tax scenarios

	Domestic premium	Domestic mid-price	Domestic economy	Imported	Illicit	Total
Industry revenue						
Scenario 1	5.9%	2.1%	-6.5%	-4.2%	-0.3%	2.4%
Scenario 2	3.2%	-2.2%	-14.4%	-11.5%	-0.3%	-1.3%
Scenario 3	-0.2%	-7.5%	-23.2%	-19.5%	-0.3%	-5.7%
Scenario 4	-3.1%	-11.7%	-29.7%	-25.4%	-0.3%	-9.3%
Government revenue						
Excise revenue (ad val. and specific)						
Scenario 1	61.3%	55.5%	42.4%	45.9%		52.3%
Scenario 2	108.0%	97.0%	72.5%	78.3%		91.0%
Scenario 3	174.7%	154.6%	111.3%	121.4%		144.2%
Scenario 4	238.1%	208.0%	145.3%	160.2%		193.4%
All tobacco tax revenue						
Scenario 1	49.1%	46.8%	37.8%	33.8%		42.3%
Scenario 2	85.0%	81.0%	64.2%	56.6%		72.4%
Scenario 3	136.3%	128.4%	98.5%	87.4%		114.1%
Scenario 4	185.2%	172.4%	128.6%	115.4%		152.9%
Consumption						
Scenario 1	-3.8%	-7.2%	-15.0%	-12.9%	-9.4%	-9.1%
Scenario 2	-6.1%	-11.1%	-22.2%	-19.5%	-9.4%	-13.4%
Scenario 3	-9.3%	-15.9%	-30.2%	-26.9%	-9.4%	-18.3%
Scenario 4	-11.9%	-19.7%	-36.1%	-32.2%	-9.4%	-22.1%
Retail price						
Scenario 1	21.4%	25.3%	32.9%	35.4%	10.0%	25.1%
Scenario 2	32.2%	39.6%	54.4%	59.3%	10.0%	39.4%
Scenario 3	48.3%	61.1%	86.6%	95.2%	10.0%	60.7%
Scenario 4	64.4%	82.6%	118.9%	131.0%	10.0%	82.0%

What Table 7 clearly illustrates is that larger increases in the excise tax have better public health and fiscal effects than smaller increases. These results support the arguments of the international tobacco control literature that encourage governments to impose large excise tax increases in order to achieve correspondingly large public health and economic benefits [8]. The effect of the tax increases is not the same for the different market segments, because, by assumption, some segments are more sensitive to price changes, and the prices of some segments (i.e. the cheaper cigarettes) are disproportionately more affected by the imposition of substantially higher specific excise taxes.

As indicated earlier, the results of these simulation exercises need to be interpreted carefully. While we are confident that there are no programming errors in the TETSiM model, we want to emphasise that the results are driven by the input values. If these input values are substantially wrong, then the outputs will be wrong as well. However, as an indication of the likely direction of change and the approximate magnitudes, the model should be a valuable tool for policy makers.

4.2 The public health consequences of increases in the excise tax

As indicated earlier in this report, the strength of the TETSiM model lies in its flexibility and in its analysis of the economic consequences of a change in the structure and/or level of the excise tax. The model does not compare well with models like the SimSmoke model, that has been designed as an epidemiological model. The SimSmoke model requires a lot of detailed data, which is often not available in low- and middle-income countries.

With these caveats in mind, we nevertheless added an epidemiological module to the TETSiM model, focusing on the number of premature deaths avoided because of the tax increase. As indicated earlier, two approaches have been followed. The one approach focuses on the decrease in smoking prevalence because of the tax increase. The decrease in smoking prevalence then translates to an estimate of how many people avoid premature death, because they have been able to quit smoking. The second approach uses the rule of thumb method developed by Jha and colleagues.

In Table 8 we present the results of the epidemiological model using the first approach, for the four different tax scenarios presented earlier.

Table 8: Epidemiological module of the TETSiM model (smoking prevalence approach)

	Units	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Base scenario					
Aggregate cigarette consumption	Million sticks	18400	18400	18400	18400
Smoking prevalence	Percentage	5.60%	5.60%	5.60%	5.60%
Per capita cigarette consumption	Cigarettes per adult	172	172	172	172
Per-smoker cigarette consumption (annual)	Cigarettes per adult	3071	3071	3071	3071
Per-smoker cigarette consumption (daily)	Cigarettes per adult	8.4	8.4	8.4	8.4
Number of smokers	Million people	5.99	5.99	5.99	5.99
Expected number of future premature deaths among smokers	Million people	2.40	2.40	2.40	2.40
After the tax change					
Aggregate cigarette consumption	Million sticks	16723	15938	15026	14326
Smoking prevalence	Percentage	5.33%	5.20%	5.03%	4.90%
Per capita cigarette consumption	Cigarettes per adult	156	149	140	134
Per-smoker cigarette consumption (annual)	Cigarettes per adult	2931	2865	2789	2731
Per-smoker cigarette consumption (daily)	Cigarettes per adult	8.0	7.9	7.6	7.5
Number of smokers	Million people	5.71	5.56	5.39	5.25
Expected number of future premature deaths among smokers	Million people	2.28	2.22	2.15	2.10
Expected number of future premature deaths among quitters	Million people	0.06	0.09	0.12	0.15
Expected number of premature deaths averted through intervention	Million people	0.06	0.09	0.12	0.15
Expected number of premature deaths averted through intervention	Thousands of people	57	86	121	149

The baseline is the same for all four tax scenarios. In the baseline, total cigarette consumption in Nigeria is estimated at 18.4 billion cigarettes. The smoking prevalence is estimated at 5.6% for the population aged 15 years and older. Both these numbers are inputs in the model. Based on a total adult population of 107 million people, the per capita consumption is 172 cigarettes per person per year (i.e. 18 400 million/107 million). Of course, most Nigerians do not smoke, but the per capita number is a useful summary statistic to compare Nigeria's smoking profile with those of other countries and Nigeria's smoking profile over time.

Among the 5.99 million Nigerians who do smoke (i.e. 5.6% of the 107 million adults), the average cigarette consumption is 3071 cigarettes per year (i.e. 18 400 million/5.99 million). This translates to 8.4 cigarettes per day on average. Compared to most high-income countries in Europe and North

America, this is relatively low, but it is a well-established fact that smoking intensity in most African countries is lower than the global average [25].

The epidemiological literature indicates that about half of regular smokers can expect to die prematurely because of a tobacco-related illness [21, 22]. These percentages have been estimated primarily in high-income countries, where life expectancy is at very high levels. It seems likely that in African countries, where life expectancy is lower for a variety of reasons, the proportion of regular smokers who die prematurely from tobacco-related illnesses will be less than 50%. In order to reflect this, and to be conservative, we have assumed that 40% of regular smokers in Nigeria will die prematurely. This is 2.4 million people.

Of course, these people will not all die in the next year or even in the next decade. The impact of smoking takes a number of decades to make itself visible in the mortality statistics.

In the second panel of Table 8, we indicate the likely epidemiological impact of the four different tax scenarios. The first line shows the expected number of cigarettes smoked per year under the different tax scenarios. The third line indicates the per capita consumption quantities. Unsurprisingly, the tax increases have decreased both aggregate and per capita consumption. The larger the tax increase the greater the decrease in consumption.

As discussed previously, a decrease in cigarette consumption is the result of the sum of a decrease in smoking prevalence and a decrease in smoking intensity. Following international precedent [8], we assume that the split is 50-50. Thus we notice that in Table 8 there is both a decrease in smoking prevalence (from 5.6% in the baseline scenario to 5.33% in scenario 1, going down to 4.90% in scenario 4), and smoking prevalence (from 3071 cigarettes a year in the baseline scenario to 2931 cigarettes per year in scenario 1, going down to 2731 in scenario 4).

As indicated earlier in this report, the epidemiological impact of the finding that continuing smokers reduce their consumption by some modest percentage is very small. A person who reduces daily consumption of cigarettes from 8.4 cigarettes a day to between 7.5 and 8 cigarettes a day will not realise any significant health gains. Thus, in the model, we assume that no premature deaths will be averted because such people reduce their cigarette intensity.

The model indicates that the number of smokers decreases from 5.99 million smokers in the baseline scenario to 5.71 million smokers in scenario 1, going down to 5.25 million smokers in scenario 4. These quitters reap substantial health benefits. However, as pointed out previously, not all the quitters will escape premature tobacco-induced death, because the damage caused by their smoking may be irreversible. We assume that 20% of quitters will die from a tobacco-related disease. As before, we assume that 40% of continuing smokers will die prematurely from a tobacco-related disease.

The last two lines of Table 8 indicate the difference between the number of premature deaths in the baseline scenario and the number of premature deaths in the simulated situations (the one line is in millions and the other is in thousands). According to the model, the numbers of premature deaths averted range between 57 000 in scenario 1 and 149 000 in scenario 4.

In Table 9 we present the results of Jha's rule of thumb method [18], and we assume that about 1.2 smokers die from a tobacco-related illness for every million cigarettes smoked. We emphasise that this is a rule of thumb, rather than a model based on precise epidemiological principles and assumptions.

Table 9: Epidemiological module of the TETSiM model (based on Jha's rule of thumb)

Base scenario	Units	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Aggregate cigarette consumption	Million sticks	18400	18400	18400	18400
After the tax change					
Aggregate cigarette consumption	Million sticks	16723	15938	15026	14326
Expected number of premature deaths averted through intervention in current year	Thousands of people	2.01	2.95	4.05	4.89
Expected number of premature deaths averted through intervention over 30 years	Thousands of people	60	89	121	147

The underlying thinking of this approach is that the effects of a change in cigarette consumption on tobacco-related mortality can be seen quite quickly. For every million cigarettes that are not smoked in each year, 1.2 premature deaths are avoided. Based on this assumption, the 1 677 million fewer cigarettes smoked in scenario 1 (i.e. 18 400 million – 16 723 million) will result in 2012 fewer premature tobacco-related deaths each year. If the same decrease in cigarette consumption is maintained in the second year, then another 2012 premature deaths will be averted. This principle will continue until the cohort has died out.

As the cohort of smokers dies off (either from tobacco-related diseases or from other causes), the aggregate cigarette consumption of the remaining cohort becomes smaller. As a result, the number of premature deaths, using this principle, becomes smaller as well. After about 60 years, one can assume that the current cohort of smokers would be effectively no more, because the youngest smokers now (i.e. someone of 15 years) would be 75 years by then. At that point nobody would avoid premature death.

As a rough estimate, we assume that the epidemiological benefit of a current (but permanent) decrease lasts for an average of 30 years. This is based on the following reasoning. The current life expectancy at birth of Nigerian men is about 61 years [26]. Given that Nigeria has a young population, the median age of smokers is about 25 years. The difference between the life expectancy and the median age of smokers is 36 years. In order to be conservative in estimating the number of premature deaths avoided, we perform the calculation over 30 years.

Multiplying the annual number of premature deaths averted by 30 yields the numbers in the last row of Table 9. The number of premature deaths averted, estimated by using this rule of thumb, is similar to the number of deaths averted, using a completely different methodology, shown in Table 8. The fact that the numbers are so similar increases the degree of confidence that one can have in them.

Should the government of Nigeria increase the excise tax to 240 naira per pack (together with an ad valorem tax of 50% of the CIF/ex-works price), both approaches used in the model predict that nearly 150 000 premature deaths can be avoided.

Conclusion

This paper follows on from a previous working paper, published in 2019, on the likely impact of a change in the excise tax in Nigeria [13]. Since 2018, Nigeria has implemented a specific excise tax on cigarettes, and has gradually increased it, in line with the ECOWAS directive. However, the ad valorem component of the tax, at 20% of the CIF or ex-works value, is still below the directive's minimum of 50%. The introduction of the specific component of the excise tax, especially, should be applauded, because international best practice shows that tax systems with a large specific component yield better outcomes than systems that are primarily based on an ad valorem tax.

Despite these improvements, the excise tax in Nigeria is still low by international standards and is very far off the target set by the WHO.

In this paper, we present a tobacco excise tax simulation model (TETSiM) for Nigeria, which incorporates the most recent tax and price changes. The model has been reprogrammed in Excel, and we believe it is simpler to use than the model that was previously used Other than presenting the standard economic consequences of a change in the excise tax, the model has an epidemiological module which estimates the number of premature tobacco-related deaths avoided through the interventions.

We strongly encourage policy makers to use the model for sensitivity analysis. All important input variables can be changed by the user.

The model demonstrates that in increase in the excise tax is a win-win situation for the fiscus and for public health. An increase in the excise tax is expected to increase tobacco tax revenue and decrease cigarette consumption. A decrease in cigarette consumption decreases the number of deaths attributable to tobacco. The larger the increase in the excise tax, the greater will be its fiscal and public health impact.

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