

Taxing tobacco as a strategy to reduce consumption and increase public health benefits in Pakistan

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Abstract

Background: Tobacco consumption poses a significant challenge to global health and contributes to the increase in noncommunicable diseases and premature deaths.

Aim: To investigate the potential impact of a 70% tobacco tax on consumption and government revenue in Pakistan.

Methods: We analysed secondary data from 2011 to 2022 (after imposition of a 70% excise tax) from the Pakistan Bureau of Statistics, Pakistan Social and Living Standard Survey, financial yearbooks and Federal Board of Revenue reports for tobacco consumption and government revenue. Variables included tobacco price inflation, per capita income, cigarette price, federal excise duty, and government revenue.

Results: The higher taxes reduced tobacco production by PKR 3.72 billion (\approx US\$ 13.4 million). Price elasticity analysis indicated an inelastic demand for cigarettes, mostly among the rural populations. Imposition of excise duty of 70% of the retail price caused a decrease in government revenue by PKR 390 million (\approx US\$ 1.4 million).

Conclusion: Implementing 70% taxation on tobacco products is beneficial, however, to fully realize its benefit, there is a need for strict regulation on brand shifting and illegal trade.

Keyword: tobacco taxation, tobacco tax, tobacco use, noncommunicable disease, revenue, excise tax, Pakistan

Citation: Aziz N, Almas A, Mahmood T, Bloomfield GS, Samad Z. Taxing tobacco as a strategy to reduce consumption and increase public health benefits in Pakistan. *East Mediterr Health J.* 2024;30(11):772–778. <https://doi.org/10.26719/2024.30.11.772>.

Received: 20/11/2023; Accepted: 16/05/2024

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Introduction

Lung cancer, cardiovascular diseases and respiratory diseases comprise a large proportion of noncommunicable diseases (NCDs) and are major causes of death among smokers (1). Tobacco is a known carcinogen which causes cancer of the lungs (2), breasts (3), mouth (4), pancreas (3), colon (5) and kidneys (6). Of the 1.3 billion tobacco users worldwide, \geq 80% live in low- and middle-income countries (LMICs) (7). WHO recommends that countries should impose a 70% tax on tobacco (8, 9). However, despite the known hazardous effects of tobacco, its consumption continues to increase and many countries do not levy a 70% tax on tobacco.

Effective and comprehensive tobacco control policies under the WHO Framework Convention on Tobacco Control can reduce smoking prevalence by 100 million smokers worldwide in the next 8 years (10). The reasons for high tobacco use in LMICs mainly include a lack of strict regulations pertaining to control of tobacco sales and use, lack of area- and age-specific smoking restrictions, and easy access to low-cost cigarettes (7). The tax burden (share of retail price) is 40.8% in upper middle-income countries, 33.1% in LMICs, and 20.1% in lower-income countries (11).

Pakistan has one of the highest consumption rates of tobacco worldwide (12). Tobacco causes \geq 100 000 deaths in Pakistan, mostly from ischaemic heart disease, other

cardiovascular diseases, stroke, emphysema, cancer and respiratory diseases (13). Tobacco is also consumed in chewable form, which contributes to some of the highest oral and lip cancer rates in Pakistan (33.6% in males and 10.4% in females) (14). For people aged \geq 15 years, daily tobacco consumption rate is 27% in males and 5.5% in females (15).

A 50% increase in cigarette prices could save an estimated 450 million years of life across 13 countries, with half of these life-years saved in China (16). The marketing strategies of the tobacco industry have resulted in an ever-increasing rate of consumption in low-income countries (17). In Pakistan, marketing of cigarettes is permitted but must include a warning message. Hence, despite bans on smoking in Pakistan, millions of adults consume tobacco products (13). The multinational tobacco companies operating in Pakistan have a market share ranging from 43% to 55%. The rest is owned by local producers who usually evade taxes by under-reporting their production, leading to lower prices for consumers (13).

Between 2017 and 2018, the taxes on each cigarette pack decreased by 22.8% in Pakistan. However, in the fiscal year 2021–2022, the tax rates increased to 41.6%, aiming to generate more revenue in all industries, including tobacco. Consequently, tobacco consumption is believed to have decreased by 4.7% (18). However, this tax increase is still low compared with the rate set by WHO: 70% per pack (19). Local production of cigarettes is subject

to federal excise duty and general sales tax. Federal excise duty contributes to almost 80% of government tax revenue on the manufacturing and sale of tobacco (20). Illicit trade goes undocumented, which allows for tax evasion. According to the Federal Board of Revenue of Pakistan, illicit cigarettes have capture at least 26% of the total market where sales have increased by 62% and are expected to increase further. The Federal Board of Revenue has estimated PKR 20 billion annual losses in revenue collection due to illicit trade.

This study investigated the impact of a 70% excise tax on tobacco on government revenue and tobacco consumption in Pakistan.

Methods

This was an observational study of macroeconomic variables in Pakistan from 2011 to 2022: real Gross Domestic Product (GDP) growth rate, tobacco Consumer Price Index (CPI) national inflation; point contribution of tobacco to food price inflation; tobacco consumption by commodity; urban and rural consumption of tobacco by commodity; average number of income earners per household; per capita income; average monthly income per household; government revenue (PKR million) from federal excise duty on tobacco and cigarettes; legal domestic cigarette sales; price per pack of 20 cigarettes; and excise duty per pack of 20 cigarettes. Data were collected for fiscal years 2010–2011 to 2021–2022 from the annual reports of the Pakistan Social and Living Standard Measurement Survey (PSLM), Household Integrated Economic Survey (HIES), Pakistan Economic Survey, and Federal Board of Revenue yearbooks. Data reported by Oxford Economics was used for cigarette sales and prices.

Data for 12 years (2011– 2022) were extracted, although cigarette price, excise duty and cigarette sales had missing values for some years. Data for earlier years could not be incorporated into the analysis because of the high number of missing values for most of the variables. A moving average forecasting approach was used to determine missing values based on a window size of 3; a statistical method was used to smoothen fluctuations in time-series data where the window size refers to the number of data points considered for averaging. A small sample size can increase the risk of multicollinearity, which can be dealt with by excluding highly correlated variables from the analysis. However, the highly correlated variables were the most important for our analysis and we could not exclude them. Therefore, ridge regression was used, which has a penalizing factor for reducing coefficient value by penalizing it depending on its *P* value. To study the relation between these variables, 4 models of ridge regression were used. R package “forecast” was used to apply moving average and the scikit-learn library of Python language was used to apply ridge regression.

Model 1: cigarette sales (per pack of 20) were treated as the dependent variable and independent variables

were year, GDP growth, tobacco CPI national inflation, per capita income, cigarette price (per pack of 20), and excise duty on cigarettes (per pack of 20). Model 2: government revenue from federal excise duty on tobacco and cigarettes was treated as the dependent variable and the independent variables were GDP growth rate, tobacco CPI national inflation, per capita income, and excise duty (per pack of 20). Models 3 and 4 were constructed while fixing excise duty at 70% of the retail price and keeping other variables constant, to see the impact of WHO recommended tobacco tax rate on tobacco sales (Model 3) and government revenue (Model 4).

Excise duty on cigarettes was not available for a pack of 20, so it was estimated by dividing the excise duty on a pack of 1000 cigarettes by 50.

Results

Model 1: effect of actual excise duty and other variables on cigarette sales

After applying ridge regression, the coefficients of these variables were penalized as per their *P* values with a regularization parameter ($\alpha = 0.476$). Model 1 showed that per capita income and cigarette price had a negative effect on cigarette sales while GDP growth rate and tobacco inflation rate had a positive effect. Year also had a positive coefficient, which suggested that cigarette sales increased annually. Only cigarette price was found to be significant by ordinary least square regression. However, as other variables were important, ridge regression penalized their coefficients as shown in Table 1. GDP growth rate coefficient decreased from 0.661 to 0.639; tobacco CPI inflation rate decreased from 0.168 to 0.130; negative effect of per capita income increased by 0.0001; cigarette price effect increased by 0.09; and effect of excise duty on cigarette sales decreased from 0.643 to 0.487.

Model 2: effect of actual excise duty and other variables on government revenue

The variables year, cigarette price and cigarette sales were excluded as they were highly correlated. After applying ridge regression, the coefficients of these variables were penalized as per their *P* values with a regularization parameter ($\alpha = 0.275$). Model 2 showed that GDP growth rate, tobacco CPI inflation rate and per capita income had a positive effect on government revenue, while excise duty had a negative impact. Only the per capita income variable was significant. Other variables were penalized, and the effect of GDP growth rate decreased to 1060.929, whereas the effect of tobacco inflation, per capita income and excise duty on government revenue increased significantly (Table 2).

Model 3: effect of 70% excise duty and other variables on cigarette sales

After applying ridge regression, the coefficients of these variables were penalized as per their *P* values with a

Table 1 Original model for estimating effects on cigarette sales

Legal domestic cigarette sales	Coefficient	t value	P value	Penalized coefficient by ridge regression
Intercept	-1227.133	-0.337	0.750	-14.379
Year	0.659	0.363	0.732	0.055
GDP growth (annual %)	0.661	1.176	0.292	0.639
Tobacco inflation rate	0.168	1.621	0.166	0.130
Per capita income	-0.0005	-1.304	0.249	-0.0004
Cigarette price	-0.708	-2.615	0.047	-0.618
Excise duty	0.643	2.157	0.083	0.487

Source: Pakistan Bureau of Statistics (Pakistan Social and Living Standard Measurement Survey, Household Integrated Economic Survey), Federal Board of Revenue.

Table 2 Original model for estimating the effect on government revenue

Government revenue	Coefficient	t value	P value	Penalized coefficient by ridge regression
Intercept	-83920	-2.310	0.082	78 072.647
GDP growth (annual %)	1099.164	0.354	0.741	1060.929
Tobacco inflation rate	761.475	2.280	0.085	8094.874
Per capita income	2.32	3.483	0.025	17 674.923
Excise duty	-107.482	-0.135	0.899	283.058

Source: Pakistan Bureau of Statistics (Pakistan Social and Living Standard Measurement Survey, Household Integrated Economic Survey), Federal Board of Revenue.

regularization parameter ($\alpha = 0.275$). Model 3 measured the positive impact of GDP growth and tobacco inflation on cigarette sales and the negative impact of per capita income, cigarette price and 70% excise duty on the retail price of cigarettes. All variables were nonsignificant. The penalized coefficients depicted in Table 3 showed that the positive effect of GDP growth and tobacco inflation and negative impact of per capita income, cigarette price and excise duty were increased by ridge regression.

Model 4: Effect of 70% excise duty and other variables on government revenue

The variables year, cigarette price and cigarette sales were excluded as they were highly correlated. After applying ridge regression, the coefficients of these variables were penalized as per their *P* values with a regularization parameter ($\alpha = 0.494$). Model 4 showed that the tobacco inflation rate, per capita income and excise duty had a positive impact on government revenue, while GDP growth rate had a negative impact. All variables were nonsignificant. The penalized coefficients showed that 70% excise duty increased the negative impact of GDP growth rate on government revenue and the positive impact of tobacco inflation, per capita income, and excise duty (Table 4).

Exploratory data analysis

Some control variables were not included in the regression models because they were highly correlated with other variables deemed significant for the model. To analyse the impact of these factors on tobacco consumption and government revenue, it was crucial to examine these variables separately. There was a strong

association between per capita income and tobacco CPI food inflation. Per capita income had an increasing trend throughout the 12 years under study, but in fiscal year 2017–2018, the rate of change in per capita income decreased by 0.30, unlike other years. For that same fiscal year, there was a decline in tobacco inflation (16.86%) and its contribution to food inflation was negative (-0.24%). Average number of income earners per household also decreased from 1.93 to 1.86 during this period suggesting that income levels were a major factor contributing to the consumption of cigarettes. There was a decline in cigarette sales in fiscal year 2015–2016 by PKR 10 billion, and a reduced rate of increase (almost by half as compared with the previous year) in excise duty on tax rates. This resulted in a decrease in government revenue by PKR 24 594.3 million the following year.

The price elasticity of cigarette demand was calculated and found to be inelastic for overall cigarette consumption (-0.67) as well as urban (0.18) and rural cigarette consumption (0.35). The excise duty elasticity on consumption indicated that when excise duty was increased by > 1%, consumption decreased by > 1% in Pakistan.

Discussion

Price elasticity for cigarettes suggested an inelastic demand which means that if the price increases by 1%, demand for cigarettes decreases by 0.67%. The price elasticity of cigarettes is higher in low-income countries (-0.5) compared to middle-income (-0.4) and high-income (-0.3) countries, which shows more responsiveness to tobacco price changes in lower-income countries than

Table 3 Imposition of 70% excise duty on cigarettes applied as a percentage of retail price

Excise duty: 70%, effect on cigarette sales	Coefficient	t value	P value	Penalized coefficient by ridge regression
Intercept	112.105	7.536	0.002	51.889
GDP growth (annual %)	0.679	0.841	0.448	0.834
Tobacco inflation rate	0.059	0.651	0.551	0.748
Per capita income	-0.0007	-2.155	0.097	-5.014
Cigarette price	-0.222	-2.466	0.069	-3.246
Excise duty 70%	-0.156	-2.466	0.069	-3.246

Source: Pakistan Bureau of Statistics (Pakistan Social and Living Standard Measurement Survey, Household Integrated Economic Survey), Federal Board of Revenue.

Table 4 Effect of 70% excise duty on cigarettes applied as a percentage of retail price

Government revenue with 70% excise tax	Coefficient	t value	P value	Penalized coefficient by ridge regression
Intercept	-47 060	-0.868	0.434	78 072.647
GDP growth (annual %)	-49.580	-0.017	0.987	-212.079
Tobacco inflation	684.07	2.087	0.105	6886.637
Per capita income	1.445	1.288	0.267	10 125.072
Excise duty	545.446	0.780	0.479	8137.079

Source: Pakistan Bureau of Statistics (Pakistan Social and Living Standard Measurement Survey, Household Integrated Economic Survey), Federal Board of Revenue.

in the other 2 (21). Unlike other LMICs, price elasticity of demand in Pakistan was inelastic, which meant it was less responsive to price. This is consistent with Ho et al., who found that cigarette demand was inelastic in LMICs (22).

However, previous studies have shown a unitary elastic demand for cigarettes of -0.48% for the short-term and -1.1% for the long-term (23, 24). A Vietnamese study proposed that increasing taxes on cigarettes would decrease consumption and increase government revenue due to the elastic demand for cigarettes (25). The difference in elasticity between these studies and ours could be because our data were specific to the number of sales and price of packs of 20 cigarettes. However, the price elasticity of demand for cigarettes when calculated for excise duty was elastic. This suggested that when the cigarette tax increased by 1%, demand for cigarettes decreased by 4.65%. Our findings suggest that the rural population spent more of their commodity consumption budget on tobacco than the urban population did. This is consistent with the findings of the Social Policy and Development Centre that reported rural and urban tobacco budget to be 2.7% and 1.8% of overall household consumption, respectively. The proportion of people with inelastic demand for cigarettes was higher in rural than in urban areas.

The negative effect of price increases on cigarette sales tripled, and the impact of excise duty changed from positive to negative after 70% taxation, which suggests that a 70% tax rate can reduce cigarette sales. There are several factors contributing to the level of cigarette sales in Pakistan. One that we established is that the demand for cigarettes is inelastic. Other studies have shown that an increase in taxes has led to a shift in demand for cheaper

cigarettes, potentially coming from illicit trade that is not subject to documentation; therefore, taxes cannot be applied. The illicit market accounts for 40% of tobacco sales according to tax-paying tobacco companies. The Australian model can be applied here, which documented a reduction in tobacco consumption due to an increase in tax as part of the National Tobacco Campaign across all occupational groups, as higher prices of manufactured brands prevented consumers from switching to cheaper alternatives (26).

WHO recommends that tax on cigarettes should be at least 70% of the retail price. Our data from Pakistan showed that excise duty was around 42% of the retail price. A decrease in cigarette sales was observed as income, cigarette price and excise duty increased. With 70% excise duty, the negative impact of per capita income, the positive impact of tobacco inflation and the negative effect of cigarette prices on sales increased. The impact of excise duty on cigarette sales changed from being positive to negative after 70% tax. These changes highlight the sensitivity of the relationship between these variables and cigarette sales to variations in tax rates.

Model 2 estimated the positive impact of tobacco inflation and per capita income, and the negative impact of excise duty on government revenue. We observed the effect of 70% excise duty on government revenue in Model 4. Tobacco inflation rate and per capita income contributed more to government revenue with 70% than with actual tax rates. In contrast, an increase of 1 PKR in excise duty previously contributed to a loss of PKR 107.482 million to government revenue, but with 70% excise duty, the government revenue decreased by PKR 283.058 million. The increase in tax rate can initially result in losses. However, it can eventually lead to growth

and revenue by, for example, improving the health of individuals due to changing consumption preferences from tobacco to other products (23).

There are control policies for smoked tobacco products according to the WHO Framework Convention on Tobacco Control, for example, warning labelling should cover 60% of the packet both front and back. However, smokeless tobacco products in Pakistan are not subject to strict control policies. This means displaying labels about addiction, adverse social and economic outcomes, and health risks to friends and family or the environment are not required. However, implementation of these policies is weak. Tobacco manufacturers often impede changes in taxation policies by using manipulative tactics such as decreasing prices when excise tax increases and vice versa.

Pakistan introduced a 3-tier tax system dividing cigarette brands into 3 categories based on their prices, with each category taxed at a different rate. This was abolished in 2013 but reintroduced in 2017. The introduction of 3-tier systems without any restrictions on brand switching would have allowed producers to change from high-priced to low-priced brands to avoid paying higher taxes, leading to a fall in government revenue. Our data represented a loss of approximately PKR 24 594 million in government revenue, which was also reported by the Pakistan Institute of Development Economics.

Our study shows that a multitude of factors contribute to the consumption of tobacco in Pakistan. Not only does the tax system need to be changed (introducing *ad valorem* and uniform tax), but tax administration needs to be monitored regularly as tax evasion and brand shifting from higher to lower priced, in case of increased taxes on high-priced brands, are common in the tobacco market, which leads to cheaper cigarettes. Tobacco sellers also resort to overshifting excise tax, which means transferring the tax burden to the consumer by increasing prices by more than the increase in the tax rate. This represents a significant proportion of market sales, as demonstrated by the fact that demand for cigarettes remains unchanged despite the availability of cheaper and high-quality alternatives that are not subject to taxation. The government generates almost 50% of

its federal excise duty revenue from the sale of tobacco, which means that it is not in its best interest to facilitate lowering tobacco sales. A multi-tiered tax system coupled with stringent policy implementation on brand shifting and overshifting, and banning transit trade of tobacco items should be adopted by policy-makers. The illegal tobacco sale resulting from tobacco products smuggled into the country should be banned, as they are a major contributor to the sale of cheaper alternatives as the price and tax rate increase.

There were several limitations to this study. Our sample size was small. Data on cigarette sales and prices of packs of 20 cigarettes were available for 12 fiscal years (2011–2022). Pakistan living standards and economic surveys for all these years were not available, leading to missing values in our dataset that exacerbated the risk of multicollinearity. To model the impact of varying tax rates on tobacco consumption and government revenue, a longitudinal study is required but the research objectives and data availability constraints led us to an observational study instead. The data in financial reports were unclear, meaning they recorded biannual figures for some years and quarterly for others. Regression models have shown nonsignificant variables at a 95% confidence interval, but this issue could be addressed with a larger sample size. We examined other factors such as the impact of tobacco on food inflation, the number of urban and rural income earners per household, and their trends. However, we did not include socioeconomic factors such as education and unemployment in our analysis as our research objective was focused on taxation, consumption and revenue.

Conclusion

Increasing excise duty on tobacco alone will not be sufficient to reduce tobacco sales. A comprehensive plan that includes brand-shifting strategies and a monitoring of illegal trade is needed in Pakistan.

Funding: This study was supported by the Fogarty International Centre of the National Institutes of Health under Award Number D43TW011625.

Competing interests: None declared.

Stratégie de taxation du tabac visant à en réduire la consommation et à accroître les bénéfices pour la santé publique au Pakistan

Résumé

Contexte : La consommation de tabac constitue un défi majeur de santé mondiale et contribue à l'augmentation des cas de maladies non transmissibles et de décès prématurés.

Objectif : Étudier l'impact potentiel de la mise en place d'une taxe de 70 % sur le tabac, tant sur la consommation que sur les recettes publiques au Pakistan.

Méthodes : Nous avons analysé des données secondaires recueillies entre 2011 et 2022 (suite à la mise en place de l'imposition de droits d'accise de 70 %) provenant du Bureau des statistiques du Pakistan, de l'Enquête sur la situation sociale et le niveau de vie au Pakistan, des annuaires financiers et des rapports du Comité fédéral des recettes publiques concernant la consommation de tabac et les recettes publiques. Les variables comprenaient l'inflation du prix du tabac, le revenu par habitant, le prix des cigarettes, les droits d'accise fédéraux et les recettes publiques.

Résultats: L'augmentation des taxes a permis de réduire la production de tabac à raison de 3,72 milliards de roupies pakistanaises, soit près de 13,4 millions de dollars des États-Unis (US). L'analyse de l'élasticité-prix a laissé entrevoir une demande inélastique de cigarettes, principalement parmi les populations rurales. L'imposition de droits d'accise à hauteur de 70 % du prix au détail a entraîné une baisse des recettes publiques de 390 millions de roupies pakistanaises, soit près de 1,4 million de dollars US.

Conclusion: L'application d'une taxe de 70 % sur les produits du tabac s'avère bénéfique. Cependant, pour en tirer pleinement parti, il est nécessaire de définir une réglementation stricte afin d'empêcher les consommateurs de changer de marques de tabac et d'en interdire le commerce illégal.

استراتيجية فرض ضرائب على التبغ للحد من استهلاكه وتحسين مزايا الصحة العامة في باكستان

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الخلاصة

الخلفية: يشكل استهلاك التبغ تحديًا كبيرًا للصحة على المستوى العالمي، ويسهم في زيادة الأمراض غير السارية والوفيات المبكرة.

الهدف: هدفت هذه الدراسة الى بحث الأثر المحتمل على الاستهلاك والإيرادات الحكومية في باكستان عند فرض ضريبة على التبغ بنسبة 70٪.

طرق البحث: حللنا بيانات ثانوية من عام 2011 إلى عام 2022 (بعد فرض ضريبة بيع بنسبة 70٪) من مكتب الإحصاء الباكستاني، ومسح المستوى الاجتماعي ومستوى المعيشة في باكستان، والحوليات السنوية المالية، وتقارير المجلس الاتحادي للإيرادات عن استهلاك التبغ والإيرادات الحكومية. وشملت المتغيرات تضخم أسعار التبغ، ونصيب الفرد من الدخل، وسعر السجائر، وضريبة البيع الاتحادية، والإيرادات الحكومية.

النتائج: أدى ارتفاع الضرائب إلى خفض إنتاج التبغ بمقدار 3.72 مليارات روبية باكستانية (13.4 مليون دولار أمريكي تقريبًا). وأشار تحليل مرونة الأسعار إلى عدم تغير الطلب على السجائر، ولا سيما بين سكان الريف. وتسبب فرض ضريبة بيع بنسبة 70٪ من سعر البيع بالتجزئة في انخفاض الإيرادات الحكومية بمقدار 390 مليون روبية باكستانية (1.4 مليون دولار أمريكي).

الاستنتاجات: فرض ضريبة تبلغ 70٪ على منتجات التبغ أمر مفيد، ولكن تحقيق الفائدة الكاملة المرجوة منه يتطلب مستوى صارمًا من التنظيم بشأن التحول من علامة تجارية إلى أخرى والاتجار غير المشروع.

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