

Better Cigarette Tax Policies and Higher Tobacco Excise Tax Revenues

Tobacconomics Working Paper Series

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Paper No. 22/10/1

October 2022

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Suggested citation: Lee, H.M., Drope, J., Guerrero-López, C.M., Perucic, A.,
Chaloupka, F.J. (2022). Better cigarette tax policies and higher tobacco excise tax
revenues (Tobacconomics Working Paper Series No. 22/10/1). Tobacconomics.
<https://tobacconomics.org/research/better-cigarette-tax-policies-and-higher-tobacco-excise-tax-revenues-working-paper-series>

Acknowledgments: This project is funded by the University of Illinois Chicago's (UIC) Institute for Health Research and Policy. UIC is a partner of the Bloomberg Philanthropies' Initiative to Reduce Tobacco Use. The views expressed in this document cannot be attributed to, nor can they be considered to represent, the views of UIC, the Institute for Health Research and Policy, or Bloomberg Philanthropies.

Abstract

Background

In November 2021, the Tobacconomics team developed and released the second edition of the *Cigarette Tax Scorecard* which evaluates cigarette taxation in each country based on four components – cigarette price, affordability change, tax share, and tax structure. This study examines the relationship between the overall cigarette tax score and tobacco excise tax revenue for 70 countries between 2014 and 2018.

Methodology

Cigarette tax score data are obtained from the second edition of the Tobacconomics *Cigarette Tax Scorecard*. Country-level tobacco excise tax revenue and tobacco control environment information are obtained from the World Health Organization (WHO) and various editions of the *WHO Report on the Global Tobacco Epidemic*. Other demographic and socioeconomic information is gathered from the World Development Indicators in the World Bank (WB) database. This analysis is based on an Ordinary Least Squared (OLS) estimation to assess the association between the overall cigarette tax scores and tobacco excise tax revenues controlling for countries' tobacco control environment, demographics, and socioeconomic characteristics. Year and country fixed effects are also included to address unobservable time and country factors, respectively.

Results

The results show that a 1-point increase in the overall cigarette 5-point tax scores is associated with an increase in tobacco excise tax revenue per capita by \$11.57 (in constant 2017 PPP international dollars). For low- and middle-income countries (LMICs), a 1-point increase in the overall cigarette tax score is associated with an increase in tobacco excise tax revenue per capita of \$11.04 (in constant 2017 PPP international dollars). Countries with low scores at the baseline period were found to have a positive relationship, where a 1-point increase in the overall cigarette tax score was associated with an increase in tobacco excise tax revenue per capita by \$ 6.77 (in constant 2017 PPP international dollars). Our simulation estimates also show that if all countries had increased their scores to '5', the tobacco excise tax revenue per capita would have increased by 21.60%. Similarly, if LMICs had implemented the optimal tobacco tax policies, the increase would have been by 24.90%.

Conclusions

Our findings indicate that higher overall cigarette tax scores are associated with higher tobacco excise tax revenue per capita, especially for LMICs and the lower performing

countries at baseline. These results suggest that these countries should aim to reach the highest level in all four components of the *Cigarette Tax Scorecard* by increasing taxes to obtain high absolute cigarette prices, reducing cigarette affordability, increasing cigarette tax shares, and applying better-designed tax structures. In this way, these countries would be able to reduce tobacco use and increase their tobacco tax revenue, which can be allocated to development priorities, including health and education.

Keywords: Tobacconomics cigarette tax scorecard, cigarette tax policy, tobacco tax revenue

Introduction

Tobacco use is the leading cause of preventable premature death worldwide. Tobacco kills more than 8 million people annually, and more than 80% of tobacco users are in low- and middle-income countries (1). Among many tobacco control policies, tobacco taxation is the most effective and cost-effective measure to reduce tobacco use (2). In fact, tobacco taxes have not been effectively implemented in many countries, most of which have not made substantial improvements in recent years.

In November 2021, the Tobacconomics team released the second edition of the *Cigarette Tax Scorecard*, following their first edition which was published in December of 2020. The Scorecard evaluates the performance of cigarette tax policies based on four key components: 1) cigarette price, 2) change in affordability, 3) tax share in cigarette prices, and 4) tax structure. Each of the components is on a 5-point scale for 160 countries and the overall score is the average of the four components. The Scorecard results demonstrate that there have not been significant increases in scores in many countries over time (3,4).

There is an extensive literature on cigarette tax and tobacco use. These prior studies can be categorized based on the four key components of the *Cigarette Tax Scorecard*. Prior studies document that higher cigarette prices lead to decreases in cigarette smoking (5,6), cessation among current smokers (7), and reduction in smoking initiation (8,9). On average, a 10% increase in price is associated with a decrease of 4% in high-income countries and 5% in low- and middle-income countries (LMICs) (1,2,10). Affordability, which is measured as relative income price (RIP) (i.e., the percentage of per capita income required to purchase 100 packs of cigarettes), has also been found to reduce cigarette consumption (11,12). Higher tax shares in cigarette prices generally lead to higher cigarette prices and, thereby, are associated with lower cigarette consumption (13). Uniform and specific tax structures are associated with lower

cigarette consumption compared to complicated tax structures which show larger price variations and lower average prices (14-16). A recent study shows that a 1-point increase in the overall cigarette tax scores is associated with a reduction in per capita cigarette consumption by 8.50% (17).

In contrast to a vast number of studies assessing the relationship between cigarette tax and tobacco use, there is a paucity of research on the relationship between cigarette taxes and related revenues. The few existing studies find that increases in cigarette excise tax are associated with increases in tobacco tax revenue (18-21). Although cigarette tax evasion (including smuggling) and reduction in smoking may follow tobacco tax increases, tobacco tax revenue still typically increases (19,21). Case studies in the World Health Organization (WHO) *Technical Manual on Tobacco Tax Policy and Administration* also show positive revenue impacts of excise tax increases using data from South Africa, the Philippines, Ukraine, Australia, and Canada (10).

Tobacco taxation has been an important research topic for many economic and public health researchers. However, there is limited evidence assessing its effect on countries' tobacco tax revenue, which is very often the focus of tax policymakers whose principal concerns often focus on maintaining or growing tax revenues. Given this gap in the literature, this study examines the association between overall cigarette tax scores and tobacco excise tax revenue using the Tobacconomics *Cigarette Tax Scorecard*. We hypothesize that countries with higher cigarette tax scores experience higher tobacco excise tax revenue. This analysis is based on an Ordinary Least Squared (OLS) estimation in which we regress country-level tobacco excise tax revenue per capita on overall cigarette tax scores along with important controls including the tobacco control environment, demographic and socioeconomic information, country fixed effects, and year fixed effects. Subgroup analyses are also conducted using country income group and baseline level of overall cigarette tax scores.

Methodology

Data

Tobacconomics Cigarette Tax scores

Overall cigarette tax scores are obtained from the second edition of the Tobacconomics *Cigarette Tax Scorecard* (4). The Scorecard evaluates the performance of cigarette tax policies in 160 countries based on four scoring components: cigarette price, changes in cigarette affordability, the tax share of cigarette price, and tax structure. Each component is scored on a scale of 0 to 5, in which a score of '5' represents the best performance (see Appendix Table 1). The overall cigarette tax

score is a composite measure that is calculated as the average of all four component scores.

Tobacco Excise Tax Revenue per capita

Tobacco excise tax revenue data is collected by the WHO from national governments. Annual tobacco tax revenue is collected at the country level by tax category, including excise tax, value-added tax (and other sales tax), and import duties. Currencies are adjusted to constant 2017 PPP international dollars using currency information in the World Development Indicators (WDI). Information on the countries' population size is obtained from the WB database. Per capita measures are generated by dividing the tobacco excise tax revenue by the number of population aged 15+.

Tobacco control environments

Information on the tobacco control environment of each country is obtained from the biennial WHO *Report on the Global Tobacco Epidemic*. The report presents MPOWER scores for each year and country based on their performances in six tobacco control domains: monitoring tobacco use and prevention policies (M), protecting people from tobacco smoke (P), offering help to quit using tobacco (O), warning people about the dangers of tobacco use (W), enforcing bans on tobacco advertising, promotion, and sponsorship (E), and raising taxes on tobacco products (R) (1). Each domain measure takes a score from 1 to 5, where a score of 1 indicates no recent data or no data to represent the national population. A score between 2 and 5 indicates the level of policy implementation where a score of 5 represents the highest performance. In our analyses, we only use POWE scores, since monitoring (M) more likely measures tobacco control policies in broader performance rather than a particular intervention and we use cigarette tax scores to measure the performance in tobacco taxation (R) (17). The POWE score is a summation of the four measures and, thus, can range from 4 to 20.

Demographic and socioeconomic information

Data on country-level demographic and socioeconomic information, which includes GDP per capita, total tax revenue (%) of GDP, % population aged 15–64, and % population aged 65+, are obtained from the WB database (22). GDP per capita is reported in constant 2017 PPP international dollars. In our subgroup analyses by income group, we use WB classification for each year. Baseline levels of cigarette tax scores are categorized into three groups (low, middle, and high) using the earliest score of a country among 2014, 2016, and 2018.

Empirical Approach

Main Analysis

The main analysis is based on Ordinary Least Squares (OLS) estimations to assess the association between countries' overall cigarette tax scores and tobacco excise tax revenue. We include GDP per capita, total tax revenue (%) of GDP, tobacco control environment (POWE), % population aged 15–64, and % population aged 65+ to control for demographic and socioeconomic characteristics of countries. Country and year fixed effects are also included to address the country-specific time-invariant factors and to account for time-specific socioeconomic shocks which could potentially affect tobacco excise tax revenue. Standard errors are clustered at the country level. All statistical analyses are conducted using Stata version 16.1.

Simulations

Based on the regression estimates from the main analyses, we run simulations on the increase of tobacco excise tax revenues in the base and ideal scenarios. In the base scenario, we predict the tobacco excise tax revenue in 2014 and 2018 using the actual overall tax scores and the estimated coefficients. With these predicted tobacco excise tax revenues, we calculate the percentage increases from 2014 to 2018. We take a similar approach in the ideal scenario, but we predict the tobacco excise tax revenue as if all countries scored '5' in 2018. Actual tax scores are used for 2014. Percentage increases are calculated based on these predicted tobacco excise tax revenues.

Results

Summary statistics of the sample are presented in Table 1. The average tobacco tax revenue per capita is \$207.67 (in international dollars PPP) and the average overall cigarette tax score is 2.62. On average, the total overall tax revenue is 17% of the country's GDP and 65% of the population is aged 15-64. The analysis includes 176 observations for 70 countries.

Table 1. Summary statistics

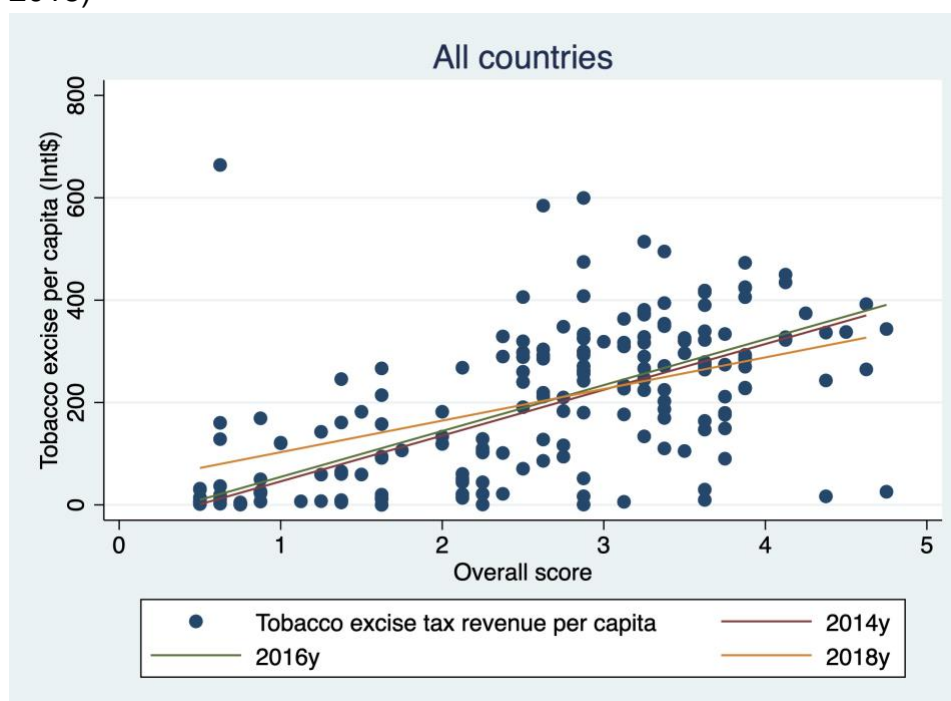
	(1)	(2)	(3)
	All countries	HICs	LMICs
Tobacco tax revenue per capita ^a	207.67	272.52	141.32
Overall cigarette tax score	2.62	3.25	1.98
GDP per capita (in ten thousand dollars) ^a	2.88	4.40	1.32
Total tax revenue (%) of GDP	17.47	20.05	14.84
POWE score	15.67	16.11	15.21
% Population aged 15-64	65.65	66.30	64.98
% Population aged 65+	13.05	17.14	8.86

Observations	176	89	87
Countries	70	36	38

^a Currency adjusted in constant 2017 PPP international dollars

Figure 1 shows the relationship between the overall cigarette tax scores and tobacco excise tax revenue per capita. In all three years, tobacco excise tax revenue per capita increases as the overall cigarette tax score increases. While the slopes of the fitted line are similar between 2014 and 2016, the slope becomes flatter in 2018.

Figure 1. Overall cigarette tax scores and tobacco excise tax revenue per capita (2014-2018)



The regression estimates are presented in Table 2. Column 1, which includes all countries in the sample, shows a positive association between the overall cigarette tax scores and tobacco excise tax revenue per capita. A 1-point increase in the overall cigarette tax score is associated with an increase of tobacco excise tax revenue per capita by \$11.57 (in constant 2017 PPP international dollars). For the high-income countries, there was no significant association found. For the low- and middle-income countries, a 1-point increase in the overall cigarette tax score was associated with an increase in tobacco excise tax revenue per capita by \$11.04 (in constant 2017 PPP international dollars).

Table 2. The association between overall cigarette tax scores and tobacco excise tax revenue per capita

VARIABLES	(1) All countries	(2) HICs	(3) LMICs
Overall cigarette tax score	11.57** (4.47)	14.47 (11.60)	11.04** (4.92)
GDP per capita	-52.90*** (7.36)	-58.28*** (9.09)	73.99 (58.48)
Total tax revenue (%) of GDP	2.21 (1.77)	0.46 (2.91)	4.33 (2.98)
POWE	6.61** (2.70)	4.89 (5.72)	5.65** (2.73)
Population (%) of age 15-64	-8.28* (4.83)	-26.47* (14.41)	-3.82 (4.50)
Population (%) of age 65+	10.29 (8.53)	5.84 (16.32)	1.41 (10.26)
Year 2016	8.99* (4.74)	3.06 9.99	10.24* 5.44
Year 2018	3.25 (8.63)	-14.40 14.63	6.04 10.54
Constant	598.03 (88.76)	2061.38 (1233.73)	98.70 (294.52)
Observations	176	89	87
R-squared	0.985	0.958	0.992

NOTE: Regressions include country fixed effects. Robust standard errors are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3 shows the association between the overall cigarette tax scores and tobacco excise tax revenue per capita by the baseline overall cigarette tax score level of each country. Countries with low scores at baseline period were found to have a positive relationship between the overall cigarette tax score and tobacco excise tax revenue per capita. A 1-point increase in the overall cigarette tax score was associated with an increase in tobacco excise tax revenue per capita of \$ 6.77 (in constant 2017 PPP international dollars).

Table 3. The association between overall cigarette tax scores and tobacco excise tax revenue per capita, by score

	(1)	(2)	(3)
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VARIABLES	Low score countries	Middle score countries	High score countries
Overall cigarette tax score	6.77** (3.13)	18.80 (12.35)	17.03 (15.24)
GDP per capita	132.60* (67.44)	-60.46*** (6.85)	23.30 (96.99)
Total tax revenue (%) of GDP	0.62 (2.27)	0.60 (2.75)	5.49 (3.97)
POWE	3.50 (2.08)	13.05* (7.17)	-1.35 (6.13)
Population (%) of age 15-64	-4.85 (3.39)	-2.91 (11.38)	-23.48 (23.59)
Population (%) of age 65+	-9.93 (12.07)	15.07 (14.30)	9.48 (24.48)
Year 2016	7.56 (6.16)	9.56 (7.90)	4.18 (15.99)
Year 2018	8.98 (9.89)	-0.83 (11.98)	-28.55 (29.04)
Constant	233.75 (204.14)	164.92 (953.36)	1,453.71 (1,999.95)
Observations	55	68	53
R-squared	0.983	0.976	0.957

NOTE: Regressions include country and year fixed effects. Robust standard errors are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Simulations were conducted using the regression estimates in Table 2. The simulated estimates show the predicted change of tobacco excise tax revenue per capita under the base scenario and an ideal scenario that all countries score 5 in 2018. Based on the estimates of all countries, there was an increase in tobacco excise tax revenue per capita by 8.13%. However, if the countries had increased their scores to '5', the change would have been 21.60%. Similarly, using the estimates for LMICs only, if the LMICs have implemented the optimal tobacco tax policies, the per capita tax revenue change would have been 24.90%.

Table 4. Simulation estimates

	Simulated estimates					
	Base scenario			Ideal scenario		
Outcome	Actual scores in 2014	Actual scores in 2018	% Change	Actual scores in 2014	All score '5' in 2018	% Change
Per capita tobacco excise tax revenue – All countries	200.60 [195.24-205.97]	216.90 [206.43-227.37]	8.13%	200.60 [195.24-205.97]	243.92 [222.00-265.82]	21.60%
Per capita tobacco excise tax revenue – LMICs	136.62 [125.17-148.07]	138.62 [128.45-148.80]	1.46%	136.62 [125.17-148.07]	170.64 [140.70-200.58]	24.90%

Limitations

This study has limitations. First, our analysis only considers the legal sales of cigarettes. The amount and changes in illicit sales of cigarettes are not addressed as they are not captured by the legal taxation scheme. While simpler tax systems and higher cigarette tax scores can enhance transparency and reduce opportunities for tax evasion activities such as smuggling (2), we were not able to test this due to data availability. Still, given that domestic tax evasion is a pervasive challenge in some LMICs (10), theoretically, LMICs would have experienced greater changes in illicit transactions of cigarettes and tobacco tax revenues in response to higher taxes. However, we find a stronger and more significant association between cigarette tax scores and tobacco tax revenue in LMICs. This may suggest that the increase in illicit cigarettes is minimal.

Second, similarly, our study focuses on cigarettes and does not include other tobacco products in the analysis. When cigarette tax and price increase, smokers may switch down to cheaper or lower-taxed tobacco products, which might include roll-your-own (RYO) and smokeless tobacco (10). This type of substitution would happen particularly in countries where other tobacco products are prevalent and where there are wide gaps in price across tobacco products (10).

Third, our findings can be sensitive to the sample size and the selection of countries in our sample. Our sample includes 176 observations for 70 countries in total. The size of our analytic sample could affect the statistical power of the analysis. However, when using different specifications and different dependent variables, the direction and significance of the estimates are similar (see Appendix Table 2). Also, our sample overrepresents HICs, consisting of an equal composition of HICs (51%) and LMICs (49%), while there are 70% of LMICs at the global level (22). In fact, the overall data availability on tobacco taxation, including tobacco tax revenue, is subject to selection. Greater support for data collection is needed in more countries, especially LMICs, and future studies should further expand this research with a larger sample.

Fourth, this analysis considers cigarette excise tax revenue as tobacco excise tax revenue. In the WHO data, countries report their tobacco tax revenue as either “all tobacco” or “cigarettes only”. While there are countries reporting their tax revenues for “all tobacco”, some countries reported their excise tax revenues as for “cigarettes only”. For these countries, their cigarette excise tax revenues were used as tobacco excise tax revenue. Nevertheless, cigarettes are still the most commonly used tobacco product in all countries worldwide, and overwhelmingly so in almost all (10). Thus, cigarette excise tax revenue remains to be the largest portion of tobacco excise tax revenue.

Fifth, the overall cigarette tax score is an average of the four key component scores, and a specific component score can be more associated with tobacco excise tax revenue. Appendix Table 3 shows regression estimates using all four components together and each component separately. Using all four component scores at once, only the tax share score is associated with tobacco excise tax revenue. When each key component is regressed on tobacco excise tax revenue individually, the affordability change score and tax share score are statistically significant. Model fit statistics including adjusted R-squared, the overall F-test, and Root Mean Square Errors (RMSE) suggest that the overall score measure shows better performance compared to tax share score alone.

Sixth, the dependent variable for this study is tobacco excise tax revenue per capita which is subject to changes in the tobacco tax, smoking prevalence, and population size. Tobacco tax is included in the estimation as the overall cigarette tax score for each country and year. Smoking prevalence is not included in the estimation model since the measure can be a mediator between cigarette tax scores and tobacco excise tax revenue per capita. When we included cigarette smoking prevalence in the analysis, the direction and significance of the estimates were similar. While using a per capita measure can be subject to changes in population size, this measure enables cross-country comparisons by presenting the scope of tax revenue collection relative to

the country population. Analyses using different dependent variables such as “Tobacco excise tax revenue (%) of GDP” and “Tobacco excise tax revenue (%) of total tax revenue” show similar results in terms of the direction and significance of the coefficients (see Appendix Table 2). To help the interpretation of the results for each country, we show the increase of tobacco excise tax revenue as a % of GDP when the overall cigarette score increases by 1-point for each country (see Appendix Table 4). These estimates assume that the population size and currency values remain the same as 2018.

Conclusions

This study examines the association between the scores from the Tobacconomics *Cigarette Tax Scorecard* and tobacco excise tax revenue per capita. We find that a 1-point increase in the overall cigarette tax score is associated with an increase in tobacco excise tax revenue per capita of \$11.57 (in constant 2017 PPP international dollars). While the association was not significant for the HICs, the LMICs were found to have a positive association in which a 1-point increase in the overall cigarette tax score was associated with an increase in tobacco excise tax revenue per capita of \$11.04 (in constant 2017 PPP international dollars). Also, countries with low baseline scores were found to have a positive association where a 1-point increase in the overall cigarette tax score was associated with an increase in tobacco excise tax revenue per capita by \$ 6.77 (in constant 2017 PPP international dollars). Simulation results suggest that if countries had increased their overall cigarette tax scores to a score of 5, they would experience average increases in tobacco excise tax revenue per capita by 21.60%. Similarly, if the LMICs had increased their overall scores to their highest level, their tobacco excise tax revenue per capita could have increased by 24.90%.

Our results indicate that LMICs would experience larger increases in tobacco excise tax revenue in response to higher cigarette tax scores than HICs. Although the absolute value of tobacco excise tax revenue per capita is less in LMICs than HICs, LMICs are more likely to rely on these tax revenues than HICs. For the LMICs, tobacco taxation can be used as a source of government tax revenue to support high priority areas, particularly ones that engender growth such as health and education. A recent related study finds that higher scores from the Tobacconomics *Cigarette Tax Scorecard* are associated with lower cigarette consumption for both HICs and LMICs (17). This suggests that although higher tax scores were associated with higher tax revenues for only LMICs, higher taxes still benefit the public health of both HICs and LMICs by reducing cigarette consumption. Also, marginal effects are larger for the lower scoring countries at baseline in their association between overall tax scores and tax revenue. This suggests there are more opportunities for these countries to make improvements in

cigarette taxation and increase their government tax revenue compared to countries that are already implementing a high and well-designed excise tax on cigarettes.

This is the first study to examine tobacco taxation in relation to tobacco tax revenue at the global level with a large sample of HICs and LMICs. Our findings show that higher overall cigarette tax scores are associated with higher tobacco excise tax revenue per capita, especially for LMICs and the lower performing tobacco taxation countries at baseline. These findings are consistent with prior literature that higher and better-designed taxes increase tobacco tax revenue for the government, especially for LMICs (10). Countries should aim to reach the highest level in all four components in the *Cigarette Tax Scorecard* by increasing excise taxes to generate high absolute cigarette prices, reducing cigarette affordability, increasing cigarette tax shares, and applying better-designed tax structures. In this way, these countries would be able to reduce tobacco use and increase their tobacco tax revenue which can be allocated to higher development priorities, including health and education, and programs to help low-income smokers to quit.

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Appendix

Appendix Table 1. Scoring criteria of the Tobacconomics Cigarette Scorecard

Key component	Scoring criteria
Cigarette price	<p>The price of a 20-cigarette pack of the most-sold brand in international dollars (in 2018 purchasing power parity) is used for the scores of the Cigarette price component.</p> <ul style="list-style-type: none"> - 5: Price \geq 10.0 Intl\$ PPP - 4: $8.0 \leq$ Price $<$ 10.0 - 3: $6.0 \leq$ Price $<$ 8.0 - 2: $4.0 \leq$ Price $<$ 6.0 - 1: $2.0 \leq$ Price $<$ 4.0 - 0: Price $<$ 2.0 Intl\$ PPP
Change in cigarette affordability	<p>Change in affordability is based on the six-year trend of cigarette affordability, which is measured as a percentage of per capita GDP to purchase a 20-stick pack cigarette of the most-sold brand. Higher scores are given to countries experiencing a decreased affordability resulting from an excise tax increase.</p> <ul style="list-style-type: none"> - 5: 7.5% average annual change or higher - 4: $5.0\% \leq$ average annual change $<$ 7.5% - 3: $2.5\% \leq$ average annual change $<$ 5.0% - 2: Average annual change $<$ 2.5% - 1: Reduced affordability, but no excise tax increase - 0: Increased affordability or no statistically significant change
Tax share	<p>The tax share component is assessed using both the share of excise taxes and the share of total taxes in retail price. The average score of each of these share measures used as the score of the tax share component.</p> <p>Total Tax Share:</p> <ul style="list-style-type: none"> - 5: 75% total tax share or higher - 4: $65\% \leq$ share $<$ 75% - 3: $55\% \leq$ share $<$ 65% - 2: $45\% \leq$ share $<$ 55% - 1: $35\% \leq$ share $<$ 45% - 0: Total tax share $<$ 35% <p>Excise Tax share:</p>

	<ul style="list-style-type: none"> - 5: 70% excise tax share or higher - 4: 60% ≤ share < 70% - 3: 50% ≤ share < 60% - 2: 40% ≤ share < 50% - 1: 30% ≤ share < 40% - 0: Excise tax share <30%
Tax structure	<p>The tax structure component evaluates cigarette tax structures in multiple dimensions. Higher scores are given to countries with excise tax structures and to countries with simple, uniform tax structures.</p> <ul style="list-style-type: none"> - 5: uniform specific tax with an automatic inflation or other adjustment; or a uniform mixed system with greater share of specific tax, with an automatic adjustment for the specific component, the retail price as the base for the ad valorem component, and a minimum specific tax - 4: A uniform specific tax or uniform mixed system with a greater share of specific tax but without other features listed above - 3: A uniform mixed system with a greater share of ad valorem tax - 2: A uniform ad valorem tax - 1: A tiered specific or ad valorem excise tax - 0: No excise tax

Appendix Table 2. Alternative specifications

VARIABLES	(1) Logged tobacco excise tax revenue per capita	(2) Tobacco excise tax revenue (%) of GDP	(3) Tobacco excise tax revenue (%) of total tax revenue
Overall cigarette tax score	0.17** (0.07)	0.077*** (0.02)	0.09*** (0.03)
GDP per capita	-0.46 (0.31)	-0.26*** (0.05)	-0.33*** (0.07)
Total tax revenue (%) of GDP	-0.05 (0.07)	0.01 (0.01)	-0.06*** (0.02)
POWE	0.13* (0.07)	0.03** (0.01)	0.03** (0.01)
Population (%) of age 15-64	0.22 (0.25)	0.01 (0.03)	0.01 (0.03)
Population (%) of age 65+	0.32 (0.34)	-0.03 (0.05)	-0.03 (0.05)
Constant	-14.31 (20.03)	-6.05** (2.46)	-3.16 (2.71)
Observations	176	176	175

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3. The association between each cigarette tax component score and tobacco excise tax revenue per capita

VARIABLES	(1) All components	(2) Price only	(3) Affordability change only	(4) Tax share only	(5) Tax structure only
Price score	6.35 (8.43)	10.97 (6.70)			
Affordability change score	2.39 (2.14)		3.08* (1.62)		
Tax share score	11.63** (4.76)			11.57** (5.33)	
Tax structure score	-2.10 (3.65)				-1.86 (3.79)
GDP per capita	-49.16*** (8.65)	-52.52*** (6.99)	-55.96*** (6.67)	-54.30*** (7.09)	-58.93*** (6.09)
Total tax revenue (%) of GDP	3.12* (1.78)	2.13 (1.70)	2.06 (1.75)	2.04 (1.64)	1.491 (1.66)
POWE	6.16** (2.88)	4.28 (2.60)	6.40** (2.81)	4.82* (2.64)	4.22 (2.72)
Population (%) of age 15-64	-8.63* (4.50)	-9.72** (4.66)	-7.66 (4.80)	-7.98 (4.91)	-7.88 (4.92)
Population (%) of age 65+	8.86 (10.14)	4.05 (9.23)	11.40 (8.93)	9.15 (8.47)	8.42 (8.94)
Constant	603.5 (383.2)	818.4** (378.1)	587.0 (396.0)	626.3 (390.9)	705.8* (399.6)
Observations	176	176	176	176	176
R-squared	0.986	0.985	0.985	0.985	0.985

NOTE: Regressions include country and year fixed effects. Robust standard errors are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 4. The increase of tobacco excise tax revenue (%) of GDP when there is a 1-point increase in overall cigarette score, by country with available data

Country	Income group	Increase in tobacco excise tax revenue (%) of GDP – using all country estimates	Increase in tobacco excise tax revenue (%) of GDP – using LMIC estimates
Argentina	HIC	0.04%	-
Australia	HIC	0.02%	-
Austria	HIC	0.02%	-
Belarus	LMIC	0.05%	0.05%
Belgium	HIC	0.02%	-
Bosnia and Herzegovina	LMIC	0.07%	0.07%
Brazil	LMIC	0.06%	0.06%
Bulgaria	LMIC	0.04%	0.04%
Cambodia	LMIC	0.19%	0.18%
Cameroon	LMIC	0.18%	0.17%
Canada	HIC	0.02%	-
Chile	HIC	0.04%	-
China	LMIC	0.06%	0.06%
Colombia	LMIC	0.06%	0.06%
Croatia	HIC	0.04%	-
Czechia	HIC	0.02%	-
Denmark	HIC	0.02%	-
Estonia	HIC	0.03%	-
Ethiopia	LMIC	0.33%	0.31%
Finland	HIC	0.02%	-
France	HIC	0.02%	-
Georgia	LMIC	0.07%	0.06%
Germany	HIC	0.02%	-
Ghana	LMIC	0.14%	0.13%
Greece	HIC	0.03%	-
Guatemala	LMIC	0.09%	0.09%
Hungary	HIC	0.03%	-
Indonesia	LMIC	0.07%	0.07%
Ireland	HIC	0.01%	-
Italy	HIC	0.02%	-
Jordan	LMIC	0.08%	0.07%
Kazakhstan	LMIC	0.03%	0.03%
Latvia	HIC	0.03%	-

Mexico	LMIC	0.04%	0.04%
Morocco	LMIC	0.11%	0.11%
Myanmar	LMIC	0.19%	0.18%
Netherlands	HIC	0.02%	-
New Zealand	HIC	0.02%	-
North Macedonia	LMIC	0.06%	0.06%
Norway	HIC	0.01%	-
Panama	HIC	0.03%	-
Paraguay	LMIC	0.06%	0.06%
Peru	LMIC	0.07%	0.06%
Philippines	LMIC	0.09%	0.09%
Poland	HIC	0.03%	-
Portugal	HIC	0.03%	-
Republic of Korea	HIC	0.02%	-
Romania	LMIC	0.03%	0.03%
Russian Federation	LMIC	0.04%	0.03%
Saudi Arabia	HIC	0.02%	-
Serbia	LMIC	0.06%	0.05%
Singapore	HIC	0.01%	-
Slovakia	HIC	0.03%	-
Slovenia	HIC	0.03%	-
South Africa	LMIC	0.06%	0.06%
Spain	HIC	0.02%	-
Sri Lanka	LMIC	0.07%	0.07%
Sweden	HIC	0.02%	-
Switzerland	HIC	0.01%	-
Uganda	LMIC	0.29%	0.28%
Ukraine	LMIC	0.08%	0.08%
United Kingdom of Great Britain and Northern Ireland	HIC	0.02%	-
Uruguay	HIC	0.04%	-
Uzbekistan	LMIC	0.12%	0.11%

Note: The estimates assume that population size and currency values in each country remains the same as 2018.