

# *As Countries Improve Cigarette Tax Policy, Cigarette Consumption Declines*

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# Abstract

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## Background

In November 2021 the Tobacconomics team released the second edition of the Cigarette Tax Scorecard, which assesses countries' performance on cigarette excise tax policies based on best practices—in price, change in affordability, optimal tax structure, and tax share of price—on a five-point scale. This study examines the association between the Tobacconomics overall cigarette tax scores and cigarette consumption in 97 countries during the period of 2014–2020.

## Methodology

Data on countries' retail cigarette sales from 2014 to 2020 are drawn from the proprietary Euromonitor International database. Data on countries' overall cigarette tax scores are from the *Tobacconomics Cigarette Tax Scorecard* (2nd edition). Information on countries' tobacco control environments are from the relevant years' *WHO Report on the Global Tobacco Epidemic*, and demographic characteristics such as gross domestic product (GDP) are drawn from the World Bank's World Development Indicators (WDI) database. Ordinary least squares (OLS) regressions are employed to examine the link between countries' overall cigarette tax scores and cigarette consumption. All regressions control for countries' tobacco control environments—measured by scores from four components of the WHO's MPOWER framework (smoke free places, cessation, warning labels, and marketing restrictions)—and countries' demographic characteristics, such as GDP per capita, percentage of the population aged 15–64, percentage of the population aged 65 and older, year indicators, and country fixed effects.

## Results

We find that each unit increase in the overall cigarette tax scores is significantly associated with a reduction of 8.50 percent in countries' per capita cigarette consumption during 2014–2020. The reduction is more pronounced in low- and middle-income countries (LMICs) (9.40 percent) than in high-income countries (HICs) (6.30

percent). Our simulation results suggest that the modest improvement in scores from 2014 to 2020 reduced consumption by 3.27 percent, while consumption could have been reduced by an additional 17 percent had countries implemented optimal tax policies that would earn the highest score of 5. Moreover, an increase in a country's overall cigarette tax scores from a 0 in 2014 to a 5 in 2020 would lead to a reduction of 46.67 percent in per capita cigarette consumption. The reduction is larger in LMICs (49.01 percent) than in HICs (39.56 percent).

## Conclusions

Our results provide evidence on the association between higher cigarette tax scores and lower cigarette consumption, which supports recommendations on strengthening countries' cigarette tax systems from the WHO Framework Convention on Tobacco Control (FCTC) Article 6 guidelines, the *WHO Technical Manual on Tobacco Tax Policy and Administration*, and the World Bank *Tobacco Tax Reform and Curbing the Epidemic* reports. Our results suggest that to reduce tobacco consumption governments must strive to implement all four components in the Cigarette Tax Scorecard at the highest level by implementing tax rates that significantly increase absolute cigarette prices, reducing cigarette affordability, increasing tax shares of cigarette prices, and applying appropriate tax structures to further reduce tobacco use and its associated burdens.

**Keywords:** Tobacconomics cigarette tax scorecard, cigarette consumption, cigarette tax policies

## Introduction

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Tobacco use is the leading cause of preventable death worldwide, with more than eight million deaths each year (1). Most of these preventable deaths occur in low- and middle-income countries (LMICs). Research shows that a significant tobacco tax increase that leads to higher prices is the most effective and cost-effective tobacco control policy tool for reducing tobacco use (2). However, many countries—particularly

LMICs—have been slow to adopt these policies, or they do not implement these policies effectively.

In 2020, to facilitate policy makers' comparative evaluation of their country's current cigarette tax policies, the Tobacconomics team released the first edition of the *Tobacconomics Cigarette Tax Scorecard* assessing countries' cigarette tax policy performance on a five-point scale. The Scorecard synthesizes established best practices, focusing on four key components: 1) cigarette price, 2) changes in the affordability of cigarettes over time, 3) the share of taxes in retail cigarette prices, and 4) cigarette tax structures. The Scorecard shows that most countries did not tax cigarettes effectively during 2014–2018, with nearly half of them scoring less than 2.0 out of the highest score of 5.0, and with limited improvement over the past six years (3). In November 2021 the Tobacconomics team released the second edition of the Scorecard, which shows that some countries improved their tobacco tax systems during 2014–2020, but the improvements were insufficient to significantly decrease tobacco use (4).

Previous studies have examined the effects of each cigarette tax component on cigarette smoking. Higher cigarette prices have been shown to decrease overall tobacco consumption (5, 6), cause current smokers to quit (7), and prevent young people from starting smoking (8, 9). Similarly, studies have shown that as cigarettes become less affordable, consumption decreases (10, 11). Affordability is often measured as relative income price (RIP)—the percentage of per capita income required to purchase 100 packs of cigarettes. RIP counterintuitively increases as affordability decreases: a one-percent increase in RIP is estimated to reduce cigarette consumption by 0.49–0.57 percent (10). A higher share of taxes in retail cigarette prices also generally indicates higher retail cigarette prices and thus reductions in cigarette consumption (12). More complicated tax structures are significantly associated with higher cigarette consumption. This is typically due to higher price variation and opportunities for smokers to substitute with cheaper cigarettes (13): changing from a specific to an ad valorem structure is associated with an increase of 6–11 percent in

cigarette consumption, and changing from a uniform to a tiered structure is associated with an increase of 34–65 percent in cigarette consumption (13).

Despite growing evidence on the effects of each cigarette tax component on cigarette smoking, little is known about the effects of all four cigarette tax components on actual smoking behaviors, especially across countries. To address this research gap, this study examines the relationship between a comprehensive set of cigarette tax policies—measured by the Tobacconomics overall cigarette tax scores—and cigarette consumption and tests the hypothesis that countries with higher overall cigarette tax scores are more likely to experience lower cigarette consumption during 2014–2020. Using data from the second edition of the *Tobacconomics Cigarette Tax Scorecard*, we utilize regression analysis to evaluate this relationship while controlling for each country’s tobacco control environment, demographic characteristics, and potential observed and unobserved time- and country-specific factors that may affect cigarette consumption.

## Methodology

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### *Data*

#### *Tobacconomics cigarette tax scores*

Data on countries’ overall cigarette tax scores for 2014, 2016, 2018, and 2020 are drawn from the second edition of the *Tobacconomics Cigarette Tax Scorecard* (4). The Scorecard (2nd edition) assesses cigarette tax policy performance in 160 countries on a five-point scale based on four key components of cigarette taxation: 1) cigarette price, 2) changes in cigarette affordability, 3) tax share of price, and 4) tax structure. The Scorecard measures countries’ performances on each of the four components on a scale of 0–5, with a score of 5 indicating the strongest performance. The composite overall cigarette tax scores are then constructed as the average of all four component scores and could range from 0, for countries with a score of 0 on all four components, to 5, for countries with a score of 5 on all four components (4).

To examine the link between cigarette tax scores and cigarette consumption, we use countries' overall cigarette tax scores instead of all four component scores. Because the four component scores are highly collinear, including all four of them in the analyses would likely underestimate the effectiveness of these scores in reducing cigarette consumption. In addition, by using overall cigarette tax scores, we utilize the greatest possible variation in scores over time to assess the link between the scores and cigarette consumption.

### *Euromonitor International retail cigarette sales*

The Euromonitor International cigarette and tobacco country reports provide information on countries' retail sales of cigarettes defined as duty-paid, machine-manufactured white-stick products for 2014–2020 (14). This definition of cigarettes is designed to exclude the volume of non-machine-manufactured products such as bidis/beedis and other smoking products made with tobacco that do not resemble cigarettes as recognized in the United States or Europe or are not machine-manufactured (14). Annual per capita cigarette consumption for each year in a country is derived as the ratio of the country's total retail cigarette sales to the size of the population aged 15 and older.

### *Countries' tobacco control environments*

Data on countries' tobacco control environments—measured by four elements (POWE) of the MPOWER scores for years 2014, 2016, 2018, and 2020—are from the *WHO Report on the Global Tobacco Epidemic* for the years 2015, 2017, 2019, and 2021 (1,15-17). The MPOWER measures were introduced by WHO in 2008 to assist Parties with implementation of the WHO Framework Convention on Tobacco Control (FCTC). The MPOWER package includes six measures: 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). These measures have been shown to be effective in reducing smoking and provide guidelines for countries as to where more action is needed (15).

For the POWE measure, the values range from 1 to 5. A score of 1 demonstrates no known or recent data or data that are not both recent and representative of the national population. A score of 2–5 indicates the lowest to the highest level of policy implementation. Since the *M* measure for monitoring is not related to a specific intervention, and the Tobacconomics cigarette tax scores already measure the performance of tax policies including the *R* measure for tax increases, *M* and *R* scores are excluded from the analyses. The composite POWE scores are then constructed as the sum of each POWE score for each country and survey year and included in the analyses. The composite POWE scores could range from a low score of 4 to a high score of 20.

### *Countries' demographic information*

The information on countries' demographic characteristics—such as GDP per capita, percentage of the total population aged 15–64, and percentage of the total population aged 65 and older—are gathered from the World Bank (WB) World Development Indicators database (18). We control for GDP per capita and purchasing power parity (PPP) (constant 2017 international dollars) in the analyses. GDP per capita in PPP is derived as gross domestic product converted to international dollars using purchasing power parity rates (18). We also construct a high-income country dummy that classifies countries as high-income based on the WB classification for each survey year.

To compile the final analytical sample, we merge all the data using year and country identifiers. The final sample includes only countries with no missing values of countries' retail cigarette sales and overall cigarette tax scores. Thus, the final sample includes 97 countries. Due to a small number of missing values of overall cigarette tax scores for a few countries in certain years, our final sample includes 381 country-year observations for years 2014, 2016, 2018, and 2020. Approximately 44 percent of countries in the sample are high-income countries.

## **Statistical Analyses**

### *Main analyses*

To allow for the nonlinear relationship between countries' overall cigarette tax scores and cigarette consumption, we use log of per capita cigarette consumption as the main outcome of the analyses. We use ordinary least squares (OLS) regressions to examine the association between countries' overall cigarette tax scores and cigarette consumption. All regressions control for countries' tobacco control environment (POWE), country-level GDP per capita, percentage of the population aged 15–64, percentage of the population aged 65 and older, year indicators, and country fixed effects. By including both year and country indicators in the regressions, we control for potential observed and unobserved time- and country-specific factors that may affect cigarette consumption. Standard errors are clustered at the country level to adjust for intertemporal correlations. All analyses are conducted in Stata v.15.0.

### *Simulations*

Using the estimated coefficients in the main analyses, we estimate the reduction in consumption attributable to the score increases from 2014 to 2020, as well as the additional reduction if all countries had increased their overall scores to 5 by 2020. Specifically, we first estimate the main regression analyses and use the Stata command “predict” to estimate the average consumption in 2020 under the three scenarios: 1) all countries have their actual scores from 2014 in 2020, 2) all countries have their actual scores from 2020 in 2020, and 3) all countries have a score of 5 in 2020. The percent reduction in consumption attributable to the score increases from 2014 to 2020 is calculated as the ratio of the difference between the estimated average cigarette consumption in 2020—in the second scenario and the first scenario—to the estimated average cigarette consumption in 2020 in the first scenario. Similarly, the percent reduction in consumption if all countries had increased their overall scores to 5 by 2020 is calculated as the ratio of the difference between the estimated average cigarette consumption in 2020—in the third scenario and the first scenario—to the estimated average cigarette consumption in 2020 in the first scenario.



Using the estimated coefficients in the main analyses, we further predict countries' per capita cigarette consumption for each year under two different scenarios: 1) all countries with a score of 0 in 2014 and 2) all countries with a score of 5 in 2020. Specifically, we reset countries' overall cigarette tax scores to all 0s and all 5s. We then predict countries' per capita cigarette consumption under each scenario using the Stata command "predict." We calculate the predicted percent reductions in cigarette consumption under two scenarios by dividing the difference between the predicted cigarette consumption, in 2020 and in 2014, by the predicted cigarette consumption in 2014.

### *Sensitivity analyses*

Since it may take a year or longer for policies (scores) to have measurable effects on cigarette consumption, we regress the current (time =  $t$ ) cigarette consumption on one lagged period (time =  $t-1$ ) of countries' overall cigarette tax scores to further examine the link between the scores and cigarette consumption. Due to a two-year gap between the releases of the *WHO Report on the Global Tobacco Epidemic* that are used to construct the Tobacconomics cigarette tax scores,  $t-1$  represents a two-year difference.

## **Results**

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Figure 1 shows changes over time in countries' overall cigarette tax scores and per capita cigarette consumption during 2014–2020. While countries' overall cigarette tax scores increased from 2.23 in 2014 to 2.53 in 2020, countries' per capita cigarette consumption decreased from more than 1,060 cigarette sticks in 2014 to 877 cigarette sticks in 2020.

Figure 1. Countries' overall cigarette tax scores and per capita cigarette consumption, 2014–2020

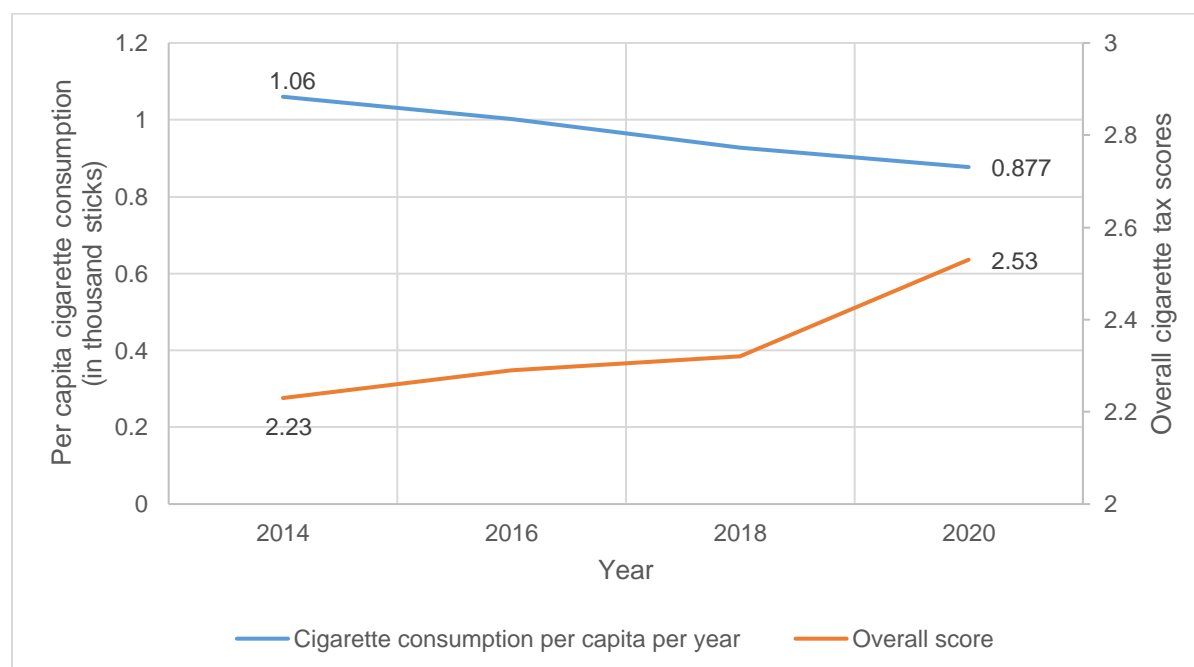


Table 1 presents summary statistics of the analytical sample. On average, the per capita cigarette consumption was 967 cigarette sticks per year. The overall cigarette tax score was 2.339—just less than half of the highest score of 5, indicating ample room for improvement. The average score of POWE was 15.601 out of the highest score of 20. The average GDP per capita was approximately 25,770 USD. The average percentages of the population aged 15–64 and aged 65 and older were 65.38 percent and 11.13 percent, respectively.

Table 1. Summary statistics

Variable	Mean	SD
Per capita cigarette consumption (in thousand sticks)	0.967	0.667
Per capita cigarette consumption (in thousand sticks) – HICs	1.096	0.462

Per capita cigarette consumption (in thousand sticks) – LMICs	0.876	0.769
Overall cigarette tax score	2.339	1.166
Overall cigarette tax score – HICs	2.999	0.927
Overall cigarette tax score – LMICs	1.871	1.090
GDP per capita (in ten thousand dollars)	2.577	2.042
POWE score	15.601	2.366
% population aged 15–64	65.379	5.368
% population aged 65 and older	11.128	6.603
N of Obs.	381	
N Countries	97	

Note: SD = standard deviations

Table 2 shows the association between countries' overall cigarette tax scores and cigarette consumption. The estimates suggest that a unit increase—one full point on the Scorecard—in countries' overall cigarette tax scores was significantly associated with a reduction of 8.50 percent in countries' per capita cigarette consumption. The reduction was more pronounced in LMICs than in HICs. Specifically, a unit increase in overall cigarette tax scores was significantly associated with a reduction of 6.30 percent in per capita cigarette consumption in HICs, while a similar increase was significantly associated with a 9.40-percent reduction in per capita cigarette consumption in LMICs.

**Table 2. The link between countries' overall cigarette tax scores and cigarette consumption, 2014–2020**

Outcome	Log (cigarette consumption)		
	Whole sample	HICs	LMICs
Overall cigarette tax score	-0.085***	-0.063***	-0.094**
(SE)	(0.017)	(0.014)	(0.028)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes

Mean (consumption in thousand sticks)	0.967	1.096	0.876
Mean (overall cigarette tax score)	2.339	2.999	1.871
N of Obs.	381	158	223
N of countries	97	43	58

Note: Standard errors (SE) in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . All regressions control for POWE scores, country-level GDP per capita, percentage of the population aged 15–64, percentage of the population aged 65 and older, year fixed effects, and country fixed effects. Standard errors were clustered at the country level.

Table 3 presents simulation results that predict countries' per capita cigarette consumption under different scenarios, along with the calculated percent reduction. As Table 3 indicates, the modest improvement in scores from 2014 to 2020 reduced consumption by 3.27 percent, while consumption could have been reduced by an additional 17 percent if countries had implemented optimal tax policies that would earn the highest score of 5. On the other hand, if all countries had a score of 0—with no tax policies at all in 2014, the per capita cigarette consumption would be 1,318 sticks. If all countries had a score of 5—with tax policies implemented at the highest level in 2020, the per capita cigarette consumption would have decreased to 703 sticks. In other words, by implementing cigarette tax policies at the highest level in 2020, countries would experience a reduction of 46.67 percent in per capita cigarette consumption. As Table 3 further suggests, the reduction would be larger in LMICs (49.01 percent) than in HICs (39.56 percent).

**Table 3. Simulation results, 2014–2020**

*Panel A: Reduction in consumption attributable to score increases from 2014 to 2020 and if all countries had increased their scores to 5 by 2020*

Scenario	Actual scores in 2014	Actual scores in 2020	% Reduction
Cigarette consumption in 2020 – whole sample	0.887	0.858	3.27%

(in thousand sticks)			
Scenario	Actual	All 5 in 2020	% Reduction
	scores in 2014		
Cigarette consumption in 2020 – whole sample (in thousand sticks)	0.887	0.703	20.74%
<i>Panel B: Reduction in consumption if all countries had increased their scores from 0 in 2014 to 5 in 2020</i>			
Scenario	All 0 in 2014	All 5 in 2020	% Reduction
Cigarette consumption – whole sample (in thousand sticks)	1.318	0.703	46.67%
Cigarette consumption – HICs	1.471	0.889	39.56%
Cigarette consumption – LMICs	1.161	0.592	49.01%

Note: Countries' average actual overall scores in 2014 is 2.23, while countries' average actual overall scores in 2020 is 2.53. The percent reduction is calculated as the ratio of the difference in cigarette consumption between 2020 and 2014 to cigarette consumption in 2014.

Results of sensitivity analyses further suggest the robustness of our findings. Appendix Table A1 shows the link between the past overall cigarette tax scores at time ( $t-1$ ) and current cigarette consumption at time  $t$  during 2016–2020. The estimates suggest that countries with higher past overall cigarette tax scores experienced significant reductions in current cigarette consumption ( $p < 0.05$ ).

## Limitations

This study has some limitations. First, our measure of cigarette consumption captured only legal retail cigarette sales and excluded the illicit sales. Due to the lack of reliable illicit trade data, we could not account for illicit cigarette sales in our analyses.

Thus, the actual reductions in cigarette consumption that are associated with increases in countries' overall cigarette tax scores may be higher than our estimates.

Second, our results may be sensitive to which countries are included in the analytical samples. Globally, there were 58 HICs (29.74 percent) and 137 LMICs (70.26 percent) in 2020 (18), but our sample contains a higher proportion of HICs (44 percent). Our sample also includes a greater share of countries with higher performance on both cigarette tax scores and POWE scores. Thus, the association between countries' overall cigarette tax scores and cigarette consumption may be underestimated. Despite this, our results are robust to different sensitivity analyses and are consistent with the findings of previous studies.

Third, cigarette consumption is a stock value of both smoking participation and smoking intensity. Using the aggregate data of overall cigarette tax scores and cigarette consumption at the national level did not allow us to examine differential effects of cigarette tax policies on smoking participation and smoking intensity, nor the effects of those policies on different subpopulations of interest. Thus, future research may benefit from utilizing longitudinal individual-level data to investigate the differential effects of cigarette tax policies on those outcomes and subpopulations.

Fourth, the Tobacconomics overall cigarette tax scores are constructed as the average of the four tax components, implying that each of the four tax component scores has equal weight. It is possible that some tax components are more effective than other measures in reducing smoking and should be assigned greater weight. Future research should further investigate the effects of those tax components with different assigned weights.

## Conclusions

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This study examines the link between the Tobacconomics cigarette tax scores and countries' cigarette consumption and documents a significant association between higher overall cigarette tax scores and reduced cigarette consumption. Specifically, a

unit increase in overall cigarette tax scores is significantly associated with a reduction of 8.50 percent in countries' per capita cigarette consumption. Our results also suggest that the association between higher cigarette tax scores and lower cigarette consumption was more pronounced in LMICs than in HICs. A unit increase in cigarette tax scores was significantly associated with a reduction of 9.40 percent in cigarette consumption in LMICs and a reduction of 6.30 percent in cigarette consumption in HICs. Our simulation results suggest that the modest improvement in scores from 2014 to 2020 reduced consumption by about 3.27 percent, while consumption could have been reduced by an additional 17 percent had countries implemented optimal tax policies that would earn the highest score of 5.

Our simulation results further suggest that if all countries had increased their overall cigarette tax scores from 0 in 2014 to 5—the highest score—in 2020, they would have experienced a reduction of 46.67 percent in per capita cigarette consumption during the period. Similarly, if all HICs had raised their overall cigarette tax scores from 0 in 2014 to 5 in 2020, they would have experienced a reduction of 39.56 percent in per capita cigarette consumption, while LMICs would have experienced a larger reduction of 49.01 percent in the same scenario. Our results are in line with the findings of previous studies that document larger effects of tobacco control policies (i.e., prices) on cigarette smoking in LMICs. While a 10-percent increase in cigarette prices was estimated to decrease cigarette smoking by 2.5 percent to 5 percent, with an average of 4 percent, in HICs, a similar increase would reduce cigarette smoking by 2 percent to 8 percent, with an average of 5 percent, in LMICs (15).

Our study is the first to examine the effects of comprehensive cigarette tax policies—measured by the Tobacconomics overall cigarette tax scores—on actual smoking behaviors across countries. Our results indicate that higher overall cigarette tax scores were significantly associated with reduced cigarette consumption, and that the reduction was more pronounced in LMICs than in HICs. Our results are in line with recommendations on strengthening countries' cigarette tax systems from the WHO Framework Convention on Tobacco Control (FCTC) Article 6 guidelines, the *WHO*

*Technical Manual on Tobacco Tax Policy and Administration*, and the World Bank *Tobacco Tax Reform and Curbing the Epidemic* reports. Our results suggest that countries—particularly LMICs—should strive to implement all four components in the Cigarette Tax Scorecard at the highest level by implementing tax rates that significantly increase absolute cigarette prices, reducing cigarette affordability, increasing the tax share of cigarette prices, and applying appropriate tax structures to further reduce tobacco use and its associated burdens.



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## Appendix

Appendix Table A1. The link between past overall cigarette tax scores and current cigarette consumption, 2016–2020

Outcome	Log (cigarette consumption)		
	Whole sample	HICs	LMICs
Lag (overall score)	-0.076*	-0.038+	-0.098*
(SE)	(0.029)	(0.021)	(0.042)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Mean (consumption in thousand sticks)	0.941	1.054	0.861
Mean (lag overall score)	2.287	2.981	1.794
N of Obs.	284	118	166
N of countries	97	42	57

Note: Standard errors (SE) in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . All regressions control for POWE scores, country-level GDP per capita, percentage of the population aged 15–64, percentage of the population aged 65 and older, year fixed effects, and country fixed effects. Standard errors were clustered at the country level.