

Appendices

Main regression model

The following regression framework is used to examine the association between countries' overall cigarette tax score and per capita cigarette consumption.

$\text{Log (per capita cigarette consumption)}_{(it)} = \alpha_0 + \alpha_1 \text{ Overall score}_{(it)} + \alpha_2 \text{ High income}_{(it)} + \alpha_3 \text{ Rescaled GDP per capita}_{(it)} + \alpha_4 \text{ POWE score}_{(it)} + \alpha_5$

$\text{Percent population aged 15-64}_{(it)} + \alpha_6 \text{ Percent population aged 65 and over}_{(it)} + \sum_{t=2016}^{2018} \text{time}_{(t)} + \sum_{i=2}^{97} \text{country}_{(i)} + \varepsilon_{(it)}$

in which: $i = 1, 2, \dots, 97$ (index of countries)

$t = 2014, 2016, 2018, \text{ and } 2020$ (index of years)

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' GDP per capita is rescaled in ten thousand dollars for easier interpretation. The omitted year is year 2014.

Similar regressions are used to examine the association between overall tax scores and cigarette consumption among HICs and LMICs. The only difference is that the high-income country dummy is not included in those regressions.

Main regression results**Appendix Table A1: Main Regression Results**

Sample	Whole sample	HICs	LMICs
Outcome: log (per capita cigarette consumption)			
Overall score	-0.09*** (0.02)	-0.06*** (0.01)	-0.09** (0.03)
Rescaled GDP per capita (in ten thousand dollars)	0.03 (0.04)	-0.00 (0.02)	0.29 (0.25)
High income country dummy	0.10*** (0.02)	- -	- -
POWE score	0.03* (0.01)	0.01 (0.01)	0.03 (0.02)
% Population aged 15-64	-0.04 (0.02)	-0.05 (0.03)	-0.04 (0.03)
% Population aged 65 and over	-0.06 (0.04)	-0.03 (0.04)	-0.12 (0.06)
<i>Year dummies</i>			
Year 2016	-0.07** (0.02)	-0.08* (0.03)	-0.05 (0.03)
Year 2018	-0.14*** (0.04)	-0.18*** (0.05)	-0.11 (0.05)
Year 2020	-0.18*** (0.05)	-0.24** (0.07)	-0.13 (0.07)
N of Observations	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. Due to a large number of country dummies included in the regressions, the estimates of the country dummy variables are not shown in the table.

Information on how each MPOWER measure is scored in the WHO Reports on the Global Tobacco Epidemic

M Score	1	No known data, or no recent data (since 2011) or data that is not both recent and representative (national population)
	2	Recent and representative data for either adults or youth
	3	Recent and representative data for both adults and youth
	4	Recent, representative, and periodic data (at least every 5 years) for both adults and youth
P Score	1	Data not reported or not categorized
	2	Up to two public places completely smoke-free
	3	Three to five public places completely smoke-free
	4	Six to seven public places completely smoke-free
	5	All public places completely smoke-free (or at least 90% of the population covered by complete subnational smoke-free legislation)
O Score	1	Data not reported
	2	None
	3	NRT (Nicotine replacement therapy) and/or some cessation services (neither cost-covered)
	4	NRT and/or some cessation services (at least one of which is cost-covered)
	5	National quit line, and both NRT and some cessation services cost-covered
W Score	1	Data not reported
	2	No warnings or small warnings (<30%) Medium size warnings (30%-49%) missing one or more appropriate characteristics OR large warnings (≥50%) missing four or more appropriate characteristics
	3	appropriate characteristics Medium size warnings (30%-49%) with all seven appropriate characteristics OR large warnings (≥50%) missing one or more appropriate characteristics
	4	characteristics
	5	Large warnings (≥50%) with all seven appropriate characteristics
E Score	1	Data not reported
	2	Complete absence of ban, or ban that does not cover national TV, radio, and print media
	3	Ban on national TV, radio, and print media only
	4	Ban on national TV, radio, and print media as well as on some but not all other forms of direct and/or indirect advertising
	5	Ban on all forms of direct and indirect advertising (or at least 90% of the population covered by complete subnational legislation)
R Score	1	Data not reported
	2	≤25% of retail price is tax
	3	26–50% of retail price is tax
	4	51–75% of retail price is tax
	5	>75% of retail price is tax

Source: WHO Report on Global Tobacco Epidemic Report 2017 (<https://apps.who.int/iris/handle/10665/255874>)

Information on how each component of cigarette taxation is calculated in the Tobacconomics Cigarette Tax Scorecard

The first two components of the Scorecard scores are cigarette price – price of a 20-cigarette pack of the most sold brand in international dollars (Intl\$), adjusted for purchasing power parity (PPP), and change in affordability. Each component is scored on a scale of 0 to 5. The scoring for those components is as follows.

Scoring – Cigarette Price

- 5: Price \geq 10 Intl\$ PPP
- 4: $8 \leq$ price $<$ 10
- 3: $6 \leq$ price $<$ 8
- 2: $4 \leq$ price $<$ 6
- 1: $2 \leq$ price $<$ 4
- 0: Price $<$ 2 Intl\$ PPP

Scoring – Change in Affordability

- 5: 7.50% average annual change or higher
- 4: $5\% \leq$ average annual change $<$ 7.50%
- 3: $2.50\% \leq$ average annual change $<$ 5%
- 2: Average annual change $<$ 2.50%
- 1: Reduced affordability, but no excise tax increase
- 0: Increased affordability or no statistically significant change

The other two components of the Scorecard scores are tax share and tax structure. The Scorecard tax share component is constructed as the average of the scores for two tax share indicators—one based on the share of all taxes in cigarette prices and the other focused on the share of excise taxes in prices. The scoring for those components is below.

Scoring – Total Tax Share

- 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%

Scoring – Excise Tax Share

- 5: 70% excise tax share or higher
- 4: $60\% \leq$ share $<$ 70%
- 3: $50\% \leq$ share $<$ 60%
- 2: $40\% \leq$ share $<$ 50%
- 1: $30\% \leq$ share $<$ 40%
- 0: Excise tax share $<$ 30%

Scoring – Tax Structure

- 5: A 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

Source: Chaloupka, F.J., Drope, J., Siu, E., Vulovic, V., Mirza, M., Rodriguez-Iglesias, G., Ngo, A., Laternser, C., Lee, H.M., Dorokhina, M., & Smith, M. (2021). Cigarette Tax Scorecard (2nd Edition). Tobacconomics

<https://www.tobacconomics.org/files/research/738/tobacco-scorecard-report-2nd-ed-eng-v5.0-final-1.pdf>

Appendix Table A2: Reduction in consumption if all countries had increased their scores from 0 in 2014 to 5 in 2020

Scenario	All 0 in 2014	All 5 in 2020	% Reduction
Cigarette consumption (in thousand sticks) – whole sample	1.32	0.70	-46.67%
Cigarette consumption (in thousand sticks) – HICs	1.47	0.89	-39.56%
Cigarette consumption (in thousand sticks) – LMICs	1.16	0.59	-49.01%

Note: Using the estimated coefficients in the main analyses, we first 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.

Appendix Table A3: The link between past overall cigarette tax scores and current cigarette consumption, 2016–2020

Outcome	Log (per capita cigarette consumption)			
	Sample	Whole sample	HICs	LMICs
Lag (overall score)		-0.08*	-0.04+	-0.10*
(SE)		(0.03)	(0.02)	(0.04)
Year FE		Yes	Yes	Yes
Country FE		Yes	Yes	Yes
Mean (consumption in thousand sticks)		0.94	1.05	0.86
Mean (lag overall score)		2.29	2.98	1.79
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, high income country dummy, 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.

Appendix Table A4: Sensitivity Analyses

Sample	Whole sample		HICs	LMICs
Overall score	-0.08*** (0.02)	-0.08*** (0.02)	-0.07*** (0.02)	-0.09** (0.03)
Rescaled GDP per capita (in ten thousand dollars)	0.04 (0.04)	0.03 (0.04)	-0.00 (0.02)	0.26 (0.25)
High income country dummy	-	0.10*** (0.02)	-	-
POWE	0.03* (0.01)	-	-	-
P Group	-	0.05 (0.03)	0.01 (0.06)	0.05 (0.03)
O Group	-	0.04 (0.03)	0.04 (0.03)	0.04 (0.04)
W Group	-	0.02 (0.02)	0.00 (0.02)	0.02 (0.04)
E Group	-	0.02 (0.02)	0.02 (0.03)	-0.00 (0.03)
Percent population aged 15-64	-0.03 (0.02)	-0.04 (0.02)	-0.05 (0.03)	-0.04 (0.03)
Percent population aged 65 and over	-0.06 (0.04)	-0.06 (0.04)	-0.03 (0.04)	-0.13* (0.06)
Year dummies				
year 2016	-0.06**	-0.06*	-0.07*	-0.05

8

	(0.02)	(0.02)	(0.03)	(0.03)
year 2018	-0.14***	-0.13**	-0.17***	-0.09
	(0.04)	(0.04)	(0.04)	(0.06)
year 2020	-0.19***	-0.18**	-0.23***	-0.11
	(0.05)	(0.05)	(0.06)	(0.08)
N of Obs.	381	381	158	223
N of Countries	97	97	43	58

Note: Standard errors (SE) in parentheses. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Due to a large number of country dummies included in the regressions, the estimates of the country dummy variables are not shown in the table.

Appendix Table A5: The Association between Component Tax Scores and Cigarette Consumption

Outcome: Log (per capita cigarette consumption)

Sample	Whole sample	HICs	LMICs
Price score	-0.04 (0.03)	0.00 (0.02)	-0.07 ⁺ (0.04)
Affordability score	-0.01 ⁺ (0.01)	-0.02* (0.01)	-0.01 (0.01)
Average tax share score	-0.05* (0.02)	-0.07** (0.02)	-0.06 ⁺ (0.03)
Tax structure score	-0.02 (0.01)	0.02 (0.03)	-0.03 ⁺ (0.02)
Mean (consumption in thousand sticks)	0.97	1.10	0.88
Mean (component score)			
Price score	2.51	3.42	1.86
Affordability score	1.39	1.70	1.17
Average tax share score	2.66	3.48	2.07
Tax structure score	2.80	3.39	2.39
N of Countries	97	43	58
N of Obs.	381	158	223

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, high income country dummy, percentage of the population aged 15-64, percentage of the population aged 65 and over, year fixed effects, and country fixed effects. Standard errors were clustered at the country level.