Modeling the Impacts of Tobacco Taxes

MODELING THE IMPACTS OF TOBACCO TAXES

Review of three most commonly used models for:

- World Health Organization's (WHO)TaXSiM model,
- The University of Cape Town's (UCT) TETSiM model, and
- Tobacconomics model of the University of Illinois Chicago (UIC).

OUTLINE

- The purpose of the models
- Structure
- Data requirement (inputs)
- Assumptions
- Differences between models
- Extensions

TOBACCO TAX MODELS

PURPOSE OF THE MODELLING

Impact of tobacco taxes on:

- government revenues
- changes on demand, population health

Very useful tool to lobby for excise tax policy changes

WHO SHOULD USE THE SIMULATION MODELS

- Policy makers
- Scientific research centres (Universities, think-thanks)
- NGOs
- Other relevant stakeholders

HOW TO APPROACH TO SIMULATION MODELLING

- Easy to access and apply in practice
- Basic data needed
- Customisable models

Tobacco tax model structure

Re-create current system
to verify the data and equations

Initial values of:
- Prices
- Consumption (or sales)
- Excise tax
- VAT
- Other taxes

Health inputs

- Adult and youth population
- Adult and youth prevalence
- Elasticity of adult and youth smoking prevalence;
- Future prevalence among current youth;
- Smoking intensity

Increase of excise tax or change of tax structure

Higher prices

Assumption
probability of dying prematurely; reduced risk of premature death

Assumptions
The behavior of the tobacco industry and smokers

Health simulation

- Reduction in prevalence
- Reductions in the number of youth and adult smokers
- Reduction in the number of smoking attributable deaths

New equilibrium

Changes in:
- Quantity consumed
- Excise tax revenue
- Total tax revenue
- Industry margins and profits

INPUT DATA

PRICE	TAX BASE	TAX	QUANTITY	BASELINE-GOVERNMENT REVENUE
Producers and importers **Collected by tax authorities or** via **market surveys** **Commercial data providers** **By brand or market segment**	**Pack of 20 sticks** Price: **Retail sales price** (RSP) – Europe **Production** price or **Import price** (West Africa)	**Specific, ad valorem, or a combination** **Uniform** or **multiple** rates **By price segments** **By type** (length, soft or hard pack) **By type of production**	Data on **sales by government.** **Production and import data,** Number of **excise stamps issued** **HES or survey data**	Consumption*total excise (including VAT)

PRICE AND TAX DATA – DIFFERENT MODELS

TaXSiM

- **The information on brands** that make up at least 80 percent of the market.
- **Up to 20 tax tiers**

TETSiM

- **Aggregated data** – most sold brand, cheapest, premium, import prices
- Both models allow for **different tax bases**

TOBACCONOMICS

- **Weighted average retail price** per unit of tobacco products
- **Tax base** – retail price

All models allow for different tax structures, including specific, ad valorem, or mixed excise taxes, as well as a minimum tax level.

EXAMPLE – INPUT DATA AND BASELINE SIMULATION

INPUT DATA 2023		
Specific excise per 1,000 cigarettes	49 €	
Specific excise per pack (20 cigarettes)	0.98 €	
Ad valorem tax	24.5%	
WAPC	2.7	
Overall excise tax	0.98+0.245*2.7 = 1.64 €	
% of overall tax in WAPC	60.74%	
Overall tax + VAT (21%)	2.10 €	
% of tax collected by the government	78.15%	
Net of tax price (margin)	2.7-2.10= 0.60€	

$$P_0 = (ETS_0 + ETA_0 \times P_0 + NOT_0) \times (1 + VAT)$$

Market segment	Price, /pack	Quantity, packs	Market share	Specific excise	Ad valorem excise	Total excise	VAT/pack	Total Tax	Net of tax	Total Excise revenue	Total revenue	Total market value
Premium	3.4	10,519,365	18.5%	0.98	0.84	1.82	0.60	2.42	1.02	19,174,699	25,455,020	36,186,616
Mid	2.7	33,207,115	58.4%	0.98	0.65	1.64	0.46	2.10	0.60	54,509,479	69,839,640	88,330,926
Economy	2.3	13,135,005	23.1%	0.98	0.57	1.64	0.40	2.04	0.28	21,561,111	26,849,850	30,473,212
Total	2.73	56,861,485	100%	0.98	0.68	1.68	0.48	2.17	0.61	95,245,289	122,144,510	154,990,753

ASSUMPTIONS – REVENUE SIMULATIONS

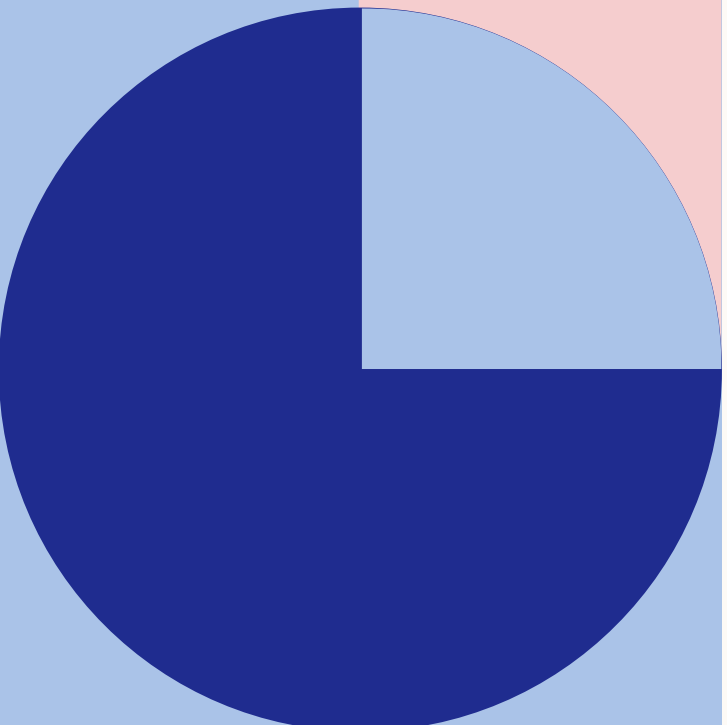
CHANGES TO SMOKERS' DEMAND IN RESPONSE TO PRICE CHANGES

Smokers' responses can include:

- **Dcreasing smoking intensity**,
- **Quitting**), or
- **moving to cheaper brands** or the illicit market

REACTIONS OF THE TOBACCO INDUSTRY

- Measured through the amount of **pass-through of tax increases to the retail price.**



ASSUMPTION-PRICE ELASTICITY

OWN-PRICE ELASTICITY OF DEMAND

Country-specific estimates

HI most being around -0.4., LMIC most around -0.5.

Youth elasticity are around **double those of adults,** as are long-run compared to short-run price elasticities.

Assumption that **low-income smokers are more price-sensitive**.

CROSS PRICE ELASTICITY OF DEMAND

Many models do not use cross price or income elasticities directly

- **TaXSiM** - an assumed **trading up or down factor** in place of a cross-price elasticity.
- **The Tobacconomics** model allows the substitution between tobacco products

ARC VERSUS POINT ELASTICITY

When the changes in price and quantity are large, arc elasticity is more appropriate.

- **Point elasticity** – TaXSiM and Tobacconomics
- **Arc elasticity** – TETSiM

ASSUMPTIONS:
INCOME ELASTICITY OF DEMAND

- It matters less for short-term forecasts, **but over time it should be taken into account.**

- **TaXSiM** does not use explicitly income elasticity, it is assumed that there is a positive relationship between a smokers' income and their preferred brand or price segment so the assumed amount of trading up or down can reflect this.

- **TETSiM** – in case of multi year forecast (model extansion).

ASSUMPTIONS: INDUSTRY PASS THROUGH

- The net of tax portion of the retail price includes different elements (CIF/Producer price, other costs, inflation and profits).
- **Tobacconimics - full pass-through** but can include a factor to increase or decrease net-of-tax.
- **TaXSiM**, the NoT is divided into the **producer price and an industry distribution margin** (**DM**), that is assumed to be a percent (η) of the retail price.
- **TETSiM** – NoT is **changed by an assumed λ percent increase** along with the tax increase.

HEALTH SIMULATION

HEALTH - INPUTS

Tobacconomics

- **Number of adults** (aged 18+) and youth (aged 0–17)
- **Adult smoking prevalence**

Sources: MoH, WHO, Statistical Office, Surveys, World Bank (WDI), CDC

TETSiM

Decrease of quantity of cigarettes consumed estimated in first part of the model

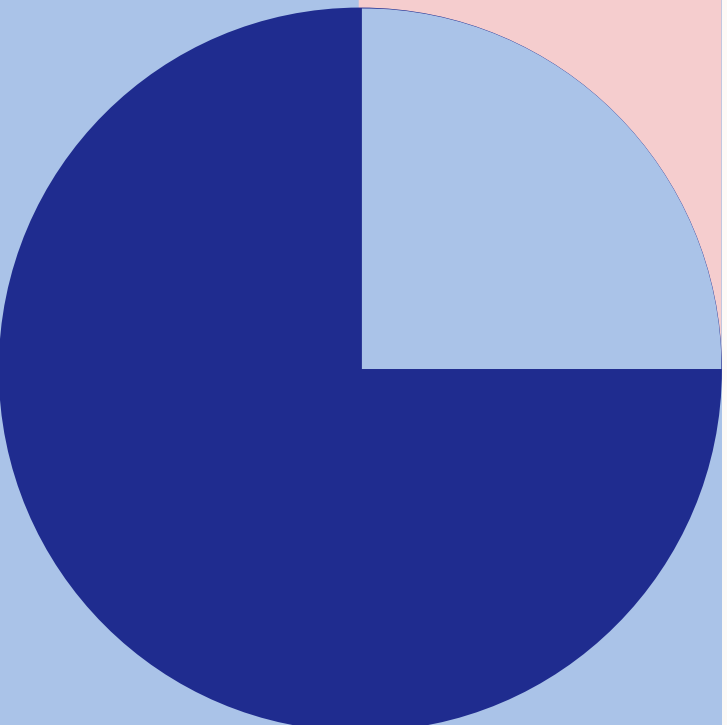
HEALTH - ASSUMPTIONS

Tobacconomics

- **Elasticity of adult** smoking prevalence
- **Prevalence elasticity share**
- **Youth prevalence**
- **Elasticity of youth** smoking prevalence
- **Youth elasticity factor**
- **Probability of dying prematurely** from smoking-related diseases- 40%
- **Reduced risk** of premature death following cessation – 70%

TETSiM

- % decrease in cigarette consumption due to decrease in smoking prevalence is 30- 50%
- % of quitters who avoid premature death - 50%



PUBLIC HEALTH SIMULATION (TOBACCONOMICS MODEL APPLIED)

	SCENARIO I	SCENARIO II
Price increase	4.8%	4.5%
Population (ages 15+)	506,880	506,880
Prevalence of smoking	31.0%	31.0%
Prevalence elasticity	-0.52	-0.52
Percent of smokers who would die prematurely from diseases caused by smoking (DP)	40%	40%
Reduced risk from cessation	70%	70%
Adult smokers	157,133	157,133
Adult smoking deaths	62,853	62,853
Reduction in adult smoking prevalence	-2.5%	-2.4%
Fewer adult smokers	3,955	3,705
New adult smokers	153,176	153,427
Fewer adult deaths	1,107	1,037
New adult deaths	61,745	61,816

YOUTH	SCENARIO I	SCENARIO II
Price increase	4.8%	4.5%
Population (ages 0–14)	110,803	110,803
Prevalence of smoking	31.0%	31.0%
Percent of smokers who would die prematurely from disease caused by smoking (DP)	40%	40%
Future smokers	34,349	34,349
Youth smoking deaths	13,740	13,740
Reduction in youth smoking prevalence	-5.0%	-4.7%
Fewer youth smokers	1,730	1,620
New youth smokers	32,619	32,729
Fewer youth deaths	692	648
New youth deaths	13,048	13,092

In the first scenario 3,955 smokers would quit due to the price increase and smoking prevalence would decrease.

- It is assumed that 40 percent, or 1,582 of them, could die prematurely from diseases caused by smoking in the case of no price increase.
- With the tax changes, 70 percent of those who quit smoking would survive, meaning that 1,107 premature deaths would be averted.

TOBACCONOMICS - EXTENSIONS

- Complexity of the Tobacconomics model varies by country depending on data availability, from being very detailed, such as for the U.S., to being much simpler, as in the case of Pakistan and Bangladesh.

- The Bangladesh study - effects on **employment** in the tobacco sector; the Pakistan and Turkey research **incorporates illicit trade** as a factor in modeling.

- The US model goes much further in that it is adapted to account for **tax evasion and avoidance, impact on health care costs,impacts of other tobacco control policies such as smoke-free air policies,** impacts of tax increases **on** health care cost savings

- The model can incorporate other tobacco products besides cigarettes, such as roll-your-own tobacco, smokeless tobacco, cigars, and e-cigarettes.

TAXSIM AND TETSIM EXTENSIONS

TaXSiM – The next update, is to include the impact of changes in prevalence and a multi-year version that can be compared to the base year, not just each prior year, as well as other updates and corrections.

TETSiM- multi-year forecasts, planned future excise tax increases are needed along with forecasts for income or GDP per capita growth and inflation, if GDP growth is in real terms.

CONCLUSION

- Forecasts are only as good as the available data and reality of the assumptions.
- It is always good practice to test the sensitivity of results to changes in the main assumptions by calculating alternative scenarios.
- The main advantage of all presented models is that they can be easily applied in all countries, due to its flexibility and ability to be adjusted to country specificities.
- Models are customizable to the excise tax system for individual countries (programmed in Excel).

THANK YOU!