



RESEARCH ARTICLE

REVISED **Impact of cigarette price increase on health and financing outcomes in Vietnam [version 2; peer review: 2 approved, 1 approved with reservations]**Daphne C. Wu ¹, Prabhat Jha¹, Sheila Dutta², Patricio Marquez²¹Centre for Global Health Research, St. Michael's Hospital, Toronto, Toronto, ON, M5B 1W8, Canada²World Bank Group Global Tobacco Program, World Bank, Washington, DC, 20433, USA

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Abstract

Background: Vietnam had about 15 million male smokers in 2015. To reduce adult tobacco use in Vietnam through an increase in the excise tax of cigarettes, we conducted an extended cost-effectiveness analysis to examine the impact of two scenarios of cigarette price increases.

Methods: We estimated, across income quintiles, the life-years gained, treatment cost averted, number of men avoiding catastrophic health expenditure and extreme poverty, and additional tax revenue under a 32% and a 62% increase in cigarette price through increased excise tax. We considered only male smokers as they constitute majority of the smokers. We used the average price elasticity of demand for cigarettes in Vietnam of -0.53.

Results: Under both scenarios of price increase, men in the poorest quintile would gain about 2.8 times the life-years and avert 2.5 times the treatment cost averted by the richest quintile. With a 32% price increase, about 285,000 men would avoid catastrophic health expenditure; as a result, about 95,000 men, more than half of whom in the poorest quintile, would avoid falling into extreme poverty. In contrast to the distribution of health benefits, the extra revenue generated from men in the richest quintile would be 1.2 times that from the poorest quintile. With a 62% price increase, about 553,000 men would avoid catastrophic health expenditure, and about 183,000 men, more than half of whom in the poorest quintile, would avoid falling into extreme poverty. The extra revenue generated from men in the richest quintile would be 3.8 times that from the poorest quintile.

Conclusions: Higher cigarette prices would particularly benefit the poorest income quintile of Vietnamese, in terms of health and financial outcomes. Thus, tobacco taxes are an effective way to improve health and reduce poverty in Vietnam.

Keywords

Cigarette price, tobacco tax, extended cost-effectiveness analysis, tobacco economics, Vietnam, Southeast Asia

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REVISED Amendments from Version 1

We have revised the paper based on the reviewers' comments.

- We have provided more details on the tax structure, the price on which the taxes are imposed on, and factory price of cigarettes.
- We have moved the section on smoking prevalence from the Results section to the Introduction.
- In response to Reviewer 3's comments on using education level as a proxy indicator for income level, we have added this as a limitation of our study in the Discussion. Due to data limitations, we are not able to compute the income by education level.
- Since we used the price of the most-sold brand which is lower than the average cigarette price, we have added that using the price of the most-sold brand is one of the limitations of our study.
- We have now justified the choice of the two scenarios of tax increase in the Methods section.
- We have corrected the number of smokers by forms of tobacco smoked to add up to the total number of tobacco smokers.
- We have removed Table 2 as per Reviewer 2's comment that the contents of Table 2 be placed in the Introduction since it is not part of the Results

Any further responses from the reviewers can be found at the end of the article

Introduction

According to the Global Adult Tobacco Survey (GATS), about 23.8% adults aged 15 years and older or about 15.3 million adults smoked tobacco in Vietnam in 2010¹. About 97% of the cigarette smokers were males¹. By education level, the prevalence is highest among men with lower secondary and upper secondary education, and lowest among those with college education and higher (47% vs 30%). To reduce the prevalence of smoking, in 2013, the government of Vietnam launched the *National Strategy on Tobacco Control through 2020* with the target of reducing the rates of smoking from current prevalence by about 40% in youths aged 15–24 (target of 18% in 2020) and by about 20% for adults (target of 39% for men and <1% for women by 2020)². Vietnam was also one of the first countries in Asia to become a party of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2005². In 2012, the country also enacted the Law on Prevention and Control of Tobacco Harms, which significantly strengthened tobacco control policies. The new law established smoke-free places; increased the size of graphic health-warning labels; instituted a comprehensive ban on tobacco advertising, promotion, and sponsorship; and established the first Vietnam Tobacco Control Fund³. Between 2010 and 2015, the prevalence of any tobacco smoking among males only fell from 47.4% to 45.3%; the prevalence among females remained at 1%^{1,4}. The majority of the smokers smoke manufactured cigarettes (70%), with the remaining being smokers of traditional bamboo water-pipe (26%), hand-rolled cigarettes (2%), and other tobacco products (2%)⁴.

Tobacco taxation is the single most effective intervention to increase cessation rates among current smokers and to decrease initiation by young people⁵. According to Article 6 of the WHO FCTC, tobacco taxation policy is “an effective and important means of reducing tobacco consumption by various segments of the population, in particular young persons”⁶. The Guidelines for Implementation of Article 6 of the WHO FCTC recognize that effective tobacco taxes significantly reduce tobacco consumption and prevalence⁶. This consumption reduction role of tobacco taxation is due to the fact that special consumption or excise taxes increase prices of tobacco products relatively to other consumption products or income; and through this to reduce smokers' demand. In order to do that, the Guidelines recommends that: “taxes rates should be monitored, increased or adjusted on a regular basis, potentially annually, taking into account inflation and income growth developments in order to reduce consumption of tobacco products”⁶. Also, effective tobacco taxation may contribute significantly to state budgets, if increasing revenue growth outweighs the percentage decline in consumption of tobacco products.

Taxation system on tobacco products in Vietnam

There are two types of excise taxes (called Special Consumption Tax (SCT)) in Vietnam: *Ad valorem* tax, which is levied as a percentage of the base price, and specific excise tax, which is levied as a specific value per unit of a product².

Immediately after the introduction of the SCT, cigarette and tobacco-product tax rates were differentiated, creating a complex system until 2005. Since 2005, the rates have been simplified and discrimination was gradually eliminated. **Table 1** presents the evolution of SCT, and other taxes and tariffs on tobacco products since the inception of the SCT in 1990. In 1990, SCT rates on cigarettes were as follows: 50% of the factory price for filtered cigarettes and 40% of the factory price for non-filtered cigarette and cigars.

The lower tax rates on cigarettes manufactured with domestic raw materials favoured domestic brands and encouraged per adult consumption of cigarettes. As with many tax policies in transition economies, this policy was intended to support domestic tobacco cultivation while discouraging imports of raw materials, and to increase state revenues from smokers of cigarettes made from imported raw materials, who had higher income. In retrospect, these were likely unwise choices as the short term demand generation has only limited impact on the medium term supply of raw tobacco, and because the tax strategy effectively made cheaper cigarettes available that were taken up most by the poor.

However, in order to meet the requirements to join the World Trade Organization (WTO), in 2005, the National Assembly amended the SCT and approved a new VAT (Value Added Tax) Law. Under this amendment, from 2006, cigarettes were taxed at 55% and were subsequently increased to 65% in 2008. The implementation of non-discriminatory tax rates was a step forward for Vietnam's international integration policy, although

Table 1. Evolution of Tobacco Special Consumption Tax, VAT and Import Tariffs. Values given as percentages.

Period	Special Consumption Tax (tax base is pre-tax factory price)				Value added tax	Tariffs
	Cigarettes			Cigars		
	Filtered produced from imported material	Filtered produced from domestic material	Non-filtered			
10/1990 – 8/1993	50	50	40	40	-	NA
9/1993 – 12/1995	70	52	32	32	-	NA
1/1996 – 12/1998	70	52	32	70	-	NA
1/1999 – 11/2001	65	45	25	65	-	NA
11/2001 – 12/2003	65	45	25	65	-	Import prohibited
1/2004 – 12/2005	65	45	25	65	10	Import prohibited
1/2006 – 12/2006		55		65	10	Import prohibited
1/2007 – 12/2007		55		65	10	100
1/2008 – 12/2009		65			10	140
1/2009 – 12/2015		65			10	140
1/2016 – 12/2017	70	70	70	70	10	135
1/2018 –	75	75	75	75	10	135

NA: Not available. Sources: Tax Policy Department (TPD) – Ministry of Finance (MOF).

those excise rates were *ad valorem* rather than, specific, as recommended in World Bank⁷.

Following the development of new tobacco products, the SCT Tax Law amendment at the end of 2008 subjected other tobacco products (used for chewing especially) to an unchanged excise tax rate of 65%.

VAT was introduced in the last decade and was part of the country's tax modernization. All organizations and individuals engaging in manufacturing and conducting business in tobacco or importing tobacco are required to pay taxes. The VAT taxable price of cigarettes sold or supplied by production or business establishments is the sales price including the excise tax but excluding VAT. For imported tobacco, the VAT taxable price is the import price at the border gate plus import duties and plus excise tax. VAT rates on tobacco products were uniform and maintained constant. In Vietnam, there are two overall VAT rates, a standard 10% which is applied to most goods and services and a reduced 5% which is applied to basic foods, transport, medical equipment, and agricultural production and services. Tobacco falls in the 10% category. The rate is zero, though, for exports of tobacco products, as for all exports, and VAT paid for inputs of goods and services is refunded.

Current tobacco tax structure and rates in Vietnam

- SCT: Vietnam levies a uniform *ad valorem* excise tax on all cigarettes⁸. The SCT was unified for all tobacco products from 2006. Since January 2019, the tax rate was 75%. For domestic tobacco products, the tax base is the factory price (without VAT and excise tax).
- VAT: The current VAT rate is 10%, and for domestic tobacco products, the tax base is factory price plus the excise tax.

- Tariff: The current tariff rate for cigarettes is 135%. The tax base for import tax is the import (CIF) price.
- Tobacco Control Fund: The Tobacco Control Fund (TCF) was established in 2012 under the Vietnam Tobacco Control Law. The TCF receives a compulsory contribution of 1% of the factory price of all cigarette packs produced locally or imported for local consumption beginning from May 2013. This rate was increased to 2% from May 2019⁹.

The proposed plan to raise tobacco taxes was submitted in August 2017. The draft law suggested amending and supplementing some articles of the Law on the Value Added Tax, the Law on Special Consumption Tax, the Law on the Corporate Income Tax, and the Law on Personal Income Tax. Regarding the tobacco excise tax, it was proposed to apply the mixed excise tax, in addition to the current tax starting from January 1, 2020. This is to be done by either applying a specific tax of Vietnamese Dong (VND) 1,000 per pack of 20 cigarettes², or by increasing the *ad valorem* tax from 75% to 80% of the tobacco's price from 2020 onwards and from 80% to 85% from 2021 onwards¹⁰. Health officials favour the first option, but strongly argued that the fixed (specific) tax be higher at VND2,000–5,000¹¹.

This paper is part of additional efforts supported by the World Bank Global Tobacco Control Program to inform the Government of Vietnam on options for tobacco taxation by providing estimates of the impact of cigarette price increase across five income groups for the period 2020–2022 under two scenarios:

- Scenario A: Increase in *ad valorem* tax from the current 75% to 90%, plus an introduction of a specific tax at VND3,000 per pack of 20 cigarettes, which, taken together, constitutes a 32% increase in price.

- Scenario B- Increase in *ad valorem* tax from the current 75% to 120%, plus an introduction of a specific tax at VND5,000 per pack of 20 cigarettes, which, taken together, constitutes a 62% increase in price.
- The two scenarios of tax increase were proposed by the Government of Vietnam.
- Scenario B: Increase in *ad valorem* tax from the current 75% to 120%, plus an introduction of a specific tax at VND5,000 per pack of 20 cigarettes (corresponding to a retail price increase of 62%).

Methods

We used the model from the Disease Control Priorities Project which draws upon the analytic framework of the Asian Development Bank to estimate the fiscal, health and poverty impact of increasing cigarette taxes^{12,13}. The model was previously used by the Global Tobacco Economics Consortium (GTEC) to estimate the impact of a 50% increase in the price of cigarettes on health, poverty, and financial outcomes in 13 middle-income countries⁵.

Study population

We focussed on male cigarette smokers aged 15 years and older, as males comprised the vast majority of cigarette smokers in Vietnam (about 12.1 million out of 12.4 million cigarette smokers overall, or 98% in 2015; about 3.1 million men smoked hand-rolled tobacco, traditional bamboo waterpipe, shisha waterpipe, pipe, cigars/cheroots/cigarillos, and other forms of smoking tobacco). To estimate the number of smokers by age and income groups, we applied the age-specific smoking prevalence for males from the GATS survey conducted in Vietnam in 2015 to the number of males in each age group in 2017⁴. We estimated the population in each age group by applying the proportion of male population in each age group from the 2009 census of Vietnam to the male population in Vietnam in 2017 obtained from the General Statistics Office of Vietnam^{14,15}. As the GATS survey did not collect information on household income, we used education level as a proxy measure of income group, as the Vietnam National Health Survey 2001 showed that prevalence of tobacco use among males is similar when classified by income quintiles and education levels¹⁶. We applied the relative prevalence of smoking among illiterate males, and those with completed primary, lower secondary, upper secondary, and college education to the number of smokers in each age group to obtain the number of smokers in each age and income group.

Cigarette price and price increase

The market price of cigarettes used was that of Vinataba, the most-sold brand of cigarettes in Vietnam, as obtained from the World Health Organization Report on the Global Tobacco Epidemic 2017¹⁷. The same source was used to obtain the *ad valorem* tax and VAT, as percentage of the final retail price. Using the current factory price of VND8,028 calculated by Fuchs and colleagues using the market price of VND20,000, *ad valorem* rate of 75%, VAT rate of 10% and mandatory contribution to the Tobacco Control Fund of 2%, as per the current tax structure, we calculated the percentage increase in the retail price under two scenarios:

- Scenario A: Increase in *ad valorem* tax from the current 75% to 90%, plus an introduction of a specific tax at VND3,000 per pack of 20 cigarettes (corresponding to a retail price increase of 32%), and

We assume, realistically, that the tax increases will be passed on to consumer prices. The industry can delay passing them fully through in the short term but will not do so at the expense of their profit margins for any reasonable time. Indeed, recent analyses of modest tax hikes and responsiveness across the states of India showed that nearly all tax hikes were more than passed onto smokers (i.e., small tax hikes enabled rent-seeking opportunities by the cigarette industry), but the few tax decreases did not reduce consumer prices;¹⁸ this is consistent with the profit-maximising behaviour of the tobacco industry.

Price effects on smoking

To estimate the number of smokers who would quit as a result of the price increase, we used the estimated price elasticity for cigarette demand in Vietnam of -0.53¹⁹. As young people and those on low income show greater price sensitivity^{20,21}, we used two times the national elasticity for young smokers (15–24 years) and applied this higher price elasticity to future smokers (those below 15 years) who have not yet started to smoke, as done previously by GTEC⁵. For those in the bottom (poorest 20% of the population) and those in the top income group (richest 20% of the population), we used the price elasticity reported by Kinh and colleagues (2006) for those in the low income quintile and high income quintile in Vietnam of -0.85 and -0.35 respectively²². We assumed price elasticities of quitting at half of the price-elasticity of cigarette demand⁵.

Effects of cigarette price increase on life-years gained, disease costs, income poverty, and taxes paid

We followed the methodology of the previous analysis of GTEC to estimate the impact of a cigarette price increase on number of deaths averted due to four major tobacco-attributable diseases (chronic obstructive respiratory disease (COPD), stroke, heart disease and cancer), life-years gained, treatment cost averted due to the four tobacco-attributable diseases, number of men avoiding catastrophic health expenditures and extreme poverty, and additional tax revenues collected⁵. The treatment cost for COPD, stroke, heart disease and cancer were obtained from the Statistics Yearbook of Vietnam 2011²³. The average income in each income quintile was obtained from Statistical Yearbook of Vietnam 2016²⁴. All costs and prices were converted into International dollars (\$Int, which convert local currencies at exchange rates that account for differences in Purchasing Power Parity). We adjusted the International dollars for inflation using consumer price index and exchange rates obtained from the World Bank Development Indicators²⁵.

The data inputs and sources of data are available as *Underlying data*²⁶.

Sensitivity analysis

We conducted sensitivity analyses to examine the impact of a 25%, 50%, and 100% price increase with the cigarette price elasticity of demand in Vietnam of -0.53, and the impact of a 32% (Scenario A) and 62% (Scenario B) price increase with the

average price elasticity of demand for cigarettes in both high income, and low- and middle-income countries of -0.40 (universal elasticity)^{20,27}. For those on low income, we used a price elasticity of -0.635, as done by GTEC⁵.

Results

Before the cigarette price increase, an estimated total of about 12.1 million males aged 15 years and older smoked cigarettes in Vietnam (Table 2). Men in the bottom income group constitute about 18%, while men in the top income group constitute

Table 2. Impact of cigarette price increase on quitting, deaths averted and life-years gained in Vietnam.

Variables by income groups	Scenario A: 32% price increase*†	Scenario B: 62% price increase*†
Number of male smokers aged ≥15 years before price increase (in millions)		
First (bottom 20%)	2.2	
Second	3.0	
Third	3.0	
Fourth	1.9	
Fifth (top 20%)	1.9	
Total	12.1	
First: fifth ratio	1.2	
Number of men who quit smoking after tax increase (in thousands)		
First (bottom 20%)	376.6	729.7
Second	433.7	840.3
Third	358.3	694.1
Fourth	183.5	355.6
Fifth (top 20%)	132.9	257.5
Total	1,485.0	2,877.2
First: fifth ratio	2.8	2.8
Total deaths averted due to COPD, stroke, heart disease, and cancer (in thousands)		
First (bottom 20%)	159.7	309.4
Second	183.9	356.2
Third	151.9	294.3
Fourth	77.8	150.7
Fifth (top 20%)	56.3	109.2
Total	629.6	1,219.8
First: fifth ratio	2.8	2.8

Variables by income groups	Scenario A: 32% price increase*†	Scenario B: 62% price increase*†
Total life-years gained (in millions)		
First (bottom 20%)	2.8	5.4
Second	3.2	6.2
Third	2.6	5.1
Fourth	1.4	2.6
Fifth (top 20%)	1.0	1.9
Total	10.1	21.3
First: fifth ratio	2.8	2.8

*Scenario A- Increase in *ad valorem* tax from the current 75% to 90% plus an introduction of a specific tax at VND3,000 per pack (equivalent to 32% increase in retail price).

† Scenario B- Increase in *ad valorem* tax from the current 75% to 120% plus an introduction of a specific tax at VND5,000 per pack (equivalent to 62% increase in retail price).

‡ Price elasticity used, by income group: First -0.85, second/third/fourth -0.53, fifth -0.35.

about 16% of the total number of male smokers. This is a small difference across income groups by international standards. Men in the lower-middle and middle income groups account for about 50% of the total number smokers.

Impact of cigarette price increase under Scenario A

An increase in cigarette price under Scenario A, which would be equivalent of a 32% increase in the retail price, would lead to about 1,485,000 men quitting smoking, with the bottom income group having 2.8 times as many quitters as the top income group (377,000 vs 133,000) (Table 2). An estimated total of 630,000 deaths due to COPD, stroke, heart disease, and cancer would be averted among current smokers due to quitting. The number of averted deaths in the bottom income group would be 2.8 times that in the top income group (160,000 vs 56,000). The deaths averted due to quitting would yield about 11 million life-years, with the bottom income group gaining 2.8 times more life-years than those the top income group (2.8 million vs 1 million). In absolute terms, over a quarter of the overall reduced deaths and life years gained would occur in the lowest income group of men.

The cost averted for treating the four major tobacco-attributable diseases would amount to about VND9,746 billion (\$Int 1.3 billion) (Table 3). The treatment cost – and suffering – averted in the bottom income group would be 2.5 times higher than in the top income group (VND2,346 billion vs 949 billion, or \$Int 304 million vs 123 million). About 285,000 men would avoid catastrophic health expenditures, with the number of men

Table 3. Impact of cigarette price increase in Vietnam under Scenario A and Scenario B on treatment cost averted, number of men avoiding catastrophic health expenditures and extreme poverty, and additional tax revenue collected in Vietnam.

Variables by income groups	Scenario A: 32% price increase ^{††}	Scenario B: 62% price increase ^{††}
Treatment cost averted (in LCU, billions (\$Int, millions))		
First (bottom 20%)	2,346 (304)	4,545 (589)
Second	2,901 (376)	5,618 (728)
Third	2,323 (301)	4,506 (584)
Fourth	1,227 (159)	2,377 (308)
Fifth (top 20%)	949 (123)	1,837 (238)
Total	9,746 (1,263)	18,882 (2,447)
First: fifth ratio	2.5	2.5
Number of men avoiding catastrophic health expenditures (in thousands)		
First (bottom 20%)	72.6	140.7
Second	89.7	173.8
Third	72.0	139.4
Fourth	38.0	73.6
Fifth (top 20%)	12.9	25.0
Total	285.2	552.5
First: fifth ratio	5.6	5.6
Number of men avoiding extreme poverty		
First (bottom 20%)	72,621	140,704
Second	12,124	23,491
Third	9,734	18,841
Fourth	0	0
Fifth (top 20%)	0	0
Total	94,479	183,036
First: fifth ratio	-	-
Additional tax revenues (in LCU, billions (\$Int, millions))		
First (bottom 20%)	1,737 (225)	827 (107)
Second	2,780 (360)	2,444 (317)
Third	3,059 (396)	3,556 (461)
Fourth	2,149 (279)	2,955 (383)
Fifth (top 20%)	2,039 (264)	3,137 (406)
Total	11,764 (1,525)	12,918 (1,674)
First: fifth ratio	0.85	0.26

[†]Scenario A- Increase in *ad valorem* tax from the current 75% to 90% plus an introduction of a specific tax at VND3,000 per pack (equivalent to 32% increase in retail price).

^{††}Scenario B- Increase in *ad valorem* tax from the current 75% to 120% plus an introduction of a specific tax at VND5,000 per pack (equivalent to 62% increase in retail price).

[‡] Price elasticity used, by income group: First -0.85, second/third/fourth -0.53, fifth -0.35.

in the bottom income group being 5.5 times that in the top income group (73,000 vs 13,000). As a result of the catastrophic health expenditures averted, about 94,500 men would avoid falling into extreme poverty as defined by the World Bank as income of under \$1.90 per day in purchasing power parity. The number of families falling into extreme poverty would be somewhat smaller, depending on earnings by other household members, but would still be large. The increase in excise tax needed to achieve the cigarette price increase would generate more than VND11.7 trillion (\$Int 1.5 billion). In contrast to the distribution of health benefits, the extra revenue generated from men in the top income group would be a modest 1.2 times that from the bottom income group (VND2 trillion vs 1.7 trillion, or \$Int 264 million vs 225 million).

Impact of cigarette price increase under Scenario B

A cigarette price increase under Scenario B which is an equivalent of a 62% increase in the retail price of cigarettes would result in about 2,877,000 men quitting smoking. Of this, the bottom income group will have 2.8 times as many quitters as the top income group (730,000 vs 258,000) (Table 2). Quitting as a result of the price increase would avert about 1.2 million deaths due to COPD, stroke, heart disease, and cancer among male smokers. The number of deaths averted in the bottom income group would be 2.8 times that in the top income group (309,000 vs 109,000). As a result of the deaths averted, Vietnam would gain about 21 million life-years and avert about VND 18,882 billion (\$Int 2.4 billion) in treatment cost for treating the four major tobacco-attributable diseases (Table 3). The averted treatment cost in the bottom income group would be about 2.5 times that in the top income group (VND4,545 billion vs 1,837 billion, \$Int 589 million vs 238 million). About 552,000 men would avoid catastrophic health expenditures, with the bottom income group avoiding 5.6 times that of the top income group (141,000 vs 25,000). As a result of the catastrophic health expenditures averted, about 183,000 men would avoid falling into extreme poverty. The tax increase would generate about VND12.9 trillion (\$Int 1.7 billion), with contribution from the top income group being about 4 times that from the bottom income group (VND3,137 billion vs VND827 billion, \$Int 407 million vs \$Int 104 million). The extra tax revenue is particularly progressive in this scenario of a 62% price increase than the smaller increase.

Comparison of 50% price increase in Vietnam vs in Indonesia

To compare the impact of cigarette price increase in Vietnam vs in other Southeast Asian countries, we used the findings of GTEC (2018). Table 4 shows the impact of a 50% cigarette price increase on the number of males who quit after the price increase, deaths averted, life-years gained, treatment cost averted, number of men avoiding catastrophic health expenditures and extreme poverty, and the additional tax revenue collected in Vietnam and Indonesia, according to GTEC (2018). Compared to Vietnam, with a 50% cigarette price increase, the ratio of the number of quitters, tobacco-attributable deaths averted, and life-years gained between the bottom

Table 4. Cumulative impact of a 50% cigarette price increase in Vietnam and Indonesia (from GTEC, 2018)[§].

	Vietnam [§]	Indonesia [§]
Number of male smokers aged ≥15 years before price increase (in millions)		
First (bottom 20%)	3.7	13.6
Second	3.3	12.0
Third	2.6	9.8
Fourth	2.6	9.7
Fifth (top 20%)	2.2	7.7
Total	13.2 [¶]	52.9
First: fifth ratio	1.5	1.8
Number of men who quit smoking after price increase (in thousands)		
First (bottom 20%)	785.8	3,255.5
Second	569.6	2,292.4
Third	336.1	1,406.3
Fourth	214.9	915.4
Fifth (top 20%)	99.8	357.4
Total	2,006.1	8,227.0
First: fifth ratio	7.9	9.1
Total deaths averted due to COPD, stroke, heart disease, and cancer (in thousands)		
First (bottom 20%)	341.6	1,418
Second	259.1	998
Third	179.0	612
Fourth	112.9	399
Fifth (top 20%)	49.4	156
Total	941.9	3,582
First: fifth ratio	6.9	9.1
Total life-years gained (in millions)		
First (bottom 20%)	5.6	22.5
Second	4.1	15.8
Third	2.4	9.7
Fourth	1.5	6.3
Fifth (top 20%)	0.7	2.5
Total	14.3	56.8
First: fifth ratio	7.9	9.1

	Vietnam [§]	Indonesia [§]
Treatment cost averted (in LCU, billions (\$Int, millions))		
First (bottom 20%)	2,284 (296)	19,776 (4,120)
Second	1,798 (233)	15,456 (3,220)
Third	1,536 (199)	13,296 (2,770)
Fourth	910 (118)	10,512 (2,190)
Fifth (top 20%)	564 (73)	5,040 (1,050)
Total	7,092 (919)	60,080(13,350)
First: fifth ratio	4.0	3.9
Number of men avoiding catastrophic health expenditures (in thousands)		
First (bottom 20%)	112.6	637.9
Second	88.6	499.1
Third	75.7	428.6
Fourth	44.9	338.8
Fifth (top 20%)	27.7	163.4
Total	349.6	2,067.9
First: fifth ratio	4.1	3.9
Number of men avoiding extreme poverty		
First (bottom 20%)	107,418	594,663
Second	77,294	499,090
Third	14,323	426,300
Fourth	3,790	84,068
Fifth (top 20%)	203	20,110
Total	203,028	1,624,2231
First: fifth ratio	529.1	29.6
Additional tax revenues (in LCU, billions (\$Int, millions))		
First (bottom 20%)	4,213 (546)	323 (67)
Second	3,464 (449)	806 (168)
Third	3,395 (440)	1,181 (246)
Fourth	3,935 (510)	1,661 (346)
Fifth (top 20%)	3,734 (484)	2,155 (449)
Total	18,743 (2,429)	6127 (1,280)
First: fifth ratio	1.1	0.2

[§]Price elasticity used, by income group: First -0.635, second/third/fourth -0.4, fifth -0.122.

[¶]Number of male smokers aged ≥15 years in Vietnam is higher in the GTEC analysis than in our current analysis because the GTEC analysis used the male smoking prevalence in 2010 which is higher than the prevalence in 2015 used in our current analysis (overall male smoking prevalence: 39.1% vs 36.1%).

and the top income group is greater in Indonesia. However, the ratio of the number of men avoiding extreme poverty is substantially higher in Vietnam than in Indonesia.

Sensitivity analysis

Figures 1a–c shows the result of our sensitivity analyses of the impact of varying levels of price increase and using the universal price elasticity of -0.40 on life-years gained, treatment costs averted and catastrophic health expenditures avoided, respectively.

Using the price elasticity in Vietnam (-0.53), with a 25%, 50% and 100% price increase, the ratio of the number of life-years gained between the bottom and the top income groups is 2.8 for all price increases (Figure 1a). The ratio increases to 6.1 when we apply the universal price elasticity to a price increase of 32% and 62%. Similarly, when the price elasticity is -0.40, the ratio of the treatment cost averted and catastrophic health expenditures avoided by the bottom versus the top income group for all price increases, except for treatment

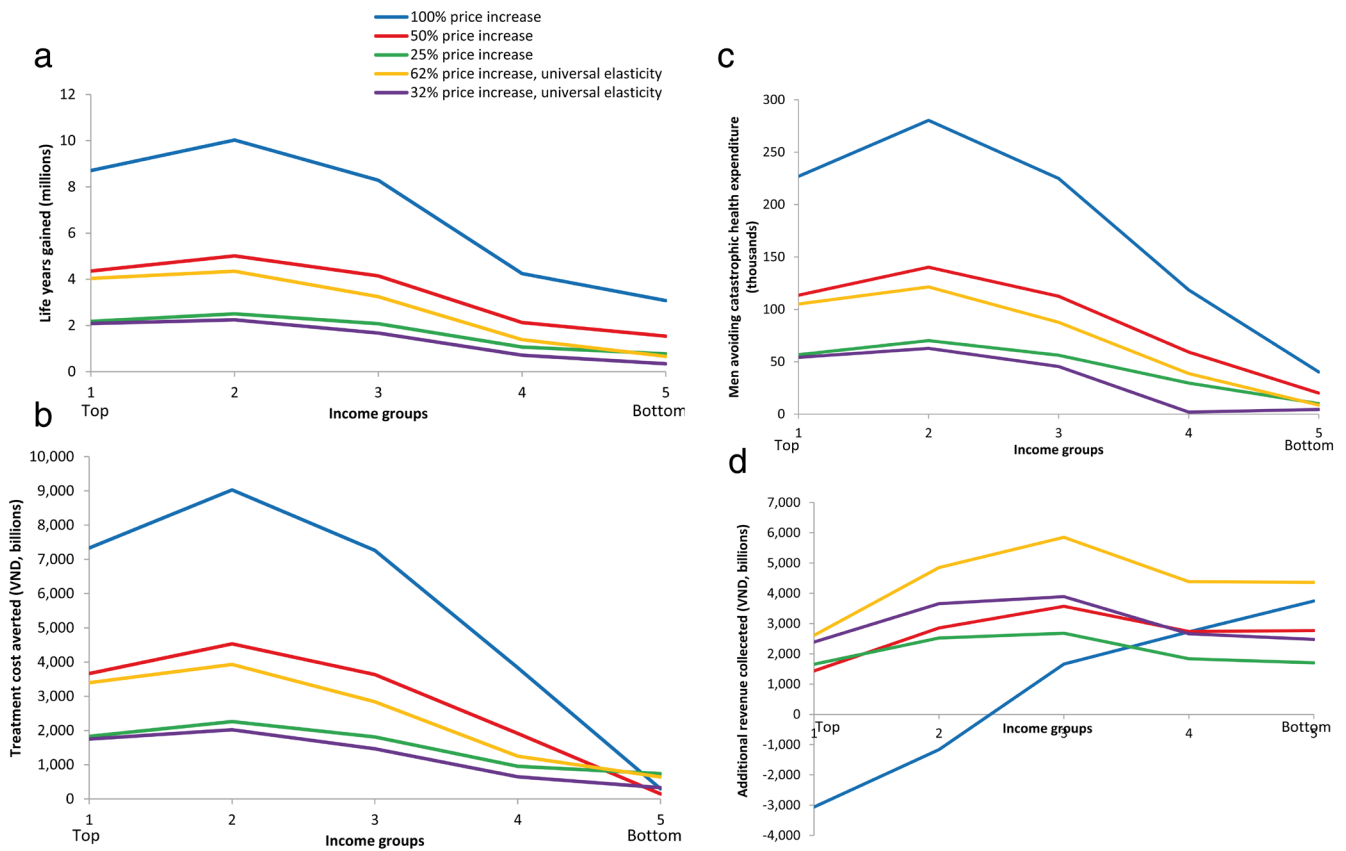


Figure 1. Sensitivity analysis. Shown are analyses for the impact of a 25%, 50%, and 100% price increase with -0.53 price elasticity (cigarette price elasticity of demand in Vietnam), and for a 32% and 62% price increase with the universal price elasticity of -0.40 on (a) life years gained, (b) treatment cost averted, (c) number of men avoiding catastrophic health expenditure, (d) additional revenue collected.

cost averted with 100% price increase, is 2.5 and 5.6 respectively, and increases to 5.3 and 12.1 respectively, when the price elasticity is -0.40 (Figure 1b, c). The additional tax revenue collected from the top income group with a 50% and a 25% price increase with -0.53 price elasticity and a 62% and a 32% price increase with -0.40 price elasticity is between 1 and 2 times that of the bottom income group (Figure 1d). With a 100% price increase, about 95% of the tax burden would be borne by the top income group.

Discussion

We found that a cigarette price of 32% or 62% in Vietnam would favour the bottom income group of the population more strongly in terms of deaths averted, life-years saved, out-of-pocket expenditures for treating tobacco-attributable diseases, catastrophic health expenditures, and extreme poverty averted. Our findings are consistent with the earlier findings of GTEC of the impact of a 50% increase in cigarette price in 13 middle-income countries, which challenges the conventional view that tobacco taxes are more detrimental to people on low versus high income⁵.

Tobacco tax hikes in other countries have shown that when taxes increase, consumption decreases and smoking rates decrease,

but government revenue still rises. Jha and colleagues recently showed that higher cigarette prices substantially reduced smoking, even after accounting for illegal cigarette sales, in France and Canada²⁸. In Canada, when tobacco tax was lowered in the early 1990s in response to illicit tobacco trade instigated by the tobacco industry, consumption rose. In Thailand, between 1993 and 2012, the SCT on cigarettes was increased 10 separate times, about one tax increase every two years, from 120% to 670% of the factory price². As a result of the price increase, the smoking prevalence decreased from 32% in 1991 to 20% in 2015, while tobacco tax revenue increased more than four times². The tax increase also did not lead to smuggling, as GATS 2011 in Thailand showed that only 4.8% of smokers used smuggled cigarettes²⁹. In the Philippines, prior to 2012, a four-tiered excise tax system, with various tax rates ranging from 2.72 Philippine Pesos (PHP) to 28.3 PHP per pack of cigarettes as applicable to tobacco products at different prices was used². In 2012, the four-tiered tax structure was replaced by a two-tiered tax structure and tax rates on cigarettes was steadily increased from 2013 to 2016, reaching a common tax rate of 30 PHP per pack in 2017². As a result of the tax increase, the rate of smoking among adults fell from 30% in 2009 to 24% in 2015³⁰, while the tobacco tax revenue increased by more than three times². Compared to

Thailand and the Philippines, Vietnam has the highest annual consumption of 3,900 million packs but collects only about one-third of the total tobacco tax collected in Thailand or the Philippines due to the current low tax rate. Increase in tobacco taxes could generate substantial revenues that could be used to finance universal health coverage in Vietnam. Although the tax revenue itself would not provide enough to meet the financial needs of universal health coverage, it would make a significant contribution⁵.

Our study has some limitations, including the assumptions of price elasticities. Variation in price responsiveness has been reported in Vietnam, as recently reviewed by Fuchs and colleagues³¹. However, various sensitivity analyses suggested that variation in elasticity did not influence the overall conclusions greatly. Second, our study used the price of the most-sold brand of cigarettes, Vinabata, which comprised about 60% of the market share in 2015–2017³². The average cigarette price is much lower than the price of the most-sold brand. The average cigarette price was VND15,000 per pack and the price of Vinabata was VND20,200 per pack in 2017³³. The Vietnam tax structure, with much higher taxes per cigarette on higher price brands, encourages downward substitution between brands, reducing quitting and decreased consumption. A set of recent analyses has shown that tobacco tax increase needs to be substantial so as to avoid downward substitution and prevent the rent seeking opportunities by the cigarette industry⁷. A large tax hike means greater revenue generation for the government versus profits for the industry. A key argument of this analysis is that to in order to maximize the health benefits, large increases in tax should preferentially be imposed on the cheapest brands. This is quite consistent with the policy guidance from the World Bank to move to specific (rather than *ad valorem*) taxes that are equal across cigarette price categories⁷. Reassuringly, the overall results focused here on avoidance of out of pocket expenditures are consistent with a recent analysis by Fuchs and colleagues that focused on net income gains across declines in Vietnam smokers³¹. The main differences in details arise in taking the male smoker as the unit of analysis here as compared to the household in Fuchs and colleagues' study, as

well as in other minor differences in the methodologies applied. Third, we used education level as a proxy indicator for income quintile. Due to data limitations, we could not verify whether the income used to represent each quintile corresponds to the income by education level. Fourth, our model applied only to the entire lifetime of the current cohort of smokers, hence it underestimates the effects on future consumption decreases, particularly if the large early price hikes also lead to higher future price expectations⁵. Finally, the assumption that the poor are more price responsive was central to our analysis, and while the exact responsiveness to price does likely vary in Vietnam from other settings, there is substantial earlier evidence, in Vietnam as well as globally, to document that the poor are in fact more responsive to price³¹.

Conclusions

Vietnam has made substantial progress in reducing tobacco use. Further progress is likely to be possible with large increases in price, particularly those that focus on narrowing the gap between the least and most expensive cigarettes. Higher cigarette taxes would also reduce poverty by reducing out of pocket health expenditures among the poorest smokers.

Data availability

Underlying data

Figshare: Data input and data sources for extended cost-effectiveness analysis of cigarette price increase in Vietnam, <https://doi.org/10.6084/m9.figshare.9033914>³⁴.

This project contains the pooled data used in the present study, alongside the original source of the data.

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Acknowledgments

An earlier version of this article is available from the World Bank Group Open Knowledge Repository: <http://hdl.handle.net/10986/31948>.

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Open Peer Review

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Version 2

Reviewer Report 20 May 2020

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Alfred Kechia Mukong

Department of Economics, University of Namibia, Windhoek, Namibia

I have reviewed their response to my comments and I am satisfied. I don't have further comments for this paper.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 11 May 2020

<https://doi.org/10.21956/gatesopenres.14315.r28807>

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Guillermo Paraje 

Business School, Universidad Adolfo Ibáñez, Santiago, Chile

I am happy with the new version.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Economics; Development Economics; Health Economics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 01 November 2019

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**Alfred Kechia Mukong**

Department of Economics, University of Namibia, Windhoek, Namibia

This paper estimates across income quintiles the life-years gained, treatment cost averted, number of men avoiding catastrophic health expenditure and extreme poverty, and additional tax revenue for 32% and a 62% increase in cigarette prices using an extended cost-effectiveness analysis. The authors showed that under both scenarios of price increase, men in the poorest quintile would gain about 2.8 times the life-years and avert 2.5 times the treatment cost averted by the richest men. Poorest men would equally avoid catastrophic health expenditure and falling into extreme poverty but extra revenue is generated from the richest than from the poorest quintile. However, there is room to improve on the analysis if the following comments and concerns are addressed.

- Using the overall average price elasticity of demand for cigarettes across the income quintile reduces the validity for comparing the estimates across the different income quintiles. It is evidence that the price elasticity of demand for cigarettes is generally different across the different income quintile. As a solution, you either estimate price elasticities by income quintile or take average elasticity for each quintile, if such elasticities exist for Vietnam.
- The authors highlighted that the paper is part of the effort of the World Bank Global Tobacco Control Program to inform the government of Vietnam on the estimated impact of cigarette price increase across five income groups. Assuming demands elasticities are equal across the five groups when they are not in reality therefore provide misleading estimates. The authors need to think critically on how to address this problem.
- Another challenge is assuming levels of education as proxies for income groupings. The fact that the prevalence of tobacco use is similar when classified by income quintiles and education levels, does not mean the level of response to price will be similar too. If this is the case then education level will not be a good proxy for income group, hence the estimates in the paper are far from valid. Is it possible to compute price elasticity by educational attainment in Vietnam for consistency of the analysis in this paper (since education level is used as a proxy for income)?
- Another concern is the use of the price of the most-sold brand of cigarettes in Vietnam. What share of the market for cigarette does this brand occupy? If this is less than 80%, then the average price of cigarettes sold in Vietnam will be more appropriate than the price of the most sold brand. If the price most-sold brand of cigarettes is not the lowest, such a policy change may see consumers moving for the high priced brand to the low priced brands (not necessarily reducing or quitting or reducing consumption of cigarettes).

- The average income in each quintile is used and obtained from Statistical Yearbook of Vietnam 2016. If education level is used as a proxy for income quintile, then for consistency, the income for each education level should be considered.
- The paper assumes two scenarios – scenario A considers a 32% increase in price and scenario B considers a 62% increase in price. However, there are no discussions to justify the choice of the different scenarios. If it is what the government of Vietnam intend to do then the authors need to clearly state this in the work.
- In the abstract, it is stated that Vietnam has over 15 million male smokers but in the study population section, the authors argued that their focus is on male smokers aged 15 years and older, because males comprised the vast majority of cigarette smokers in Vietnam (about 12.1 million out of 12.4 million overall). There is not information about the 2.9 million of the 15 million. What do they smoke? Or are they less than 15 years. This needs to be made clear.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 16 Apr 2020

Daphne C. Wu, St. Michael's Hospital, Toronto, Toronto, Canada

1. Using the overall average price elasticity of demand for cigarettes across the income quintile reduces the validity for comparing the estimates across the different income quintiles. It is evidence that the price elasticity of demand for cigarettes is generally different across the different income quintile. As a solution, you either estimate price elasticities by income quintile or take average elasticity for each quintile, if such elasticities exist for Vietnam. *Response-* For those in the bottom and top income groups, we used the price

- elasticities of -0.85 and -0.35 respectively, as reported by Kinh and colleagues in Vietnam (please see page 5).
2. The authors highlighted that the paper is part of the effort of the World Bank Global Tobacco Control Program to inform the government of Vietnam on the estimated impact of cigarette price increase across five income groups. Assuming demands elasticities are equal across the five groups when they are not in reality therefore provide misleading estimates. The authors need to think critically on how to address this problem. *Response-* We used different price elasticities for those in the top and bottom income quintile (please see our response to comment 1 above).
 3. Another challenge is assuming levels of educations as proxies for income groupings. The fact that the prevalence of tobacco use is similar when classified by income quintiles and education levels, does not mean the level of responsive to price will be similar too. If this is the case then education level will not be a good proxy for income group, hence the estimates in the paper are far from valid. Is it possible to compute price elasticity by educational attainment in Vietnam for consistency of the analysis in this paper (since education level is used as a proxy for income)? *Response-* As mentioned in the Discussion section, one of the limitations of our study is the assumption on price elasticity. Most studies examining the price elasticity of cigarette demand in Vietnam reports the price elasticity by income groups, and due to data limitations, we are not able to compute the price elasticity by education level. However, as our sensitivity analysis shows, variation in elasticity did not significantly change our overall conclusions.
 4. Another concern is the use of the price of the most-sold brand of cigarettes in Vietnam. What share of the market for cigarette does this brand occupy? If this is less than 80%, then the average price of cigarettes sold in Vietnam will be more appropriate than the price of the most sold brand. If the price most-sold brand of cigarettes is not the lowest, such a policy change may see consumers moving for the high priced brand to the low priced brands (not necessary reducing or quitting or reducing consumption of cigarettes). *Response-* We have added this as a limitation of our study.
 5. The average income in each quintile is used and obtained from Statistical Yearbook of Vietnam 2016. If education level is used as a proxy for income quintile, then for consistency, the income for each education level should be considered. *Response-* Due to data limitations, we could not obtain the income by education level. We have added this as a limitation of our study.
 6. The paper assumes two scenarios – scenario A considers a 32% increase in price and scenario B considers a 62% increase in price. However, there are no discussions to justify the choice of the different scenarios. If it is what the government of Vietnam intend to do then the authors need to clearly state this in the work. *Response-* We have added this to the Methods section.
 7. In the abstract, it is stated that Vietnam has over 15 million male smokers but in the study population section, the authors argued that their focus is on male smokers aged 15 years and older, because males comprised the vast majority of cigarette smokers in Vietnam (about 12.1 million out of 12.4 million overall). There is not information about the 2.9 million of the 15 million. What do the smoke? Or are they less than 15 years. This need to be made clear. *Response-* We have now corrected this. A total of about 15.2 million men smoked tobacco in Vietnam in 2015: about 12.1 million (out of 12.4 million cigarette smokers) are males (or 98% of total cigarette smokers); about 3.1 million men smoked hand-rolled tobacco, traditional bamboo waterpipe, shisha waterpipe, pipe, cigars/cheroots/cigarillos, and other forms of smoking tobacco.

Competing Interests: We have no competing interests to declare

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Guillermo Paraje 

Business School, Universidad Adolfo Ibáñez, Santiago, Chile

There are no doubts, at least to me, that this type of analysis is extremely useful and pertinent to advancing policies on tobacco control. Extended Cost-Effectiveness (ECE) analyses are to this effort what General Equilibrium models are to the understanding of how an economy works in Economics. The fact that tobacco taxes, the single most effective policy to reduce tobacco consumption, have benefits that include reduce the financial burden that tobacco-related illnesses may entail for different population groups. The name Extended Cost-Effectiveness is misleading, as tobacco taxes do not have any cost involved if used to correct the externalities caused by tobacco consumption. These taxes do not have the usual efficiency losses involved in taxation, but rather an efficiency gain. Hence, the “cost” part in the name is far from being clear. At any rate, it is not something that can be blamed on the authors of the article.

The article applies this methodology on Vietnam. The article uses ECE to assess the impact that two alternative proposals for increasing tobacco taxes would have on averted treatment costs, life-years gained and males avoiding catastrophic health expenditures and extreme poverty. The analyses focus on males, as female smoking rates are low, and by income quintiles to assess the distributional impacts of such policies. The conclusions of the article are that, under both tax increase scenarios males in the poorest quintile would benefit far more than those in the top quintile, both in terms of life-years gained and treatment costs averted.

Overall, the results are worth what the assumptions in the analyses are worth and, though I believe findings are very important, they can be improved and/or made more robust (as the authors acknowledge when mentioning the limitations of the study). In this sense, the sensitivity analyses considered in the article can be improved. The key assumptions made on price elasticities for the different quintiles (page 5) are not well justified. They cite a previous study that estimated price elasticities for Vietnam, though such a study estimated elasticities for the bottom 40% and top 40% of households and in this study those figures are used for the bottom 20% and top 20% of them. It is highly likely to be true that poorer individuals have demands that are more price sensitive, as the evidence shows for many countries and also for Vietnam, but it would be convenient to reinforce the results with a good sensitivity analysis on elasticities.

One way to do this that the authors may consider is, for a given value of the price elasticity for the top quintile, to determine the price elasticity value for the bottom quintile, for which the differential gains in health and costs averted disappear. In other words, to determine the elasticity for the bottom 20%, for which the “First: fifth ratios” in Tables 3 and 4 tend to one. My intuition is that such a parameter would be

have an absurd value, given the existing evidence. If I am correct, that would be a definitive proof that for Vietnam tobacco taxes do have positive impacts on total population (unquestionable because tobacco demand slopes are negative), but especially for poorer individuals.

Some specific comments:

1. In the first paragraph of the introduction, when giving the number of smokers, it would be useful to have the month-prevalence. In fact, it is said what the target prevalence would be in 2020 but the current prevalence is never mentioned.
2. The tax structure outlined in Table 1 is not explained well. First, it is not clear whether the 10% VAT rate, for instance, is applied on all goods or on a subset of goods. Second, the tax base for the SCT is factory price, which raises the question of who determine the factory price (is it the manufacturer or the tax authority, as done in certain countries); and how realistic is the factory price, as it could be a mechanism to decrease taxes paid. To say that SCT rate on cigarettes is 75% sounds quite impressive, though it is far less impressive if the tax base is determined by the manufacturer and artificially low. This is crucial for the simulations. **If the tax base is determined by the manufacturers, how did the authors determine the tax bases to simulate the increase in the ad-valorem tax?** On page 5 they use a “current factory price of VND 8,028. **Where does that value come from?**
3. Though it is mentioned that a specific excise is imposed on tobacco, there is no explanation or description of values, taxable units, indexation mechanism, etc.
4. In the first paragraph of page 3, it is said that “The lower tax rates on cigarettes manufactured with domestic raw materials favoured domestic brands and encouraged per adult consumption of cigarettes.” I believe this is misleading: what favors consumption is not low taxes but low prices and/or affordable cigarettes. **Can the authors say something about these two variables and their evolution?**
5. On the same page, it is first said that “VAT is imposed on the added value of goods or services arising during the process from manufacturing up through retail sales”, and then that for VAT “the tax base is factory price plus the excise tax”. I believe that the two definitions cannot be true: one of them is incorrect, as there are stages in distribution and sale that, according to the first definition should be taxed, but according to the second definition would not be taxed. **Which is it?**
6. On the same page it is said that the TCF receives a contribution of 2% of “taxable price of all cigarette packs”. **Which is the taxable price?**
7. The authors put the smoking prevalence in the first paragraph of results. That, as suggested, should be moved to the first paragraph of the article.
8. On page 10 it is said that “One of the criticisms of increased tobacco excise taxes is that it increases smuggling. However, in Vietnam, cigarettes are smuggled into the country mainly to avoid import tax or due to the fact that smokers prefer well-known, illicit brands, both of which are not affected by the level of excise taxes.” I do not understand this sentence. **Does it mean that smuggled cigarettes only evade import taxes? Do they pay the tobacco taxes?** If that is the case, it should be stated explicitly. If, as I suspect, smuggled cigarettes do not pay tobacco taxes,

the sentence is wrong and should be changed and a brief discussion on the relationship between tobacco taxes and smuggling in Vietnam could be provided.

9. In page 10 it is said that “Variation in price responsiveness has been reported in Vietnam, as recently reviewed by Fuchs and colleagues”. The analysis conducted in the referred document is quite unclear and, though this is not the place to discuss it, may have serious methodological limitations (e.g., endogeneity). It may also underestimate price elasticity as it seems to consider only the effect of price on intensity of smoking (intensive margin) and not the effect of price on the decision to smoke (extensive margin). Given these limitations I would suggest, again, the sensitivity analysis I propose above.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Economics; Development Economics; Health Economics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 10 September 2019

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Nigar Nargis

Economic and Health Policy Research, American Cancer Society, Washington, DC, USA

Summary

Based on an extended cost-effectiveness analysis, this paper undertook a deterministic estimation of the effects of cigarette tax-induced price increase on smoking, public health, tax revenue, health expenditure and poverty status of households classified by five income groups from the poorest to the richest. The authors of the paper have extensively used this well-recognized methodology in previous research. It would make a valuable contribution to the advancement of the tobacco tax policy proposal under consideration in Vietnam by showing that tax and price increase do not only reduce smoking and improve public health, it can result in disproportionately larger health and financial gain to the poor and improvement in health and economic equity.

While the paper has its merit, it requires major revisions to improve methods and reporting of results for it to be indexable. I have made very specific comments and recommendations separately for each section below. There are some typographical and grammatical errors that I have left to be taken care of at the final stage of production.

Abstract

1. Insert 'gained' after 'life-years' in the first sentence of the Results section.
2. The Conclusions section can be strengthened by rephrasing the final statement: 'Thus, tobacco taxes are an effective way to improve health, reduce poverty and improve health and economic equity'. Because the results focus on disproportionately larger health and financial gain and disproportionately smaller burden of revenue for the poorest. Unfortunately, the authors forgot to mention this conclusion altogether in the Conclusions section of the manuscript, which is very different from the conclusions stated in the Abstract. Please make the conclusions in the Abstract and in the main text consistent.

Introduction

1. How many smokers were there according to GATS 2015? Even though prevalence decreased, number of smokers might have increased or remained the same due to population growth. It is advisable to show the comparison in terms of the number of smokers in addition to smoking prevalence in the opening paragraph. Because the results of the tax increase are reported in head counts (number of deaths avoided, number of people avoiding catastrophic health expenditure, number of people avoiding falling into extreme poverty) derived from the number of smokers who would quit.
2. Please add the following reference to show that the reduction in smoking has not been as high as expected based on comparative analysis from GATS 2010 and 2015: Minh HV, Giang KB, Ngoc NB et al. Prevalence of tobacco smoking in Vietnam: findings from the Global Adult Tobacco Survey 2015¹.
3. The last sentence in the second paragraph states: "Also, effective tobacco taxation may contribute significantly to state budgets, if increasing revenue growth outweighs the percentage decline in consumption of tobacco products." This statement needs some clarity. The fact that revenue increases in response to tax increases is attributable to inelastic demand for tobacco products. Inelastic demand means that the percentage change in consumption is lower than the percentage change in price and as a result consumers' expenditure on tobacco product increases. The price increase may lead to revenue gain if it is induced by tax increase. But there are other reasons for

price increase in which case revenue may decrease. So 'tax-induced price increase' should be underscored.

4. In the sub-section "Taxation system on tobacco products in Vietnam", in the first sentence of the second paragraph, it suffices to mention 'tobacco product tax rates' instead of 'cigarette and tobacco product tax rates'. Restate the sentence as: Immediately after the introduction of the SCT, tobacco product tax rates were differentiated, creating a complex system that persisted until 2005.
5. In Table 1, please indicate the tax bases in the column heading for Value-added tax and Tariffs.
6. In Table 1, the cells in the bottom two rows with same tax rate can be merged like the previous rows to make the presentation consistent.
7. Page 4, first paragraph: How did the price of cigarettes made from imported raw materials compare to those made from domestic raw material? By stating that the smokers of the cigarettes made from imported raw materials had higher income, it is implied that these cigarettes are more expensive and hence affordable to higher income people. Is there any reference to support this presumption?
8. Page 4, second paragraph: The recommendation of specific tax is not originally from the World Bank document cited in the manuscript. The Article 6 Guidelines of WHO FCTC should be cited here.
9. Page 4, third paragraph: Please revise this statement as follows: For imported tobacco, the VAT taxable price is the import price at the border gate plus import duties plus excise tax. A uniform VAT rate applied to all tobacco products that remained constant.
10. In the sub-section "Current tobacco tax structure and rates in Vietnam", please indicate if excise tax applies to imported tobacco products as well and whether at the same or at a different rate from domestic tobacco products.
11. Please elaborate CIF as Cost, Insurance and Freight, the first time it is used in the text in Page 4 in the sub-section "Current tobacco tax structure and rates in Vietnam".
12. In the description of the Tobacco Control Fund in Page 4, please add the explanation of the 'taxable price' as follows: The TCF receives a compulsory contribution of 1% of the taxable price (pre-tax factory price for locally produced cigarettes and CIF value for imported cigarettes) of all cigarette packs produced locally or imported for local consumption beginning from May 2013.
13. In Page 4, the reference to the proposal of 'mixed excise tax' is not explained well in the second paragraph of the second column. Under mixed system, both options must have an ad valorem component and a specific component. The Scenarios A and B used for the analysis in this paper are both mixed. However, the way the proposal is described in this paragraph, it seems to me: Option 1: 75% ad valorem and VND 1,000 specific, which is a mixed system. Option 2: The ad valorem will be increased from 75% to 80% to 85% without any specific excise. This is pure ad valorem and not a mixed system. Also, what time frame '2020 onwards' and '2021 onwards' in the description of the proposal mean? Tax rates generally apply for a fiscal year. If I understood correctly, it should be described as: "increasing the ad valorem tax from 75% to 80% in 2020 and from 80% to 85% in 2021"? The phrase "2021 onwards" would imply that there would be no further

increase in tax after 2021. Please describe the proposal more clearly to avoid confusion.

14. In Page 4, third paragraph in the second column, it is important to explain the following as the rationale of the analytical approach of the paper:
 - What additional information the analysis by five income groups would provide that an aggregate level analysis would not.
 - Why was it necessary to undertake this analysis in the context of Vietnam? For example, it might be the case that the government is hesitant to implement the tax proposal in fear of regressivity of the tax increase (that the increased tax burden might hit the poor most).

Methods

1. Similar smoking prevalence by income quintiles and education levels is not the correct rationale for using education as a proxy measure of household income. Individual education can predict individual earning very well, but not necessarily household income. For education to be an appropriate proxy for income, the two variables must be strongly correlated regardless of the smoking status of individuals. Besides, income quintiles are based on per capita household income which is calculated as total household income divided by household size. Total household income can be a function of the education levels of household head and other earning members of the household. The use of individual educational status as a proxy of household income quintile in the youngest age group is subject to the caveat that upper secondary and college education are not completed at age 15 and individuals at this age do not necessarily earn income. Individual education after age 22, for example, can very well predict individual earning. Even then it does not necessarily predict household income status unless that individual is the head of the household or the principal earner of the family. For younger adults, it is usually their parents' education levels that would determine their household income status. Researchers using GATS data construct wealth index to represent household income quintile as GATS does not collect household income data. I recommend constructing wealth index in place of individual education to proxy income in the present analysis. The income classification is at the heart of the analysis in this paper and hence needs to be carefully designed and interpreted. Please see the following article to consult on how to use the wealth index from GATS: Nargis N, Yong H-H, Driezen P, Mbulo L, Zhao L, Fong GT, et al. (2019) Socioeconomic patterns of smoking cessation behavior in low and middle-income countries: Emerging evidence from the Global Adult Tobacco Surveys and International Tobacco Control Surveys².
2. Page 5 Sub-section "Price effects on Smoking": By 'price elasticity of quitting', I believe the authors meant the price elasticity of smoking prevalence which is generally taken as half of the total price elasticity (sum of the elasticity of smoking prevalence and smoking intensity). The price elasticity of prevalence reflects reduction in smoking both due to increased quitting and reduced initiation and transition to regular smoking habit. The authors indicated the part of the reduction in smoking due to quitting only. The price elasticity of quitting is positive because it represents the percentage increase in quitting probability in response to a given percentage increase in price. As such, price elasticity of quitting is not exactly interpretable as half of the price elasticity of cigarette demand. I recommend the authors look at Chapter 4 in Monograph 21: The Economics of Tobacco and Tobacco Control for detailed review of the studies that estimated price elasticity of quitting.
3. Page 5 Sub-section "Effect of cigarette price increase on life-years gained, disease costs, income poverty, and taxes paid": The authors referred to GTEC and bypassed the description of the methods of analysis. While reading this section, the questions that came readily to my mind were: What are the coefficients that were used to translate the number of smokers who quit to number of deaths averted and number of life-years gained? How are catastrophic health expenditures and

extreme poverty defined? I had to look at the BMJ paper to find the answers. The methods need to be presented in this paper as a stand-alone approach with the specifics and adjustments in parameters applied in the context of Vietnam. The GTEC can be referred to for the details.

4. Page 5 Sub-section “Effect of cigarette price increase on life-years gained, disease costs, income poverty, and taxes paid”: Please describe the treatment cost. Is it out-of-pocket expenditure only that covers medication, doctor's fee, hospitalization, etc? Does it also include government's expenditure? In what form is this variable available in the Statistics Yearbook--per patient/per visit for health care utilization, monthly/annual etc? A summary table of the treatment cost variables by the four disease categories would be informative.
5. Page 5 Sub-section “Effect of cigarette price increase on life-years gained, disease costs, income poverty, and taxes paid”: Conversion to international dollars is necessary for multi-country comparison. In this single-country paper, analysis in local currency and conversion into USD would be enough. That said, there is no harm in conversion to international dollars if it is done correctly. The following steps are required to do this conversion:
 - First adjust prices/costs for inflation to express in base year constant prices (e.g. 2017 constant prices);
 - Then divide the inflation-adjusted prices/costs by the purchasing power parity conversion factor of the base year (e.g. of 2017) to convert to inflation-adjusted international dollars. The description here says that Step 2 was done first and then Step 1. Please confirm if it was done in the right sequence.

Results

1. Page 5 Sub-section “Cigarette smoking among males in Vietnam”: How do the income groups correspond to the education groups? For example, were the illiterate individuals coded as the poorest and those with college education or above coded as the top income group? It needs to be specified earlier in the Methods section.
2. Page 5 Sub-section “Cigarette smoking among males in Vietnam”: All tables present the income groups as first, second, third, fourth and fifth. Are those groups renamed as low, lower-middle, middle etc. income groups as written in the first paragraph of this section? Please maintain consistency in labeling the income groups throughout the manuscript.
3. Are the top and bottom income groups labeled correctly in the horizontal axes in Figure 1? The bottom income group seems to have lower gains than the top income group while the description says the opposite. The numbers 1 to 5 representing income groups seem correct, but the labels 'Top' and 'Bottom' were flipped.
4. What do the negative values of additional revenue collected in income groups 1 and 2 indicate in Figure 1 (d)? It is important to report the base revenue levels for each income group to enable one to interpret the negative values. For example, if the baseline revenue level collected from Income Group 1 was less than 3,000 billion VND, the additional revenue of -3,000 billion VND in Figure 1 (d) would imply that the after-tax increase revenue collection from Group 1 is negative. It means that smokers in the bottom income group would be subsidized instead of paying taxes.

Discussion

1. The Discussion section missed the discussion of the major finding of the paper that the poorest gain most from the tax increase which helps gain health and economic equality. Both the Discussion and the Conclusion sections need to be aligned to highlight this very important finding.

2. The GTEC paper included Vietnam among the 13 middle income countries. Please elaborate what this paper adds to the analysis or findings over those of the GTEC paper. Why was it necessary to publish a country-specific paper for Vietnam while it was already available in a multi-country paper?
3. Does the study by Jha and colleagues (2019) show increase in revenue? Please indicate it because the leading statement in this paragraph makes the point that revenue increases despite decrease in consumption and you are providing supporting evidence from different countries. The reference to illegal cigarette sales is cannot be put in context here unless the study also shows that smoking decreased while revenue increased event after accounting for illegal cigarette sales.
4. The statements below in the Discussion section are not substantiated or do not directly follow from the results of the paper. They are rather speculative.
 - “Compared to Thailand and the Philippines, Vietnam has the highest annual consumption of 3,900 million packs but collects only about one-third of the total tobacco tax collected in Thailand or the Philippines due to the current low tax rate.” Without detailed information on the number of cigarettes packs consumed in the three countries and the comparison of tax rates as percentage of retail price, this claim is not warranted. I recommend taking this statement out unless the authors can cite a source with this comparison.
 - “Although the tax revenue itself would not provide enough to meet the financial needs of universal health coverage, it would make a significant contribution.”
 - Is any estimate of the cost of financing universal health coverage in Vietnam available? What percentage of this cost can be covered by the increased revenue?I recommend removing both these statements.

Conclusions

1. The Conclusion section should emphasize the fact that the poorest gain most from tax increase and that this finding dispels the myth that tobacco tax increase is regressive.
2. The policy implication written in the conclusions section to qualify large increases in price particularly those that focus on narrowing the gap between the least and most expensive cigarettes does not follow from the finding of this paper. The analysis was done using the price of the most sold brand. A more nuanced analysis with differential prices and consumption by brands at different price tiers is needed to draw this conclusion. Please omit this statement. The Conclusion section must cover what this study found in terms of the overall effect of tax increase on smoking, public health and tax revenue as well as greater public health gain for the poor.

References

1. Van Minh H, Giang KB, Ngoc NB, Hai PT, et al.: Prevalence of tobacco smoking in Vietnam: findings from the Global Adult Tobacco Survey 2015. *Int J Public Health*. 2017; **62** (Suppl 1): 121-129 [PubMed Abstract](#) | [Publisher Full Text](#)
2. Nargis N, Yong HH, Driezen P, Mbulo L, et al.: Socioeconomic patterns of smoking cessation behavior in low and middle-income countries: Emerging evidence from the Global Adult Tobacco Surveys and International Tobacco Control Surveys. *PLoS One*. 2019; **14** (9): e0220223 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Economics of tobacco and tobacco control

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.
