Income and cigarette price responsiveness: evidence from Vietnam

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ABSTRACT

Background Vietnam has an ad valorem tobacco excise structure, with the tax base being factory gate price, making the excise susceptible to tax avoidance and less effective in reducing tobacco use. To address these issues, therefore, the government has considered switching to a mixed system in which a specific rate would be imposed on every cigarette pack in addition to the existing ad valorem rate. However, little is known about how smokers with different incomes respond to price increases in Vietnam, raising the concern of regressivity of the tax reform.

Objectives This paper aims to provide timely and more updated evidence to support policy discussion on tobacco excise tax reform.

Methods The study relies on the smokers' stated preferences, which are elicited from the Tobacco Consumption Survey in Vietnam in 2017–2018. We use data on actual purchases and the stated maximum prices that smokers are willing to pay for their cigarette brands to calculate conditional price elasticity at the individual level. Regression analysis then is used to quantify the extent to which income and other socioeconomic characteristics shape the smokers' price sensitivity.

Results Both the individual incomes and household incomes have negative and significant effects on the price elasticity of conditional demand for cigarettes. This effect is particularly strong after taking the product heterogeneity into account by considering only the most popular brand, but becomes smaller when looking at a more heterogeneous market by excluding that brand from the original sample. The magnitude of the impact of income adjusted for cigarette price is much higher than unadjusted income. The implication is that with sufficiently large variation in price across cigarette brands, which are often the case for countries with ad valorem tobacco excise tax structures, the low-income smokers may not be more sensitive to cigarette price than the high-income smokers so that a uniform percentage increase does not necessarily result in larger consumption fall for the low-income smokers. Narrowing the price gaps between cigarette brands by adding a specific tax component can help address this issue.

Conclusion Raising tobacco tax can make the tax policy more progressive and benefit the poor more than the rich in Vietnam. Thus, the Government of Vietnam should switch from the current, purely ad valorem excise tax structure to the mixed system to reduce price variation and make the tobacco tax more progressive.

INTRODUCTION

The welfare implication of increasing tobacco taxes depends critically on how differently smokers with different incomes react to higher prices induced by tax increases. If the poor are more price-sensitive than the rich, an equal increase in the price will result in disproportionately bigger consumption reduction among the former. After taking into account the benefit of less tobacco use through saved healthcare costs and longer working years, the aggregate net effect of the higher tobacco tax can benefit the poor more than the rich, implying the progressiveness of tobacco tax increase.[1 2]

Extensive literature has been devoted to examining the relationship between price responsiveness and income. It is well-documented that smokers in low-income and middle-income countries (LMICs) are at least as responsive to price as those in

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WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The negative relationship between income and price elasticity is found within many high-income countries but the evidence is limited, and for those available, mixed and inconclusive in low-income and lower-middle-income countries.
⇒ The only income and price elasticity estimated for Vietnam using data from 1997 to 1998 Vietnam household living standard survey was too outdated to inform the current tobacco taxation policy discussion in Vietnam.

WHAT THIS STUDY ADDS

⇒ The effect of income on cigarette price elasticity is estimated using the most up-to-date data available for Vietnam, which could be used to support the current country's tobacco taxation reform.
⇒ Using the stated willing-to-pay approach, this paper is able to provide an arc elasticity estimate for Vietnam and hence enrich the literature for low-income and middle-income countries (LMICs).
⇒ Smokers in LMICs are at least as responsive to price as those in high-income countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study expands the evidence base on the relationship between income and price elasticity by providing an up-to-date estimate that could be used in policy discussion in the context of current Vietnam tobacco taxation reform.
⇒ Furthermore, this study suggests raising tobacco tax can make the tobacco taxation policy more progressive and benefit the poor more than the rich in Vietnam.

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high-income countries (HICs).[1 3] The overall price elasticity of tobacco use is typically estimated to range from −0.2 to −0.9 in LMICs and from −0.2 to −0.6 in HICs. This negative relationship between income and price elasticity is found within many HICs but the evidence is limited, and for those available, mixed and inconclusive in LMICs.[1 3]

The variation in within-country results between HICs and LMICs may be attributed to differences in their excise tax structures. HICs typically adopt either a uniform specific or a uniform mixed scheme combining both specific and ad valorem components (mostly European countries) while a large number of LMICs rely on uniform ad valorem and complicated, tiered structures.[4] Previous studies on the relationship between the variation of cigarette prices and the excise tax structures demonstrate that the specific uniform tax structures are associated with the least price variability, followed by the mixed system with a greater share of the specific component.[5 6] The purely ad valorem and tiered systems show the highest price variation, thereby creating more room for strategic brand choice, brand-switching and tax avoidance. Consequently, low-income smokers may choose cheaper cigarette brands to achieve higher consumption, thereby becoming less responsive to a given percentage change in price.

Vietnam is among the countries with the highest smoking prevalence worldwide. Approximately 22.5% of the adult population use tobacco products.[7] Such high prevalence has been attributed to the rising affordability of cigarettes in the country between 2010 and 2020.[8] Such increasing affordability stems to a large extent from its adoption of an ad valorem excise structure, with the tax base being factory gate price, which makes the excise susceptible to tax avoidance.[9] As of 2020, while the ad valorem rate stays at 75%, the total tax imposed on the most popular cigarette brand accounts for 38.8% of its retail price, which falls far short of the 75% minimum rate recommended by WHO.[8] To make the tobacco tax more effective in reducing tobacco use, therefore, the government has considered switching to a mixed excise in which a specific rate would be imposed on every cigarette pack in addition to the existing ad valorem rate.

Unfortunately, there is only one study that has attempted to examine the relationship between income and price sensitivity to inform the government of the potential welfare impact of the tobacco tax increase and tax structure reform. Using household survey data collected in 1997–1998, the authors found that low-income smokers have higher price elastic demand than do high-income smokers.[10] Given the increasing affordability of cigarettes, however, there is an urgent need for timely and more updated evidence to support policy discussion, which this paper aims to provide. We use data collected more recently in 2017–2018 on actual purchases and the stated maximum prices that smokers are willing to pay for their cigarette brands to measure conditional cigarette price elasticity at the individual level. Regression analysis then is employed to examine how income and other socioeconomic characteristics shape smokers' price sensitivity. The method is simple and can be easily replicated in other countries.

METHODOLOGY

In our paper, price elasticity is estimated using the stated willingness-to-pay approach. This approach has been used in estimating demand elasticity in economics literature, including for environmental service,[11] and for healthcare delivery research.[12] In our paper, the smokers' stated preferences are elicited from the Tobacco Consumption Survey (TCS) conducted

by the Development and Policies Research Center in Vietnam in 2017–2018. In the survey, each smoker was asked to report the maximum price that he would be willing to pay for his current cigarette brand should its price increase. We use this reported maximum price to approximate the one at which his consumption equals zero. This approach allows us to observe changes in both the price and quantity demanded, holding his income and other factors constant, which are sufficient to estimate conditional cigarette price elasticity. Furthermore, as the elasticity is calculated with the constant change of 100% in consumption, it is comparable across smokers.

The absolute value of price elasticity (E_i) is simply computed as the following:

$$E_i = \left| \frac{C_i^1 - C_i^0}{C_i^0} * \frac{P_i^0}{P_i^1 - P_i^0} \right| = \left| \frac{0 - C_i^0}{C_i^0} * \frac{P_i^0}{WTP_i - P_i^0} \right| = \frac{P_i^0}{WTP_i - P_i^0} \quad (1)$$

where C_i^0 is the current consumption of the smoker i, P_i^0 current price the smoker paid for his or her cigarette pack, $P_i^1 = WTP_i$ stated maximum price that the smoker would be willing to pay for his or her cigarette pack and $C_i^1 = 0$ the cigarette consumption at the price $P_i^1 = WTP_i$.

The obtained elasticity, E_i, is then regressed against income and other control variables in the following specification:

$$E_i = \beta_0 + \beta_I INC_i + \gamma X_i + u_i \quad (2)$$

where INC_i is either the monthly income or monthly income divided by cigarette price of smoker i, X_i a vector of control variables (including demographic characteristics and a dummy for illicit trade) and u_i error term.

In the paper, we adopt the concept of marginal regressivity to study the equity implication of the tobacco excise tax.[1 13 14] A tax is marginally regressive if the ratio of the change in tax payment caused by the change in taxes or tax rates, to income rises as income decreases. This is different from the average regressivity, which occurs when the ratio of tax payment to income is negatively associated with income. If a tax is marginally regressive, then an increase in tax rate will make it become more regressive or less progressive averagely. Thus, the sign of β_I suggests the marginal regressivity of the tobacco tax. The negative coefficient implies that the smokers with lower incomes tend to be more price-responsive on average so that a price increase induced by raising the tobacco tax can reduce cigarette consumption more among the low-income smokers than the high-income smokers. Consequently, it can shift tax burden from the low-income smokers to the high-income smokers, making the tobacco tax marginally progressive, and averagely less regressive. With similar arguments, the tobacco tax can be marginally regressive, and an increase can make it averagely more regressive if the coefficient is positive, and has neutral effects if the coefficient equals zero.

The TCS is a household survey, covering a sample size of over 2700 smokers in nine provinces in Vietnam, including the three largest and most developed cities, Hanoi, Da Nang and Ho Chi Minh City. Its target population is males and females aged 18 years and above, who currently smoke cigarettes at least once a week. Multistage stratified cluster random sampling is employed to recruit survey participants. In addition to the stated Willingness-to-pay (WTP), the survey collects data on consumption, brand choice and price in the smokers' most recent purchases, as well as their socioeconomic characteristics. Cigarette packs from smokers in their most recent purchases are also collected and carefully inspected to identify the prevalence of illicit cigarette brands, which are typically smuggled into the country. Since it is reasonable to expect that the behaviours of the smokers, who live in the same village are more highly correlated with each

other, than those far apart, all analyses cluster SEs in accordance with the clustering and stratification used in the survey design. To eliminate potential outliers, observations in the first and 99th percentiles of the WTP distribution is excluded from our final sample. All analyses are also weighted by sampling weights.

This paper studies both the smokers' and their households' incomes, all of which are measured monthly. We suspect that it is the income adjusted by prices of cigarette packs that would also affect the price sensitivity of the smokers, rather than only the unadjusted income because the adjusted income reflects the affordability of cigarettes to individual smokers. Therefore, we also divide the income by cigarette prices and run the regression to account for this possibility. To control for product heterogeneity, we disaggregate the data by cigarette brands and consider the most widely used one. This brand makes up a roughly 30% share of the national market measured on the total number of smokers, rather than total number of cigarettes consumed. It is distributed almost exclusively in the North and dominates this regional market with a roughly 65% share. Such popularity and high geographical concentration create a relatively homogenous market, while at the same time, provide a sufficiently large sample for evaluating the effect of income on price elasticity. Furthermore, the incomes of its consumers appear to vary across a relatively wide range, allowing one to observe the consumption behaviour of both low-income and high-income smokers.

RESULTS AND DISCUSSION

Table 1 presents a descriptive summary by income level. The low-income group represents smokers in the first half of income distribution while the high-income group comprises the remaining. Average cigarette consumption is estimated at over five packs per week and does not significantly vary across the two groups. Although low-income smokers smoke significantly cheaper products, they are paying higher relative prices when normalised by income. Consequently, their income share on cigarettes is higher, and is consistent with previous studies in Vietnam,[15] and many other countries.[1] Similar results also hold in the cases of the most widely used brand and of all other cigarette products. Our estimated average price elasticity equals 2.4, exceeding most of the estimates in the literature, which are typically <1. However, they are not comparable due to their different estimation methods. Most previous studies estimate demand functions for market data, and then derive the point estimates of price elasticity from those estimated functions. By contrast, our study uses the discrete, arc estimates of price elasticity, which are obtained at individual level by combining market data on price and stated willingness to pay.

Table 2 compares the most widely consumed brand with all other brands. The former is significantly cheaper, but its smokers consume fewer cigarettes per week, implying lower

Table 1 Descriptive summary by income level

	High-income	Low-income	Difference	Student's t-statistic*
Entire sample				
Consumption (cigarettes per week)	5.54	5.60	−0.06	−0.18
Price (thous. VND)	12.62	10.54	2.08	8.27
Price relative to income (× 1000)	1.73	7.27	−5.54	−6.53
Smoker income (mil. VND)	8.67	2.45	6.22	15.65
Income share on cigarettes (%)	4.28	14.19	−9.91	−21.54
Household income (mil. VND)	15.44	8.01	7.43	6.82
Household income share on cigarettes (%)	2.73	5.30	−2.57	−13.65
Price elasticity	2.24	2.50	−0.25	−3.08
No observation	1045	1049		
Most popular brand				
Consumption (cigarettes per week)	5.10	4.79	0.31	0.55
Price (thous. VND)	9.70	9.71	−0.01	−0.10
Price relative to income (× 1000)	1.42	6.34	−4.92	−5.47
Smoker income (mil. VND)	8.21	2.44	5.77	35.73
Income share on cigarettes (%)	3.51	12.56	−9.05	−7.39
Household income (mil. VND)	15.34	8.57	6.77	10.94
Household income share on cigarettes (%)	2.03	4.19	−2.17	−17.89
Price elasticity	1.47	2.45	−0.98	−2.75
No observation	217	226		
All other brands				
Consumption (cigarettes per week)	5.76	5.90	−0.14	−0.50
Price (thous. VND)	14.06	10.86	3.21	8.15
Price relative to income (× 1000)	1.88	7.66	−5.77	−4.73
Smoker income (mil. VND)	8.90	2.45	6.45	12.66
Income share on cigarettes (%)	4.66	14.87	−10.21	−16.35
Household income (mil. VND)	15.50	7.80	7.70	4.26
Household income share on cigarettes (%)	3.07	5.73	−2.66	−10.36
Price elasticity	2.63	2.52	0.10	0.65
No observation	820	815		

*Null hypothesis of the Student's t-statistics for each variable is H0: mean (high-income)−mean (low-income)=0.
mil., million; thous., thousand; VND, Vietnamese Dong.

Table 2 Descriptive summary by cigarette brands

	Most popular brand	Other brands	Difference	Student's t-statistic*
Consumption (cigarettes per week)	4.95	5.84	−0.89	−5.76
Price (thous. VND)	9.71	12.22	−2.51	−4.09
Price relative to income (× 1000)	3.92	5.18	−1.26	−1.22
Smoker income (mil. VND)	5.25	5.19	0.06	0.18
Income share on cigarettes (%)	8.14	10.43	−2.29	−1.86
Household income (mil. VND)	11.85	11.10	0.75	0.65
Household income share on cigarettes (%)	3.15	4.58	−1.43	−9.53
Price elasticity	1.96	2.57	−0.61	−1.72
No observation	459	1635		

*Null hypothesis of the Student's t-statistics for each variable is H0: mean (most popular brand)−mean (other brands)=0.
mil., million; thous., thousand; VND, Vietnamese Dong.

cigarette expenditure. There is no statistically significant difference between them in terms of the smokers' incomes, household incomes and relative income price. Therefore, smokers of the most popular brand spend less income share on cigarettes than those of other brands as expected.

Table 3 presents our main results when considering smoker incomes while those associated with their household incomes are shown in table 4. Since results in the two cases are similar to each other, we discuss only the first case. Overall, we find a negative and statistically significant relationship between income and price elasticity in Vietnam. For each additional income of VND 1.0 million (equivalent to US$46.5), the elasticity tends to fall by 0.026 units, implying that smokers with lower incomes are more price responsive (column 1). Compared with the whole

sample, the magnitude of the income effect nearly triples when restricting to only the most widely smoked brand (column 3). The coefficient however decreases slightly in the case of all other brands (column 5). The difference between the two brand groups may be explained by the increase in the price variability due to the exclusion of the most popular brands.

As discussed above, we also regress price elasticity against the adjusted income (ie, the income divided by the cigarette price). The estimated coefficient has a negative and statistically significant effect on the price elasticity (columns 2, 4 and 6). The implication is that, if the price variation is sufficiently large, low-income smokers, who choose to smoke cheap products may have adjusted income comparable to high-come smokers who choose more expensive cigarettes. In this case, the estimated

Table 3 Regression results with individual incomes

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**All**	**All**	**Most popular brand**	**Most popular brand**	**Other brands**	**Other brands**
Smoker income	−0.026***		−0.073**		−0.017*	
	(0.006)		(0.013)		(0.008)	
Income to price ratio (× 1000)		−0.500**		−0.653**		−0.378**
		(0.141)		(0.134)		(0.129)
Dummy for tertiary education	0.053	0.059	−0.377*	−0.380*	0.470	0.464
	(0.379)	(0.404)	(0.120)	(0.127)	(0.630)	(0.669)
Age	0.062*	0.064*	0.101*	0.103**	0.041	0.045
	(0.028)	(0.028)	(0.032)	(0.032)	(0.038)	(0.038)
Squared age	−0.001	−0.001	−0.001**	−0.001**	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy for illicit cigarette	1.714***	1.566***			1.679***	1.575***
	(0.290)	(0.302)			(0.298)	(0.290)
Dummy for urban commune	0.439	0.413	−0.192	−0.211	0.669*	0.632*
	(0.225)	(0.218)	(0.171)	(0.173)	(0.271)	(0.279)
Dummy for North	−0.556**	−0.564**			−0.804	−0.803
	(0.154)	(0.143)			(0.503)	(0.467)
Dummy for Central	−0.283	−0.304			−0.330	−0.339
	(0.264)	(0.259)			(0.239)	(0.240)
Constant	0.775	0.911	0.056	−0.054	1.077	1.142
	(0.656)	(0.612)	(1.156)	(1.138)	(0.935)	(0.919)
Observations	2094	2094	443	443	1635	1635
R²	0.075	0.079	0.035	0.034	0.090	0.092

Data come from the Tobacco Consumption Survey conducted in Vietnam in 2017–2018 by DEPOCEN. All regressions are weighted by using sample weight. SEs clustered in accordance with the survey design are reported in parentheses. *, ** and *** denote 90%, 95% and 99% significance levels, respectively. Since all packs of the most popular brand collected are licit, and almost all of them are found in the North, dummies for illicit cigarettes and regions are excluded from the second regression. The dependent variable is our estimated price elasticity at the individual level.
DEPOCEN, Development and Policies Research Center.

Table 4 Regression results with household incomes

Variables	(1) All	(2) All	(3) Most popular brand	(4) Most popular brand	(5) Other brands	(6) Other brands
Household income	−0.011***		−0.042***		−0.009**	
	(0.002)		(0.006)		(0.003)	
Household income to price ratio (× 1000)		−0.307***		−0.356***		−0.278***
		(0.038)		(0.058)		(0.065)
Dummy for tertiary education	0.042	0.055	−0.382**	−0.385**	0.490	0.468
	(0.375)	(0.381)	(0.086)	(0.098)	(0.631)	(0.647)
Age	0.058	0.060*	0.108*	0.109*	0.035	0.038
	(0.029)	(0.029)	(0.043)	(0.042)	(0.039)	(0.038)
Squared age	−0.000	−0.000	−0.001**	−0.001**	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy for illicit cigarette	1.714***	1.529***			1.684***	1.521***
	(0.296)	(0.279)			(0.301)	(0.270)
Dummy for urban commune	0.426	0.381	−0.336	−0.351	0.673*	0.622*
	(0.221)	(0.217)	(0.173)	(0.174)	(0.272)	(0.279)
Dummy for North	−0.540**	−0.530**			−0.783	−0.755
	(0.156)	(0.135)			(0.515)	(0.434)
Dummy for Central	−0.280	−0.320			−0.336	−0.367
	(0.262)	(0.251)			(0.239)	(0.231)
Constant	0.816	1.025	−0.102	−0.220	1.201	1.362
	(0.664)	(0.655)	(1.467)	(1.462)	(0.957)	(0.903)
Observations	2074	2074	440	440	1618	1618
R^2	0.074	0.080	0.037	0.034	0.090	0.094

Data come from the Tobacco Consumption Survey conducted in Vietnam in 2017–2018 by DEPOCEN. All regressions are weighted by using sample weight. SEs clustered in accordance with the survey design are reported in parentheses. *, ** and *** denote 90%, 95% and 99% significance levels, respectively. Since all packs of the most popular brand collected are licit, and almost all of them are found in the North, dummies for illicit cigarettes and regions are excluded from the second regression. The dependent variable is our estimated price elasticity at the individual level.

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results indicate that these low-income smokers may be equally or even less price sensitive than high-income smokers. Although this is not the case of Vietnam where low-income smokers have lower adjusted income than high-income smokers, these findings suggest that reliance on purely ad valorem and complicated tiered excise tax structures, which are associated with higher price variation may be one possible explanation for the inconclusive results in the LMICs. Furthermore, if that is the case and low-income smokers are equally or less price sensitive than high-income smokers, the tobacco excise tax is not marginally progressive.

In addition to the incomes, we examine the effects of other socioeconomic factors and current price on the smokers' price elasticity. First, the influences of formal education and age become statistically significant only after controlling for product heterogeneity (column 3 and column 4). Smokers with tertiary education are less price responsive. Higher ages are associated with more elastic demand in the case of those less than approximately 50 years old, but with less elastic demand for smokers above that age (column 3 and column 4). We find no systematic evidence suggesting a significant difference in price responsiveness between smokers in urban and those in rural areas. Finally, smokers of illicit cigarettes tend to be more price-elastic than those of licit counterparts (column 1 and column 2). This result may be attributable to a substantially large price gap between them as illicit brands are much more expensive in Vietnam, unlike many other countries where they are typically cheaper than licit brands.[16]

CONCLUSION AND POLICY IMPLICATION

The findings in the paper support the argument that low-income smokers are more price-responsive than high-income smokers in Vietnam. This negative relationship between income and price elasticity is particularly strong after taking the product heterogeneity into account by considering only the most popular brands but becomes less prominent when looking at a more heterogeneous market by excluding that brand from the initial sample. This difference may be attributed to the brand choices of smokers with different incomes. Low-income smokers tend to select cheaper brands, which allow them to afford more cigarettes. Consequently, when price variation is sufficiently large, a 1% increase in the price of cheap cigarettes can be so small that there may be no significant difference in the price elasticity between the two income groups. This mechanism may be one possible explanation both for the consistent results in the HICs, which typically rely on uniform specific or mixed excise tax structure, and for the inconclusive evidence in the LMICs, where the ad valorem and tiered excise tax system are usually adopted.

Our findings have two policy implications. First, raising tobacco tax can make the tax policy more progressive and benefit the low-income smokers more than the high-income smokers in Vietnam. Because the low-income smokers are generally found to be more price sensitive than the high-income smokers, a given increase in price results in disproportionally higher consumption reduction among low-income smokers. Second, the Government of Vietnam should switch from the current, purely ad valorem excise tax structure to the mixed system to reduce the price variation and contribute to making the tobacco tax even

more progressive. As shown in this paper, with sufficiently large variation in price across cigarette brands, which are more likely to occur in the countries with ad valorem tobacco excise tax structures, the low-income smokers may not be more sensitive to cigarette price than the high-income smokers so that a uniform percentage increase is not necessarily result in larger consumption fall for the low-income smokers. By narrowing the price gaps between cigarette brands, adding a specific tax component can help address this issue.

This research is subject to several limitations. First, the analysis assumes smokers would quit smoking once the price of their current cigarette brands exceeds their willingness to pay. In our paper, data availability does not allow us to consider the possibility of switching to another cigarette brand or to a different tobacco product such as bamboo waterpipe. Second, the analysis relies on stated willingness to pay, which may not be completely free from hypothetical bias, even though smokers are likely to have good knowledge of cigarette brands that they were smoking at the time of the survey, which can help reduce the bias.

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