Cigarette tax pass-through in Vietnam: evidence from retailers' data

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Abstract

Purpose – This study aims to estimate the pass-through rate of the increases in the excise tax and TCF tax on tobacco in Vietnam. This study seeks to shed light on how the tax burden is split between consumers and producers and inform policy discussions in the country. Using panel micro-level data collected from three waves of a nationwide retailer's survey, this study provides an evidence-based pass-through estimation for tobacco tax in Vietnam and contributes to the understanding of tax policy on smoking and smoking-related issues.

Design/methodology/approach – Following increases in the excise tax and TCF tax on tobacco in 2019, the differential effect of the tax hike on the "treatment group" (domestic cigarettes) versus the "control group" (illicit cigarettes) using a difference-in-difference (DID) analysis has been studied. The study utilized unique longitudinal retailers' data on cigarettes prices in Vietnam from 2018 to 2019 to estimate the tax pass-through rate for some of the most popular factory-made cigarette brands.

Findings – This study found evidence of an over-shifting of cigarette taxes on smokers. Specifically, it discovered that the tax increase is absorbed more by low-priced brand smokers compared to premium brand users due to (1) the limited increase in prices under a pure ad valorem system and (2) the way the Vietnamese currency is denominated. Additionally, there is evidence of cushioning to mitigate price shock on consumers as the real prices increase gradually over the period of one year after the tax change.

Originality/value – To the best of the authors' knowledge, this study is the first to collect and analyze a unique panel micro-level data from three waves of a nationwide retailers' survey, which captures the changes in marketing and pricing strategies of the tobacco industry in Vietnam before and after an increase in excise tax in 2019. The results of this study could be used as a reference for future policymakers in considering increasing taxes on tobacco.

Keywords Tobacco taxation, Tax pass-through, Public health, Regulation, Tobacco industry

Paper type Research paper

1. Introduction

Tobacco consumption is harmful not only for its health consequences but also for its economic cost. WHO (2011) projected that tobacco use would lead to 10mn deaths a year by 2030, with 70% of these deaths occurring in developing countries where tobacco is relatively more affordable. Vietnam is currently among those with the highest prevalence of tobacco use globally. The total economic cost of smoking in 2011 (including direct health costs and productivity loss) was estimated at US$1.2bn, approximately 1.0% of the 2011 gross domestic product (Anh, Ross, Anh, Linh, & Minh, 2016). Despite the government's adaptation of comprehensive tobacco control legislation marked by the Tobacco Control (TC) Law in 2013, the prevalence of smoking remained high at 22.5% in 2015 - a reduction of only 1.3% points compared to 2010 according to the Global Adult Tobacco Survey (GATS).

Such high prevalence has been attributed to the affordability of cigarettes, which are by far the most popular tobacco products used in Vietnam. Since the country has achieved exceptional economic growth while taxes imposed on tobacco have not changed until very recently, cigarettes have become more affordable in the country since 1994 (Blecher & Nguyen, 2019). Various studies have observed that the taxation policy in Vietnam has yet to make cigarettes less affordable (Marquez, Krasovsky, Andreeva, & Isenman, 2019; Tran, Tran, Le, Nguyen, & Goodchild, 2018). One possible reason is its adaptation of a pure valorem system, which is considered to be less effective in reducing tobacco use than purely specific or mixed excise systems (Ho, Schafferer, Lee, Yeh, & Hsieh, 2018; WHO, 2018). Using ex-factory prices as the tax base also exacerbates the issue as it gives more space for the tobacco industry to respond, including launching more products in the low-price segments and using a variety of promotion techniques to sell cheaper products since low prices mean low taxes. The WHO estimates that the current total taxes account for only 36% of the retail price of the most widely sold cigarette brand in Vietnam, which is much lower than the recommended level of 75% (Marquez *et al.*, 2019). Accordingly, researchers suggest that increasing cigarette taxes would yield substantial health impacts and financial savings in Vietnam. Levy, Bales, Nguyen and Nikolayev (2006) applied a *Vietnam SimSmoke* simulation model and found that among five types of tobacco control policies, including tax increases, mass media campaigns, advertising bans, clean air laws and youth access policies, the largest impact results from an increase in taxes. In detail, a 100% tax increase could reduce male and female smoking prevalence by 24.5% and 14.5%, respectively, and save 9,000 premature deaths each year. Jha *et al.* (2012) constructed a static model to estimate population structure, age- and gender-specific smoking, and expected deaths in five Asian countries, including Vietnam. The results indicated that a 50% price increase would help Vietnam to avoid 27.2mn deaths and gain US$24.7bn in revenue. Recently, Minh *et al.* (2018) made use of the same model to estimate the health impacts of increasing cigarette taxes in Vietnam. They modeled four scenarios in which the WHO-recommended policy scenario is most ideal. Under this assumption, up to 12.3mn deaths could be prevented, and at the same time, up to US$112bn in mortality costs could be saved. The evidence suggests that raising taxes on cigarettes brings both health and economic impacts (Fuchs & Gonzalez, 2019).

Taking that into account, the Vietnam government is taking steps to increase tobacco taxes. Cigarettes made in Vietnam are currently subject to three different taxes. The first is an ad valorem excise tax or commonly referred to as a special consumption tax, which is levied on ex-factory price. The country initially imposed different tax rates on different types of tobacco products but changed to a uniform system in 2006. Since then, the ad valorem rate has increased the number of three times, from 50% in 2006 to 65% in 2008, 70% in 2016 and most recently 75% in 2019. The second is a compulsory contribution to the Tobacco Control Fund (TCF), which was established in 2012 by the Vietnam Tobacco Control Law. The contribution rate started from 1.0% of the taxable price of all cigarette packs in 2013 and increased to 1.5% in 2016, and most recently to 2% in May 2019. The third is the value-added tax (VAT), which is applied to both tobacco and non-tobacco products in the country. The VAT currently amounts

to 10% of the sum of the taxable price, excise tax, and TCF contribution. Thus, in 2019, the total taxes imposed on a cigarette increased by a total of 6.05% points (from 88.65% to 94.70%) of the ex-factory price in 2018. This paper attempts to estimate the pass-through of this change in taxation policy to inform policy discussion in Vietnam.

While the impact of a tax increase on consumption depends on how the tax burden is split between consumers and producers, to the best of our knowledge, there have been no existing studies that attempt to shed light on this issue in Vietnam. Relevant studies normally assume that tax is fully passed on to smokers, including the *TaXSiM* simulation model by WHO. This assumption could lead to over- or under-estimated effects of taxation on the impact of cigarette tax on smoking and smoking-related issues. Acknowledging the need for evidence-based pass-through estimation for tobacco tax in Vietnam, this study collects and analyses a unique panel of micro-level data from three waves of a nationwide retailers' survey in the period of 2018–2019. The rich dataset allows us to conduct a difference-in-difference (DID) analysis, in which the treatment group consists of all licit domestic cigarette brands while illicit cigarettes smuggled into the control serve as the control group. The results from DID allow us to compute the brand-level pass-through rate, which in turn opens discussion on not only the tax burden on smokers but also the response of different players in the tobacco industries. Such discussions are critical to providing inputs for the ongoing tobacco tax reform in the country.

Our empirical analysis shows that the burden of tax is over-shifted to smokers, especially in the economy segment of the market, where the amount of tax hike is significantly low. We also perform a timeline analysis of real price changes and found that tax increase is gradually shifted to customers to avoid a shock in prices.

The remaining is outlined as follows. We first briefly review existing literature on tobacco tax pass-through and the main features of the cigarette market in Vietnam in Sections 2 and 3, respectively. Section 4 describes our unique micro-level data on cigarette prices at retail establishments. Our identification strategy for estimating the incidence of tobacco taxation is explained in Section 5, while Section 6 presents and discusses the results and estimates the incidence of tobacco taxation. Section 7, the final section, concludes and suggests relevant policy recommendations.

2. Background literature

Economic theory suggests that in a perfect competition scenario, (1) a tax increase cannot be fully passed on to consumers and (2) ad valorem tax and specific tax have the same effect on price. However, in an imperfect competition scenario, the tax burden can be passed on to consumers to varying degrees, depending on demand conditions. In an imperfect competition setting, however, both under-shifting, complete pass-through and over-shifting are possible, depending on demand conditions (Weyl & Fabinger, 2013). Furthermore, the level of pass-through in different taxation systems, such as ad valorem, specific or mixed tax, can vary significantly depending on the market structure of a specific product (Anderson, De Palma, & Kreider, 2001; Delipalla & Keen, 1992). In most countries worldwide, including Vietnam, the tobacco industries are highly concentrated (IARC, 2011) and thus exhibit imperfect competition. Consequently, determining whether a tobacco tax increase is partially, completely or excessively transmitted to retail prices is rather an empirical question.

Indeed, several studies have attempted to estimate the tax pass-through rates in the cigarette market. Most of them focus on specific taxes in the USA, with some exceptions, such as Delipalla and O'Donnell (2001), who compare the ad valorem and specific taxes in European countries, Marsh *et al.* (2016) on the New Zealand tobacco taxation or Hu, Mao, and Shi (2009) on the tax reform in China. Results, however, are mixed and support both under-shifting (Chiou & Muehlegger, 2014; Harding, Leibtag, & Lovenheim, 2012; Hu *et al.*, 2009; Linegar & van Walbeek, 2018), complete pass-through (DeCicca, Kenkel, & Liu, 2013; Espinosa & Evans, 2013) and over-shifting (Hanson & Sullivan, 2009; Sullivan & Dutkowsky,

2012). The estimated pass-through rate varies from 80% (Chiou & Muehlegger, 2014) to 117% (Hanson & Sullivan, 2009). Cross-brand pass-through are found to be similar in various studies (Espinosa & Evans, 2013; Harding *et al.*, 2012; Sullivan & Dutkowsky, 2012), while Chiou and Muehlegger (2014) estimate that the pass-through rate for discount brands is 10% points higher than for premium brands. Finally, Delipalla and O'Donnell (2001) find that the ad valorem is passed through to smokers at lower rates than the specific, confirming the theoretical prediction by Delipalla and Keen (1992). There are studies that suggest that the pass-through rate of excise tax on cigarettes also varies depending on the type of consumer and their purchasing habits. For instance, Xu, Malarcher, O'Halloran, and Kruger (2014) found that smokers in the USA are able to avoid the full impact of state excise tax on the cost of smoking by buying cartons, using generic brands or buying from Indian reservations.

Evidence in LMICs is rather limited. The exception includes Cevik (2016), who finds that on average, about 80% of the specific tax increases are transmitted to retail prices in Pakistan from 2004 to 2015. The pass-through rate, however, varies across price segments with complete pass-through for premium brands and an under-shift of 73% for economy brands. Most recently, using the sales price of cigarette brands produced in Indonesia from 2005 and 2017, Prasetyo and Adrison (2020) estimated that tobacco taxes are under-shifted to smokers and the pass-through rate is the smallest in the pure ad valorem compared to purely specific and mixed tax systems, which is consistent to the findings from Delipalla and O'Donnell (2001).

Our paper contributes to this literature by providing evidence from another LMIC – Vietnam, which would be particularly relevant for better employing taxation tools to curb the tobacco epidemic.

3. Tobacco industry in Vietnam

According to Nguyen and Nguyen (2021), the tobacco industry in Vietnam can be classified by products' origins and by geographical distribution.

By origins, tobacco products traded in the Vietnamese market are distinguished by three main types: domestic cigarettes produced locally in Vietnam, legally imported products and illicit cigarettes smuggled from other countries.

The tobacco industry in Vietnam is dominated by state-owned enterprises. There are about 30 companies organized under six state-owned corporations, with the leading role played by the Government-owned Vietnam National Tobacco Corporation (Vinataba). To gain access to Vietnam's market, foreign companies are required by law to form joint ventures with Vinataba. British American Tobacco (BAT), Phillip Morris International (PMI) and Japan Tobacco International (JTI) are three leading foreign-owned transnational tobacco companies (TTCs) that have done so. Vinataba is also the only company that is licensed to import cigarettes and distribute them in the country. Given the extremely high import duty, however, legally imported cigarettes account for only a marginal share of total consumption. Cigarette prices vary substantially across brands, ranging from as low as VND 6,000 ($0.26) to over VND 40,000 ($1.74). Domestic producers dominate lower-priced segments while TTCs focus on more expensive products. Domestic brands are those produced solely by domestic-owned companies, while foreign brands are made by a joint venture between TTCs and Vinataba. Both of them are produced locally in Vietnam.

Besides, illicit products also account for a significant proportion of the total market share, posing a threat to tax reform in Vietnam. Recent estimates show that illicit cigarettes account for over 13% of total consumption in 2017, significantly lower than about 20% observed five years earlier (Nguyen & Nguyen, 2019). Interestingly, they generally cost more than their licit counterparts in Vietnam, unlike many other countries where they are typically cheaper. Jet and Hero are the two most predominant illicit brands, making up over 80% of the illicit market (Nguyen, 2020). The two do not have licit tracks, are smuggled across the border from

Cambodia and thus, almost exclusively sold and consumed in Southern Vietnam. Another popular cigarette brand is SE555, which can be found nationwide, particularly in big cities like Hanoi, Da Nang and Ho Chi Minh City. This foreign brand has both a legal and illicit version. The legal one is manufactured locally by the joint venture between Vinataba and BAT. Unlike licit products, which must have a tax stamp, health warning texts in Vietnamese, and pictorial health warning labels printed on packs as stipulated by the Tobacco Control Law, illicit cigarettes typically have none of these requirements. Thus, it is relatively easy to determine whether a cigarette pack is licit or illicit simply by inspecting its packaging.

The legally imported products account for just a small proportion of the cigarette market in Vietnam, leaving the main market shares to domestic and illicit products. While locally produced cigarettes are fully subjected to taxes, this is not the case for illicit products. It is widely predicted by the tobacco industry that raising the taxes levied on tobacco is likely to cause higher illicit consumption as consumers shifted to smuggled products which are not subjected to tax hikes. Therefore, smuggling has the potential to diminish the effect of tax-driven price increases (Guindon, 2002). Due to the lack of data, such an effect is normally overlooked, given that it is difficult to separate the change in price for domestic and illicit cigarettes. Furthermore, the majority of the existing studies compute the tax pass-through rate on average instead of examining the changes for specific brands. This approach provides us with a broader look at the whole market but fails to shed light on the response of the major players in the tobacco industry. In this paper, we employ a unique dataset collected from cigarette retailers that allow us to analyze the effect of tax-driven price increases for different domestic brands traded in the market in relation to the trade of illicit products.

The cigarette market structure can also be defined geographically. Vietnam has three regions with relatively different natural, socio-economic and cultural characteristics, namely, North, Central and South. The set of the most popular cigarette brands varies between regions. Some brands are popular in one region, but at the same time are hardly found or account for a very modest market share in the other two. As mentioned, illicit cigarette brands such as Jet and Hero are relatively prevalent in the South, but not in the other parts of the country. These regional characteristics will play an essential role in determining our identification strategy when estimating the tax pass-through rate in Vietnam.

4. Data

4.1 Data collection

Data for our analysis come from the retailer surveys designed to investigate the changes in marketing and pricing strategies of the tobacco industry in Vietnam before and after an increase in excise tax from 70% in 2018 to 75% since January 2019. It is a longitudinal survey conducted in six provinces across the country, namely, Ha Noi and Bac Giang in the North, Da Nang and Lam Dong in the Central and Ho Chi Minh City and Long An in the South. Ten types of outlets were chosen to be observed, including tobacco dealers/tobacco stores, kiosks/street vendors, grocery stores, supermarkets, convenience stores, liquor stores, street tea shops, tea shops/coffee shops, restaurants and bars/pubs. These data allow us to control for retailers' attributes, which we believe to have a significant effect on the retail price. As mentioned, the market structure exhibits a regional disparity, which can affect the sales of specific cigarette products, while different types of retailers apply distinguished sales tactics, e.g. street vendors tend to apply a lower markup per product in comparison with coffee shops.

In total, the survey consists of four waves: (1) the baseline in 2018, (2) the first follow-up in early 2019, three months after the tax increase in January 2019 to capture short-term responses of the industry, (3) the second follow-up in late 2019 and (4) the end-line survey in 2020. All four surveys were conducted using a face-to-face data collection approach. In Wave 1, the surveyed stores were selected using the purposive sampling method, depending on the

availability of stores in each locality. In three big cities (Ha Noi, Ho Chi Minh City and Da Nang), we conducted the survey in three to five districts including both urban and rural ones, while in the other three provinces (Bac Giang, Lam Dong and Long An), only one urban district and one rural district were sampled. In each district, the number of surveyed stores was divided equally in the two surveyed communes, and the allocation of stores was decided based on their availability in each locality so that two stores of the same type must be located at least one kilometer apart. In the following waves, missing or ineligible stores were replaced by the nearest store of the same type. This allocation of sample ensures the representativeness of the selected stores, while the longitudinal nature of the repeated survey allows us to analyze the price evolution across our observed years.

The retailer questionnaire was developed to collect information on retailers' characteristics (geography, type of retailer, number of cigarette products available in store, current marketing and advertising strategies) and products' attributes [1], including the retail prices and products' origins, which can either be domestic, legally imported or illicit cigarettes. However, information on the originality of cigarette products was missing in the first round conducted in 2018. Moving forward with our DID analysis, separating illicit cigarettes (control group) from domestic ones (treatment group) is crucial. To provide a proxy for the missing originality, we assume that in Round 2 of the survey, the same product line from an identical retailer will share the same origin as the previous year [2], therefore, the products' origin in Round 1 will be determined by the collected information in Round 2. We believe there is solid ground for this assumption. First, as most retailers that participated in our survey operate on a small scale and locate at the lower tier of the distribution chain, it is less likely that they change the source of supply over the short period of one year. Second, the majority of brands have fixed originality during the period of the survey. For instance, Hero, Jet and Esse are illicit as they are neither produced domestically nor legally imported, while the origin of locally produced brands such as Hoa Binh, Vinataba, Khanh Hoi, Saigon, etc. must be domestic. Therefore, we can construct the missing information in Round 1 with high accuracy.

In this paper, we only utilize the first three waves of the survey data to estimate the real price changes responding to tax hikes. The data from the end-line survey 2020 is excluded from this study for two main reasons. First, although we managed to collect the data when the Covid-19 lockdown was lifted during the last months of 2020, the Covid-19 pandemic could potentially bring disruption to the market. Second, the regulations concerning the sales of illicit cigarettes remained unchanged in the period from 2016 to 2019, but have been tightened since 2020, which has contributed to the increases in the price of illicit products. Evidently, as Phan (2021) noticed, in 2018 and 2019, there were 8.39 and 7.55 mil packs of smuggled cigarettes got confiscated, this number for 2020 was almost doubled, to 14.3. As such disruption can lead to a violation of the parallel trend assumption in our DID analysis, we have decided to drop the data from the 2020 survey.

4.2 Descriptive statistics

4.2.1 Sample's characteristic. Putting the retailer survey data of three selected waves together, we construct an unbalanced panel for our analysis. In the first round of the survey, information on 2,980 cigarette products was collected, while this number is only 1,124 in the second wave, which was conducted 3 months later. Wave 3, which was carried on at the end of 2019, consists of 1,989 observations. Table 1 describes the characteristics of our sample.

Regarding the type of retailers participating in our surveys, grocery stores consistently account for a dominant share of the sample, with more than 40%, followed by kiosks/street vendors, tea shops/coffee shops and street tea shops. Geographically, observations concentrate on the two biggest cities of Vietnam, namely Ha Noi and Ho Chi Minh City,

	Wave 1	Wave 2	Wave 3
Type of retailers			
Tobacco dealers	0%	5%	0%
Tobacco stores	13%	11%	7%
Kiosks/Street vendors	21%	17%	14%
Grocery stores	43%	41%	50%
Supermarkets	0%	1%	1%
Convenient stores	5%	8%	5%
Liquor stores	4%	5%	3%
Tea shops/Coffee shops	6%	5%	6%
Street tea shops	4%	4%	10%
Restaurants	2%	2%	3%
Bars/Pubs	1%	1%	1%
Observations by province			
Ha Noi	47%	30%	30%
Bac Giang	4%	7%	9%
Da Nang	8%	9%	14%
Lam Dong	5%	6%	8%
HCMC	30%	42%	31%
Long An	7%	6%	7%
Observations by brands			
SE555	10%	11%	10%
Bastos	3%	4%	4%
Craven	12%	12%	14%
Dunhill	2%	2%	2%
Esse	2%	3%	1%
Hero	1%	1%	1%
Jet	2%	3%	3%
Kent	6%	6%	3%
Marlboro	10%	10%	10%
Sai Gon	12%	10%	13%
Seven Diamonds	2%	2%	2%
Thang Long	14%	14%	15%
Vinataba	5%	5%	5%
White Horse	4%	4%	5%
Hoa Binh	1%	2%	2%
Khanh Hoi	1%	2%	1%
Prince	1%	1%	1%
Others	11%	7%	4%
Total observations	2,980	1,124	1,989

Source(s): Authors' calculation based on retailer survey data

Table 1.
Characteristics of
retailers in the sample

followed by the central hub of Da Nang City. Amongst cigarette brands sold in Vietnam, State
Express 555, Craven A, Marlboro, Sai Gon and Thang Long are sold in more than 10% of the
retailers in our survey. We record the availability of each cigarette's brands and their
varieties in different types of retailers, yet we did not collect the market share of these brands.
For instance, Jet and Hero, despite accounting for 13% of the entire market share in 2017
(Nguyen & Nguyen, 2019), are sold mostly in Southern stores. That explains the modest
number of the retailers in our nationwide survey offering these two brands to consumers,
from 1% to 3% only.

4.2.2 Retail prices. Figure 1 shows the evolution of retail prices from the end of 2018 to the
end of 2019 via three rounds of surveys for the whole country (Figure 1a) and the South in
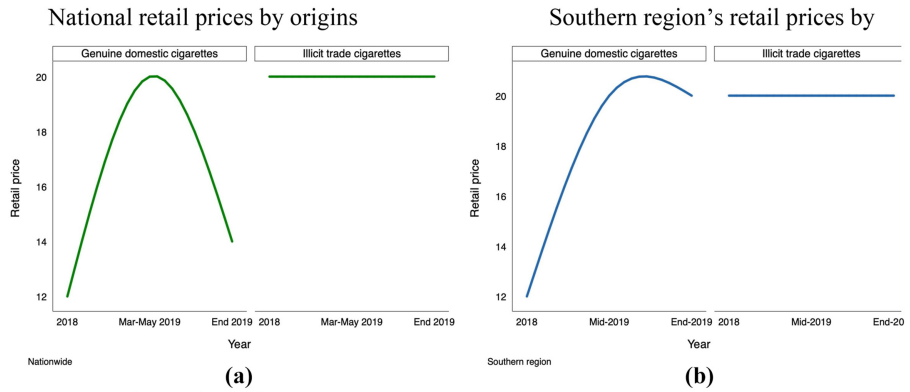
National retail prices by origins

Southern region's retail prices by

(a)

(b)

Source(s): Figures by authors

particular (Figure 1b). As mentioned, in 2017, Hero and Jet accounted for over 80% of the illicit consumption in Vietnam and are mostly concentrated in the South. Evidently, the figure shows that the country's trendline for illicit cigarettes is almost identical to the one from the Southern region. However, the price of domestic products in the Southern region increased after 2018 and did not decrease much after reaching its peak in mid-2019, while the country's average price of domestic cigarettes adjusted itself to a lower level, despite still being sold at a higher price on average than in 2018 – before the tax hike. Furthermore, while the price of illicit products was kept almost unchanged from the end of 2018 (the first round) to the end of 2019 (the third round), the price of domestic cigarettes – which are applicable to taxes – volatile significantly. It confirms the existence of differences between these two groups, which provides more evidence to justify our employment of the DID framework. As mentioned, both groups of products are sold in the same store and subjected to the same environment except for government taxes, their prices would move parallelly without treatment – an increase in taxes. The detailed specification of the DID model will be elaborated in the next section.

5. Methodology
5.1 Theoretical framework to estimate pass-through rate
We adopt a simple theoretical framework to understand how changes in cigarette taxes influence the pricing decisions of producers and subsequently impact consumers' behavior. When a new tax rate τ is introduced, producers adjust the price of cigarettes based on a function $\varphi(\tau)$. The relationship between the original price p_0 and the new price p is defined by the equation:

$$p = p_0 + p_0\varphi(\tau) \tag{1}$$

The impact of price adjustments is classified into three categories: overshift, when $\varphi(\tau) > \tau$, indicating producers over-adjust prices; undershift, when $\varphi(\tau) < \tau$, implying producers under-adjust prices; and no shift, when $\varphi(\tau) = \tau$, signifying a direct pass-through.

This framework introduces the pass-through rate r, defined as $r = \frac{\varphi(\tau)}{\tau} \times 100$. Consequently, r can be estimated as follows:

$$r = \frac{p - p_0}{\tau p_0} \times 100 = \frac{(p - p_0)/p_0}{\tau} \times 100 \tag{2}$$

Equation (2) is a commonly used formula to measure the pass-through rate of taxes, including tobacco taxes (Chiou & Muehlegger, 2014; Harding *et al.*, 2012). In order to determine the pass-through rate, we need to estimate (1) the change in real price ($p_0\varphi(\tau)$), which will be done by employing a DID model and (2) the amount of tax hike, which will be computed in three scenarios.

Policy works on tobacco taxation and smoking prevalence oftentimes assume that tobacco taxes are fully passed through to smokers, implying that the change in real prices brought about by tax increase equals the amount of tax hike. In other words, when there is a complete pass-through, smokers will cover all the price changes. Our paper challenges this assumption, particularly in the context of Vietnam, where the increasing affordability of cigarettes suggests that a complete pass-through of tobacco taxes to smokers may not hold true.

5.2 Estimation of real price change

To estimate the real price change of cigarettes' retail prices in response to the tax hike, we perform a DID analysis separately on the 12 most popular products sold in the Vietnamese domestic market, by considering the retail prices of the treated items (domestic cigarettes) with those of a control group (illicit products).

According to the revised STC law in 2014, the Vietnamese government has increased the cigarette excise tax from 70% to 75% of the factory price starting from January 2019. Besides, the 2012 TC Law also required a compulsory contribution – the Tobacco Control Fund (TCF) tax, which has been increased from 1.5% to 2% starting from May 2019. Given that these taxes do not apply to illicit products, changes in retail prices before and after the tax were compared in the domestic and the illicit groups. Illicit products are assumed to reflect the behavior of domestic ones in the absence of treatment, meaning if there were no increase in tax, their prices should move in a parallel trend. Both types of cigarettes with different origins are sold in the same store; thus, they should exhibit similar price evolution before the tax increase in 2019. Therefore, the DID approach can provide an unbiased estimate of the changes in retail prices in response to taxes.

To capture the short-term and long-term effects of taxes on some of the most popular cigarette brands, we run the regression model in equation (3) for two periods of time. The first model employs the data from the baseline survey in 2018 and the second wave conducted from March to May 2019, which was three to five months after the increase in excise tax, while the second model combines the baseline data with the third wave survey conducted from October to December 2019. The regression equation for the DID can be written as follows:

$$p_{ijt} = \beta_0 + \beta_1 treat + \beta_2 post + \beta_3 treat * post + \beta_4 X_{ijt} + \varepsilon_{ijt}, \qquad (3)$$

where p_{ijt} is the retail price of a particular cigarette i sold at shop j at time t; *treat* is a dummy variable that equals 1 for domestic products that are liable to taxes, and equals 0 for illicit cigarettes; *post* is a dummy variable to indicate the time when the treatment started and equals 1 when the year is 2019; *treat*post* is the DID interaction and equals 1 when a product is liable to the tax (i.e. domestic cigarettes in 2019), while it equals 0 otherwise (i.e. illicit cigarettes in all periods from 2018 to 2019); X_{ijt} consists of the control variables for time-invariant characteristics of the product (brands and varieties of the cigarettes) and the stores (type of retailers and location). β_3 is our coefficient of interest, which represents the real changes of tax on retail price. Hence, our equation (2) becomes:

$$r = \frac{\beta_3}{\Delta tax} 100 \qquad (4)$$

To test the assumption of parallel trends, we use a placebo treatment test, in which we randomly assigned a placebo treatment (subjectivity to tax changes) to a fake treatment group, and re-estimated the regression model using this placebo treatment interaction variables. Our test results do not find any impact as in the real treatment group. This suggests that the parallel trend assumption holds and no significant pre-existing differences between the treatment and control groups may confound the DID estimates.

5.3 Estimation of tax hike

To compute the pass-through rate, we need to find the denominator, which is the amount of tax hike. The retail price of cigarette i equals the entry price plus retail margin:

$$p_i = x_i + \tau_i + VAT_i + TCF_i + \pi_i, \tag{5}$$

where x_i is the excise taxable price of i *(ex-factory price)* ; τ_i is the amount of excise tax ; VAT_i represents the value-added tax ; TCF_i is the contribution to tobacco control fund; and π_i is the markup value of i.

In 2018, the amount of excise tax τ_i of 70% and TCF tax of 1.5% were applied to the ex-factory price x_i. On top of that, an applicable 10% of VAT is unchanged for tobacco products. From equation (5), the total tax imposed on a cigarette is approximately 88.65% of the ex-factory price in 2018. Assume that x_i and π_i are constant between 2018 and 2019, after January 2019 and before May 2019, only the excise tax increases from 70 to 75%, which raises the imposed taxes on a cigarette to 94.15%, a 5.5% increase from 2018. Adding the increase in TCF contribution in the period after May 2019, we estimate that the total tax imposed on a cigarette has increased by a total of 6.05% points of the ex-factory price.

According to Tan and Dorotheo (2018), in Vietnam, the tobacco tax burden accounted for only 35.3% of the retail price, while as estimated earlier, the total tax imposed was approximately 88.65% of the ex-factory price in 2018. From these figures, we can estimate that in 2018, the ex-factory price of cigarettes in Vietnam was roughly around 40 % of the retail price. Given that there is no other information available on the ex-factory price for Vietnamese cigarette products by brands, we compute the amount of tax hike based on three scenarios: ex-factory price equals 40% of retail prices in the first scenario, while this percentage is assumed to equal 45% and 50% of retail prices in the second and third scenarios, respectively. Using the 2018 retail price from the survey as a baseline, we can compute the tax hike for each brand in three scenarios for the two periods of interest. Table 2 shows the estimated amount of tax hike for 12 cigarette brands legally sold in Vietnam.

The economy segment consists of five brands whose average price per pack is smaller than VND 20,000 (USD 0.87): Bastos, Sai Gon, Thang Long, Hoa Binh and Khanh Hoi. In contrast, seven brands whose average price per pack is higher than VND 20,000 are classified as premium. The amount of tax hike estimated in 2019 ranges from VND 241 to 331 for the economy segment and VND 551 to 758 for premium products, on average. The smallest hike is recorded for Bastos, while the estimation for Dunhill is the highest, as high as VND 1,034 in scenario three, at the end of 2019. The estimated amount of tax hike highlights the disadvantages of the pure ad valorem tax system, given that the tax increase in the low-price segment is remarkably insignificant.

6. Results and discussion

6.1 Full sample

Table 3 shows the DID results for the full sample. Our DID coefficients (*treat*post*) for two periods of time are the interaction coefficients of domestic cigarettes after taxes have been increased. The fixed effect models' results appear to be more stable than the Pooled-OLS

Scenarios	Mid-2019			End-2019		
	(1) $x_i = 0.4p_i$	(2) $x_i = 0.45p_i$	(3) $x_i = 0.5p_i$	(1) $x_i = 0.4p_i$	(2) $x_i = 0.45p_i$	(3) $x_i = 0.5p_i$
Bastos	210	236	262	231	260	289
Sai Gon	251	282	313	276	310	345
Thang Long	286	322	358	315	354	393
Hoa Binh	243	273	304	267	301	334
Khanh Hoi	214	240	267	235	264	294
Economy	*241*	*271*	*301*	*265*	*298*	*331*
Vinataba	397	447	497	437	492	546
White Horse	512	576	640	563	634	704
Craven	394	443	492	433	487	541
Licit SE555	611	687	763	672	755	840
Dunhill	752	846	940	827	931	1034
Kent	601	676	751	661	743	826
Marlboro	592	666	740	651	732	813
Premium	*551*	*620*	*689*	*606*	*682*	*758*

Source(s): Authors' estimates

Table 2.
Estimated amount of tax hike in three scenarios (in VND)

Specification	(1) OLS	(2) OLS	(3) OLS	(4) Fixed effect	(5) Fixed effect	(6) Fixed effect
Domestic * Mar-May 2019	1.471* (0.817)	1.235 (0.797)	−0.0741 (0.281)	0.728** (0.301)	0.716** (0.300)	0.00419 (0.234)
Domestic * Oct-Dec 2019	1.923*** (0.671)	3.173*** (0.657)	0.654*** (0.231)	1.297*** (0.276)	1.494*** (0.275)	0.683*** (0.201)
Control for province	Yes	Yes	Yes	Yes	Yes	Yes
Control for type of retailer	No	Yes	Yes	No	Yes	Yes
Control for product's variety	No	No	Yes	No	No	Yes
Observations	5,947	5,947	5,947	5,947	5,947	5,947
R-squared	0.167	0.216	0.921	0.1581	0.2062	0.9208

Note(s): Standard errors in parentheses
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Authors' estimates

Table 3.
Regression results for the full sample

models. After controlling for cigarette variety, both the OLS and fixed effect model significantly gained more explanation power as R-squared increased. The coefficients of both models are also similar. In the short term, the DID coefficient is close to 0 and not statistically significant, implying that the price is sticky in the first three to five months after the increase in excise tax as this raise has not transferred to a change in real prices. In the longer term, at the end of 2019, the real price change is estimated to equal VND 683 (or VND 654 in the OLS model).

As mentioned, in 2018, the tobacco tax burden accounted for 35.3% of the retail price in Vietnam (Tan & Dorotheo, 2018). Given that the average retail price in 2018 is an estimated VND 19,344 from our survey, the total taxes are, therefore, approximately VND 6,829. After May 2019, an increase of 6.05% of total taxes, assuming that markup and ex-factory price are constant between 2018 and 2019, equals VND 414. With a tax hike of VND 414 and a real price increase of VND 683, according to equation (3), the pass-through rate is estimated at 165%,

implying an over-shift of taxes to consumers after a period of one year. Smokers pay the full amount of the tax hike and an extra VND 269 for each cigarette pack, on average.

This estimated pass-through rate is generally higher than the results computed for the United States (80% in Chiou & Muehlegger, 2014; 117% in Hanson and Sullivan (2009)) and Pakistan (80% in Cevik, 2018). Additionally, Hu *et al.* (2009) also suggested that there is an incomplete pass-through caused by the new tax structure in China. It can be explained by the affordability of tobacco products in Vietnam. In 2015, the cigarette price in Vietnam was ranked second-lowest among 20 countries in the Western Pacific Region (WHO, 2018). Low prices and high affordability leave a bigger space for real prices to increase in the Vietnamese market in comparison with other countries.

6.2 Pass-through by brands

The overall pass-through is estimated at 165%. However, to understand the tactics of the tobacco industry in response to taxes, we need to break down the result to the brand level. The same fixed effect model as in the full sample section has been applied to the twelve most popular brands in Vietnam, including the economy segment (Bastos, Hoa Binh, Khanh Hoi, Sai Gon and Thang Long) and premium segment (Vinataba, Whitehorse, Craven A, SE555, Dunhill, Kent and Marlboro). Tables 4 and 5 show the estimations for the economy and premium segments, respectively.

When focusing on these main brands, the shift in real prices in responding to taxes has become more significant. The higher shift in estimated real price change in some of the most popular brands shows that with more market power, more demanded brands can afford to increase the price at a higher level than their counterparts, signaling a higher pass-through rate with stronger market power.

On average, the retail prices for brands in the economy segment have increased 6% (VND 803) in the short term and 9% (VND 1,165) in the long-term analysis. Thang Long's retail price is the least to gain while Hoa Binh's and Sai Gon's prices responded quite strongly to the tax hike. In contrast, retail prices of premium cigarettes have increased by a modest amount. By May 2019, the average retail price has increased by VND 691 (3% increase), while by the end of 2019, this change is estimated at VND 919 (4% increase in price). The price of Dunhill increased dramatically by a swift amount of approximately VND 3,000 per pack (12% increase), followed by Whitehorse, domestic SE555 and Kent with an increase of VND 1,500, about a 6–7% increase in price.

Using the estimated amount of tax hike for each scenario in Table 2, we compute the brand-level pass-through rate, which is shown in Table 6. Except for Khanh Hoi, Thang Long,

Variables	Bastos	Hoabinh	Khanhhoi	Saigon	Thanglong	Economy
Domestic * mid-2019	0.391	1.351*	1.023	1.099***	0.354	0.803***
	(0.454)	(0.715)	(0.821)	(0.365)	(0.334)	(0.276)
Domestic * end 2019	1.204***	1.747***	1.125	1.404***	0.835***	1.165***
	(0.437)	(0.633)	(0.754)	(0.323)	(0.31)	(0.258)
Control for region, retailers' & products' characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	566	448	416	1,051	1,179	2,248
Number of id	435	360	334	797	894	1,648
R^2	0.923	0.9005	0.8943	0.913	0.8912	0.8789

Table 4.
Fixed-effect results for selected economy brands

Note(s): Standard errors in parentheses
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Authors' estimates

	Vinataba	Whitehorse	Craven	Licit SE555	Dunhill	Kent	Marlboro	Premium
Domestic * mid-2019	−0.495	1.489***	0.632*	1.742***	2.907***	0.639	0.346	0.691**
	(0.542)	(0.542)	(0.374)	(0.444)	(0.900)	(0.506)	(0.405)	(0.289)
Domestic * end 2019	0.593	1.658***	0.430	1.515***	3.197***	1.503***	0.575	0.919***
	(0.471)	(0.488)	(0.352)	(0.426)	(0.725)	(0.499)	(0.366)	(0.249)
Control for retailers' & products' characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	642	618	1,125	885	480	638	963	3,106
Number of id	500	480	883	675	388	512	757	2,342
R^2	0.8435	0.8089	0.8616	0.7965	0.8738	0.8138	0.8038	0.8457

Note(s): Standard errors in parentheses
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Authors' estimates

Table 5.
Fixed-effect results for
selected premium
brands

Vinataba, Craven A and Marlboro, evidence is found that the tax increase has been over-shifted to smokers of other brands.

6.3 Discussion

6.3.1 Market structure and pass-through rate. As highlighted in the previous literature review, the tobacco industry's imperfect competition can lead to diverse outcomes, including under-shifting, complete pass-through or over-shifting of the tax burden. In light of this, our study's findings shed light on the tax burden distribution within the Vietnamese tobacco market, which is characterized by its highly concentrated and imperfectly competitive nature. Specifically, our empirical analysis suggests that a significant portion of the tax burden is indeed passed on to consumers (over-shift). The finding aligns with the notion of imperfect competition, where producers have the market power to influence price adjustments.

6.3.2 Short-term and long-term pass-through. The timeline of real price adjustment in responding to tax hikes at the brand-level is seen to follow the overall pattern, when the price is stickier in the short-term, leading to either a lower pass-through rate or an insignificant result, except for Craven A and SE555. This observation implies that tobacco companies may attempt to minimize the effect of tax increases on smokers by gradually passing on the price. This practice is largely known as cushioning and has been proven effective in mitigating the reducing consumption due to sudden "shock" in price (Bayly, Scollo, & Wakefield, 2022; Hiscock *et al.*, 2017). Retailers can also practice cushioning via stockpiling, given that the government announced the 2019 excise tax increase as early as 2013, leaving the sellers enough time to prepare for the tax changes. With enough stock, which has been bought at pre-tax prices, sellers can gradually adjust the price to avoid price shock to the customers. Chiou and Muehlegger (2014) also found evidence of substantial stockpiling for discount cigarette sales prior to the tax hike. Additionally, our results show that cigarette taxes started to pass on to consumers in the period of three to five months after the increase in tax. Combined with the cushioning effect, by the end of 2019, almost all of the brands had adjusted their prices to the extent that the taxes were more than fully passed onto smokers.

6.3.3 Pass-through by segments. We found that pass-through is higher for discount cigarettes in comparison with premium brands, which is similar to the study by Chiou and Muehlegger (2014). However, this finding is largely contradictory with the estimations for

| Scenarios | Short-term | | | | Long-term | | | |
	(1)	(2)	(3)	Significance	(1)	(2)	(3)	Significance
Bastos	186	166	149		521	463	417	***
Hoa Binh	556	495	444	*	654	580	523	***
Khanh Hoi	478	426	383		479	426	383	
Sai Gon	438	390	351	***	509	453	407	***
Thang Long	124	110	99		265	236	212	
Economy	*333*	*297*	*267*	***	*440*	*391*	*352*	***
Vinataba	−125	−111	−100		136	121	109	
White Horse	291	259	233	***	294	262	236	***
Craven	160	143	128	*	99	88	79	
Licit SE555	285	254	228	***	225	201	180	***
Dunhill	387	344	309	***	387	343	309	***
Kent	106	95	85		227	202	182	***
Marlboro	58	52	47		88	79	71	
Premium	*125*	*111*	*100*	**	*152*	*135*	*121*	***

Table 6.
Brand-level pass-through rate (%)

Source(s): Authors' estimates

New Zealand (Marsh *et al.*, 2016), Pakistan (Cevik, 2018), the USA (Espinosa & Evans, 2013; Harding *et al.*, 2012; Sullivan & Dutkowsky, 2012), etc. The main explanation for such a phenomenon comes from the tobacco tax system in Vietnam. In a pure ad valorem tax system, the higher the ex-factory price, the higher the applicable taxes, which is likely to lead to a lower pass-through rate. The current system is not effective with low-cost cigarettes – since low prices mean low taxes, therefore, tends to create a big price gap among cigarette products in the different price segments. For economy products, the amount of tax hike is estimated at only VND 200–400, while the real price increases are computed at more than VND 1,000 (only 4.3 cents) which is still a modest increase. While there is still room for price increases in the economy segment, the sellers must be more careful when it comes to premium products. First, smokers can switch to economy cigarettes if the price of the premium product increases. Second, luxury goods tend to have a higher elasticity of demand given that consumers typically pay more attention when purchasing goods at a higher cost. Combined with the attribute of ad valorem tax, the pass-through for premium cigarettes in Vietnam is significantly lower than for the economy segment.

6.3.4 Currency denomination and pass-through rate. Despite the increasing popularity of e-commerce and cashless payment in Vietnam, cash is still the most popular means of transaction, especially in small-scale retailers. Besides, Circular No. 47/2014/TT-BCT classifies tobacco products as one of five goods that are banned for online sales. Given that the main method of payment for cigarettes is cash, the denominations of Vietnam dong have a substantial impact on the real price changes proposed by retailers. In detail, since VND 1,000 is the smallest value of Vietnamese banknotes that are still widely used, it is encouraging for retailers to increase their prices at least by this amount, which has led to a very high pass-through rate for economy brands, given that the estimated amount of tax hike for economy cigarettes are only from VND 200–400. Apparently, when customers make a cash payment, they need to think about the amount to be paid, the available notes, and the amount of change. Rounded prices make it easier for both retailers and consumers to conduct transactions, especially in cases when changes are not available due to the lack of small denomination notes. The denominational structure of the Vietnam dong has indirectly created a high pass-through rate for the low-cost segment of the market due to an insignificant amount of tax increase. Despite the considerable role of the denominational structure in taxation policy, no studies focus on examining a tax policy that is more suitable for the money system.

7. Conclusion and policy implications

This paper utilizes retailer panel data to estimate the effects of tobacco taxation policies on the price of cigarettes. Using the three waves' sales data of retailers nationwide from 2018 to 2019, we were able to perform a DID analysis on two groups of products, namely, domestic and illicit cigarettes, which provides much clearer evidence of detailed changes in selling prices in response to the tax increase in 2019. From this information, we compute the tax pass-through rate for some of the most popular brands in the market, which consistently shows an overshift of tax incidence to smokers. Moreover, we are able to look at the timeline of price increases, which has shown a gradual rise in retail price during the period of three to five months (short-term) and one year (long-term). This evidence indicates an industrial tactic widely known as cushioning, which effectively mitigates taxation's effects on smoking cessation. Finally, we decompose the pass-through rate for economy and premium segments, which provides insight into the impact of taxation in relation to market structure. Our results reaffirm the disadvantages of the Vietnamese purely ad valorem tobacco tax system, which encourages the production of low-price cigarettes to avoid high taxes.

The analysis shows that the room for cigarette price increases in Vietnam is still rather spacious, given that Vietnam is one of the countries where cigarettes are most affordable. The

nature of the ad valorem tax system undermines the effect of tax increases on consumption as the amount of tax hike is on the negligible side, especially for lower price products. Companies and retailers can afford to overshift the tax burden to smokers, leading to a high pass-through rate. This can be good news considering that higher retail prices might help curb cigarette consumption. However, a lower tax hike brings smaller tax revenue for the government but higher profit to the suppliers, which can encourage them to further engage with the industry. Therefore, the government should consider raising taxes at a much higher rate. Besides, a specific tax system should be employed to decrease the price gap between premium and economy products, which will limit the number of smokers who switch to cheaper cigarettes.

Additionally, the amount of tax increase should be an increment of VND 1,000, the smallest value of the banknote, to better accommodate the retail transaction. For instance, a tax hike of VND 600 and VND 900 will likely lead to the same real price increase of VND 1,000. Choosing an appropriate amount of tax hike can help the government raise their tax revenue significantly while reaching the desired amount of price changes to curb cigarette consumption. Besides the tobacco taxation policy, the government should consider applying a monthly quota for tobacco wholesalers to limit sales. This policy will prevent the increase in sales in the earlier months after the tax increase, which will prevent retailers from stockpiling products and cushioning the retail price. This intervention could increase the price shock on smokers, which will enhance the impact of a higher price on lower consumption.

Notes

1. Information was collected at a variety level for all cigarette brands offering in the market. Some brands, such as Khanh Hoi and Hoa Binh, offer only one variety, while others, such as Saigon, Craven A, Vinataba, SE555, etc., come with various options ranging from economy to premium.

2. Example of specific cigarette varieties of a specific brand can be SE555 from England, Kent with mint flavor or Esse light from Korea.

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