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# Exploiting a low tax system: non-tax-induced cigarette price increases in Taiwan 2011–2016

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## ABSTRACT

**Introduction** This study aims to analyse the non-tax-induced price increasing strategies adopted by tobacco industry in Taiwan, a high-income country with comprehensive tobacco control policies but low tobacco taxes and a declining cigarette market.

**Methods** Using governmental tax, price and inflation data, we analysed cigarette sales volume, affordability, affordability elasticity of demand, market share, pricing and net revenue of the top five tobacco companies in Taiwan from 2011 to 2016 when no tax increases occurred.

**Results** Total revenue after tax grew significantly for all the major transnational tobacco companies between 2011 and 2016 at the expense of the state-owned Taiwan Tobacco and Liquor Corporation. In terms of market share, Japan Tobacco (JT) was the leading company, despite experiencing a small decline, while British American Tobacco and Imperial Brands remained stable, and Philip Morris International increased from 4.7% to 7.0%. JT adopted the most effective pricing strategy by increasing the real price of its two most popular brands (Mevius and Mi-Ne) and, at the same time, doubling the sales of its cheaper and less popular brand Winston by leaving its nominal retail price unaltered.

**Conclusions** Low and unchanged tobacco taxes enable tobacco companies to use aggressive pricing and segmentation strategies to increase the real price of cigarettes without making them less affordable while simultaneously maintaining customers' loyalty. It is crucial to continue monitoring the industry's pricing strategies and to regularly increase taxes to promote public health and to prevent tobacco industry from profiting at the expense of government revenues.

## INTRODUCTION

Increasing tobacco taxes is one of the most effective ways to reduce tobacco consumption,<sup>1–4</sup> smoking initiation by youth<sup>5</sup> and social-economic inequalities caused by tobacco use.<sup>6</sup> At the same time, it is well known that the tobacco industry counters government tax rises by using strategies such as over-shifting and under-shifting tax increases across their brand portfolios, smoothing prices changes and reducing pack sizes, all to keep tobacco affordable.<sup>7–11</sup> Less is known, however, about how tobacco companies take advantage of an environment with low and static tobacco taxation. Taiwan is one such market, and hence the aim of this paper is to explore the strategies adopted by the industry in this context.

## Background

In the last two decades, Taiwan has made important progress in tobacco control, especially after 2009 when regulations were tightened in line with the guidelines provided by the Framework Convention on Tobacco Control (FCTC). Smoking has been forbidden in most work sites and public spaces, tobacco advertisement and promotion have been banned and pictorial health warnings have been introduced. Moreover, taxes were increased several times during the last two decades, with positive effects on tobacco consumption.<sup>12–14</sup> As a result of all these measures, during the 2009–2016 period, the smoking rate decreased from 20% to 15% among adults, and from 14.8% to 9.3% among senior high school students (16–18 years old).<sup>15</sup> Smoking is largely a male and age-related habit in Taiwan. In 2005, the age group with the highest smoking rate among men was the 40–44 years old group (57.4%),<sup>16</sup> while in 2015 it was the 50–54 one (47.4%).<sup>17</sup> During the same period, the smoking rate among men aged 25–29 years decreased from 47.9% to 22.4%. The daily consumption of adult smokers decreased from 19 cigarettes in 2008 to 17.3 cigarettes in 2016, while the cigarette consumption per capita above the age of 15 years old decreased by 5.9% from 1970 in 2009 to 1857 in 2016.<sup>15</sup> (Here and in the rest of the paper, the percentage change is calculated with the midpoint method).<sup>18</sup>

In Taiwan, manufactured cigarettes are by far the most common form of tobacco smoking, while the use of other products is extremely limited. In 2016, the entire market share of non-cigarette tobacco products, including everything from hand-rolling, chewing and pipe tobacco, to cigars and snuff, was only 10% of the total.<sup>19</sup> Only the standard pack size of 20 cigarettes is allowed. In the rest of the paper, the term 'pack' will always indicate a 20-cigarette pack.

Four types of taxes are applied to tobacco products in Taiwan: a tobacco tax of \$NT11.8 per pack (US\$0.38, as \$NT1=US\$0.032); an additional surcharge earmarked exclusively for public health named the Tobacco Health and Welfare Surcharge (THWS); a tariff for imported tobacco products of \$NT2.7 per pack and a 5% value added tax (VAT) applied to most goods and services. The THWS has been progressively increased from \$NT5 per pack in 2002 to \$NT20 per pack in 2009,<sup>15</sup> yet cigarettes are still affordable in Taiwan<sup>20</sup> compared with many other countries. It was estimated that the last tax increase in 2009 determined a 14.5% reduction in cigarette consumption per capita,<sup>12</sup> with a demand



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elasticity for cigarettes of about  $-0.7$  among Taiwanese smokers above the age of 15 years old.<sup>13</sup> In 2016, taxes in total comprise about 48% of the retail price for most popular brand sold,<sup>21</sup> which is well short of the greater than 70% recommended by WHO.<sup>22</sup>

While taxes/levies on tobacco products remained unchanged from 2011 to 2016 in Taiwan,<sup>15</sup> the four major transnational tobacco companies (TTCs) operating in the country, namely Japan Tobacco (JT), British American Tobacco (BAT), Philip Morris International (PMI) and Imperial Brands (IB), all implemented various non-tax-induced price increases for their products during this period.<sup>23</sup>

## Objective

The aim of this paper is to analyse the trends in cigarette sales volumes, affordability, affordability elasticity of demand, company/brand market shares, pricing and net revenue in Taiwan between 2011 and 2016, when there were no changes in tobacco taxation to shed light on the pricing strategies implemented by the state-owned Taiwan Tobacco and Liquor Corporation (TTL) and by the four major TTCs. Using sales, inflation and price data, we aim to understand how tobacco companies can take advantage of an absence of pro-health tobacco tax policy to introduce non-tax-induced price increases, thereby enhancing their revenues despite an overall declining cigarette market.

## METHODS

### Sales volume and market share

The aforementioned tobacco tax of \$NT11.8 per pack is collected by the Ministry of Finance (MOF) and the total annual amount paid by each company in Taiwan is public information, downloadable from the MOF financial statistics database.<sup>24</sup> Thus, dividing this quantity by \$NT11.8, we were able to compute the yearly legal sales volumes for TTL, JT, BAT, PMI and IB over the 2011–2016 period, along with the corresponding market shares based on the total yearly sales volume (from the same source).

Brand level data are only publicly available from TTL (on request from the Taiwan Government Open Data Platform)<sup>25</sup> due to the state-owned nature of the company. With these data, we computed yearly sales volumes and market shares for the most popular TTL brands. Brand level data for JT, BAT, PMI and IB are not disclosed by the companies, which led us to apply the following estimation procedure. Every year since 2004, the Health Promotion Administration (HPA, Ministry of Health and Welfare) has been conducting the Adult Smoking Behavior Survey (ASBS),<sup>26</sup> a nationally representative survey based on stratified random sampling. The number of interviews is usually around 25 000, and the results are adjusted by gender, age, education background, as well as county and city distribution. The ASBS in 2011, 2014, 2015 and 2016 asked current smokers to indicate the brand they use most frequently. Using the stated answer to this question, we first summed up the frequencies of all the brands belonging to the same company to obtain the company-level market share ( $marketshare_{syy}$ ) for JT, BAT, PMI and IB in the four available years. Then, we estimated the yearly market share for each brand, multiplying the frequency from the survey by the ratio  $\frac{marketshare_{real}}{marketshare_{syy}}$ , where  $marketshare_{real}$  is the corresponding company-level market share derived from the governmental tax data. Multiplying this number by the total sales volume estimated from the tax sales data, we obtained the yearly sales volume for each brand.

## Real net revenue

Data on nominal retail prices of cigarettes in 2011, 2012, 2015 and 2016 (market surveys on retail prices of cigarettes were not conducted in 2013 and 2014) were retrieved from the results of a research project founded by the HPA.<sup>23</sup> To get real prices, the nominal prices were adjusted for inflation using the Consumer Price Index from the Taiwan Statistical Bureau<sup>27</sup> and by setting 2011 as the base year. Real retail prices were weighted by the market share of each brand to estimate the (weighted) average price per pack for each company. The total tobacco tax liable (\$NT31.8 per pack, adjusted for inflation) and the VAT were then deducted to compute the real net revenue per pack for each company. Finally, this was multiplied by the total sales volume to work out the total real net revenue for each company.

## Brand categorisation

Nominal retail prices in 2011 (first year of the study period) and the classification provided by Cornelius *et al*,<sup>28</sup> were used to classify the cigarette brands most popular in Taiwan into two categories: economy and premium. Among the discount brands listed by Cornelius *et al*, the only one also present in our dataset is Pall Mall (BAT), whose nominal retail price in 2011 was \$NT55. We therefore assigned to the lowest class, economy, all the brands with a nominal retail price of \$NT60 or less, namely Pall Mall, Ace, New Paradise and Long Life. The remaining brands, with a nominal retail price of \$NT70 or above were categorised as premium.

## Brand affordability

For each available year, the cigarette affordability of each brand was estimated by calculating the relative income price (RIP), defined as the ratio of the nominal retail price of 100 packs to the nominal Gross Domestic Product (GDP) per capita, all measured in the national currency.<sup>29</sup> The lower the RIP, the more affordable the brand is. The Taiwan annual GDP per capita is reported by the National Statistical Bureau.<sup>30</sup>

## Affordability elasticity of demand

Affordability and sales volume data were used to estimate the affordability elasticity of demand (AED)<sup>29 31 32</sup> of each brand, in order to explore the sensitivity of demand to changing affordability. We calculated the AED, using the mid-point method<sup>18</sup> with the following formula:

$$AED = \frac{\frac{(D_1 - D_0)}{[(D_1 + D_0)/2]}}{\frac{(RIP_1 - RIP_0)}{[(RIP_1 + RIP_0)/2]}}$$

where  $D_1$  is the quantity demand at time 1,  $D_0$  is the quantity demand at time 0,  $RIP_1$  is the relative income price at time 1, and  $RIP_0$  is the relative income price at time 0. AED then represents the expected percentage change in the demand of a product for each 1% change in its affordability, as measured by the RIP.

## RESULTS

### Sales volume and market share

Overall, the number of packs of cigarettes sold in Taiwan decreased by 1.7% during the period of analysis, declining from 1884 million in 2011 to 1853 million in 2016, with the per capita consumption (above the age of 15 years old) decreasing from 96 packs to 91 packs per year. As shown in table 1, TTL and JT dominate the cigarette market with a combined 60%–65% market share, although their respective market shares declined between 2011 and 2016, from 29.8% to 26.4% and from 35.6% to 33.1%, respectively. The share of IB also decreased from

**Table 1** Sales volume and market share of the top-five tobacco companies in Taiwan from 2011 to 2016

Year	TTL		JT		BAT		PMI		IB		Total	
	Packs (million)	Market share (%)	Packs (million)	Market share (%)	Packs (million)	Market share (%)	Packs (million)	Market share (%)	Packs (million)	Market share (%)	Packs (million)	Market share (%)
2011	561	29.8	671	35.6	133	7.0	90	4.7	185	9.8	1640	87.0
2012	551	29.6	688	37.0	133	7.1	99	5.3	217	11.7	1688	90.7
2013	553	29.3	633	33.5	141	7.5	112	5.9	225	11.9	1664	88.1
2014	476	26.7	542	30.3	183	10.2	149	8.3	223	12.5	1574	88.1
2015	474	26.4	556	31.0	184	10.2	167	9.3	186	10.3	1565	87.2
2016	490	26.4	613	33.1	135	7.3	130	7.0	176	9.5	1545	83.3

All percentage figures are rounded to one decimal place.

BAT, British American Tobacco; IB, Imperial Brands; JT, Japan Tobacco; PMI, Philip Morris International; TTL, Taiwan Tobacco and Liquor Corporation.

9.8% to 9.5%, while BAT's and PMI's shares increased from 7% to 7.3% and from 4.7% to 7%, respectively.

Focusing on market share by brand, we estimated that the 22 most popular brands consumed by Taiwanese smokers accounted for between 82% (2011) and 80% (2016) of the total during the study period (table 2), which also suggests that the entry by new brands has not been a particular issue. JT's Mevius, TTL's Gentle and Long Life and BAT's Davidoff are the most popular brands in Taiwan, and, although their sales volumes decreased, together they still account for almost 50% of the market. On the other hand, market shares for JT's Winston and Caster, TTL's Ace and New Paradise have grown. The share of PMI's Marlboro increased from 2.4% in 2011 to 3.4% in 2014 but then dropped to 2.1% in 2016, BAT's Dunhill and Pall Mall followed a similar pattern, while PMI's L&M almost tripled its market share in 5 years.

### Real net revenue

Between 2011 and 2016, overall cigarette sales volumes declined. However, during the same period, the real net revenue of the four TTCs increased considerably (figure 1), with PMI increasing its real net revenue by 55% (from \$NT3188 million to \$NT5609 million), BAT increasing theirs by 21.0% (from \$NT4559 million to \$NT5628 million), IB by 8.1% (from \$NT9045 million to \$NT9812 million) and JT by 15.0% (from \$NT29 105 million to \$NT33 818 million). In contrast, the real net revenue of TTL decreased by 19%, changing from \$NT16 751 in 2011 to \$NT13 850 in 2016.

### Brand affordability and affordability elasticity of demand

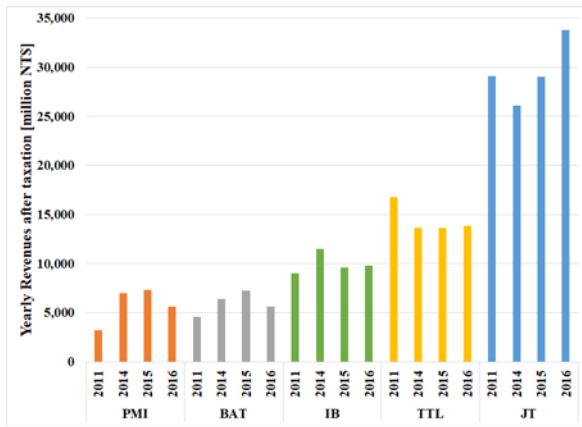
The affordability of the most-purchased brands among Taiwanese smokers and its relationship with the demand variations were

**Table 2** Sales volume and market share of the cigarette brands most sold in Taiwan (2011, 2014–2016)

Company	Brand	Market share (%)				Packs sold (million)			
		2011	2014	2015	2016	2011	2014	2015	2016
JT	Mevius	27.1	20.4	22.1	22.0	510	364	396	408
	Winston	1.0	3.1	3.0	3.8	19	56	54	71
	Mi-Ne	3.7	3.3	3.4	3.4	70	60	61	63
	Caster	0.0	0.5	1.2	1.8	0	9	22	33
	More	3.8	3.0	0.9	1.7	72	53	15	31
	LD	0.0	0.0	0.4	0.4	0	0	6	7
TTL	Gentle	13.3	13.9	13.3	12.3	252	249	240	229
	Long Life	8.5	8.1	7.4	6.5	161	145	133	121
	New Paradise	1.4	1.7	1.8	1.9	26	30	32	35
	Ace	1.3	1.5	1.5	1.5	25	27	27	29
IB	Davidoff	9.8	9.1	6.7	6.6	185	162	120	122
	Boss	0.0	2.0	1.8	1.5	0	36	32	28
	West	0.0	1.4	1.9	1.4	0	25	34	26
BAT	Dunhill	4.7	5.8	4.7	3.9	88	104	85	73
	Pall Mall	1.7	4.0	3.9	3.1	32	71	69	57
	555	0.7	0.4	1.6	0.3	12	8	29	5
PMI	L&M	0.9	2.3	2.4	2.6	17	41	43	48
	Marlboro	2.4	4.1	3.4	2.1	46	74	60	39
	Next	0.0	1.1	2.7	1.4	0	19	49	26
	Parliament	1.4	0.9	0.8	0.9	27	16	15	17
KT&G	Bohem	0.0	0.8	1.3	0.6	0	14	24	10
CNTC	Hóng Jin Lóng	0.0	0.1	0.6	0.0	0	2	11	1
Other	Other	18.2	12.5	13.2	20.2	343	224	237	374

All percentage figures are rounded to one decimal place.

BAT, British American Tobacco; CNTC, China National Tobacco Corporation; IB, Imperial Brands; JT, Japan Tobacco; KT&G, Korea Tobacco & Ginseng Corporation; PMI, Philip Morris International; TTL, Taiwan Tobacco and Liquor Corporation.



**Figure 1** Estimates of yearly net revenues by company in 2011, 2014–2016 in Taiwan. BAT, British American Tobacco; IB, Imperial Brands; PMI, Philip Morris International; TTL, Taiwan Tobacco and Liquor Corporation.

estimated (table 3). Notably, TTL's Long Life and Gentle and IB's Davidoff are the only three brands whose demand decreased despite the fact that their affordability increased (ie, their RIP decreased), resulting in positive AED values. For instance, if Long Life became 1% more affordable, we would expect the quantity demanded for Long Life to decrease by 1.69%. Four brands became less affordable (ie, their RIP increased) between 2011 and 2016: BAT's Dunhill, PMI's Marlboro, JT's Mevius and Mi-Ne. However, the corresponding demand decrease was generally small, as the AED values range between  $-1.47$  and  $-2.82$ . The only exception is JT's Mevius, the most purchased brand in Taiwan (see table 2), whose demand decreased by 22.3% despite a negligible 0.32% increase in RIP (AED= $-68.86$ ). BAT's Pall Mall and JT's Winston also had relatively large AED values, namely  $-6.8$  and  $-6.85$ , respectively, although in these cases they were more affordable (ie, their RIP decreased).

Starting from the market leader JT, it is interesting to observe (table 3) that the company increased the real price of its two major brands Mevius (the most popular in Taiwan) and Mi-Ne (the most expensive in the market) making them less affordable by 6.5% and 0.32%, respectively, which was associated with a decrease in demand ( $-22\%$  and  $-9\%$ ). At the same time, JT made more affordable one of its less popular brands Winston,

allowing the real price to decrease from \$NT70 in 2011 to \$NT66.6 in 2016, during which time demand increased substantially by 115%. BAT adopted a similar strategy increasing the real price of its economy brand Pall Mall only from \$NT55 to \$NT57.09, which actually became 8% more affordable and the real price of its (most popular) premium-price brand Dunhill from \$NT75 to \$NT90.39, which became 7% less affordable. However, demand for Pall Mall (cheaper than Winston) increased by 55%, while sales of Dunhill decreased by 19%. Notably, both JT and BAT increased the real prices and reduced the affordability of their higher premium brands and made their economy/lower premium brands more affordable, thereby increasing their pricing spread. We can also observe that in contrast, the state-owned TTL did not implement any price changes over the study period and consequently, all its main brands became more affordable due to inflation. Nonetheless, the sales of its two most popular brands Long Life and Gentle decreased by 28% and almost 10%, respectively, while JT's Winston (same price as Gentle) doubled its sales and only its two low-economy brands Ace and New Paradise experienced demand growth (14% and 29%, respectively)

In our dataset, the gap between the cheapest and the most expensive brand increased for the four TTCs, but not for TTL. In 2011, the TTL cheapest brands were Ace and New Paradise (\$NT55) and the most expensive was Gentle (\$NT70), resulting in a price gap of \$NT15. In 2016, the situation was exactly the same since no price changes were introduced and consequently, because of inflation, the price gap was \$NT14.27. For JT, the price gap was \$NT25 in 2011 but \$NT47.58 in 2016, for BAT the price gap was \$NT20 in 2011 but \$NT33.3 in 2016. PMI and IB only offer a single brand and hence have no price gap.

Furthermore, looking at 2011 data, it is possible to easily classify the brands into two segments: economy (nominal retail price up to \$NT60, including three out of four TTL brands) and premium (nominal retail price from \$NT70 to \$NT95). In 2016, however, the situation appears different. BAT, PMI, JT and IB all raised the nominal retail price of their most popular premium brand to the same figure \$NT95; TTL's Gentle and JT's Winston could be considered as a new mid-price group; and JT established Mi-Ne as the ultra-premium brand (nominal retail price \$NT120). Overall, the four economy brands accounted for

**Table 3** Affordability and demand trend for some of the most common cigarette brands in Taiwan from 2011 to 2016

Company	Brand	Nominal retail price (\$NT)*	Real retail price (\$NT)*	RIP*	RIP change (%)	Demand (millions of packs)*	Demand change (%)	AED	Price segment
TTL	Ace	55 to 55	55.0 to 52.3	0.89 to 0.75	-16.8%	24.77 to 28.55	14.16%	-0.84	Economy
TTL	New Paradise	55 to 55	55.0 to 52.3	0.89 to 0.75	-16.8%	26.13 to 35.03	29.08%	-1.73	
BAT	Pall Mall	55 to 60	55.0 to 57.1	0.89 to 0.82	-8.16%	32.22 to 56.92	55.43%	-6.80	
TTL	Long Life	60 to 60	60.0 to 57.1	0.97 to 0.82	-16.8%	160.66 to 120.71	-28.40%	1.69	
TTL	Gentle	70 to 70	70.0 to 66.6	1.13 to 0.96	-16.8%	251.54 to 228.53	-9.59%	0.57	Premium
JT	Winston	70 to 70	70.0 to 66.6	1.13 to 0.96	-16.8%	19.04 to 70.86	115.27%	-6.85	
BAT	Dunhill	75 to 95	75.0 to 90.4	1.22 to 1.3	6.8%	88.04 to 72.69	-19.11%	-2.82	
PMI	Marlboro	75 to 95	75.0 to 90.4	1.22 to 1.3	6.8%	45.99 to 38.8	-16.95%	-2.50	
JT	Mevius	80 to 95	80.0 to 90.4	1.3 to 1.3	0.3%	510.06 to 407.73	-22.30%	-68.86	
IB	Davidoff	85 to 95	85.0 to 90.4	1.38 to 1.3	-5.7%	184.77 to 121.97	-40.94%	7.14	
JT	Mi-Ne	95 to 120	95.0 to 114.2	1.54 to 1.64	6.5%	69.78 to 63.41	-9.57%	-1.47	

Figures are rounded to one or two decimal places.

\*2011–2016.

AED, affordability elasticity of demand; BAT, British American Tobacco; IB, Imperial Brands; JT, Japan Tobacco; PMI, Philip Morris International; RIP, relative income price; TTL, Taiwan Tobacco and Liquor Corporation.

17.25% of the sales volume of the most popular brands in 2011 and 19.37% in 2016.

## DISCUSSION

To the best of our knowledge, this is the first study using company and brand-level data to investigate pricing strategies, sales and resulting revenues of the major TTCs in comparison with a state-owned company in Asia.

Between 2011 and 2016, when tobacco taxation was unchanged, cigarette sales in Taiwan decreased by 1.7%, this trend mainly affecting TTL and JT whose sales were reduced by 72 million packs and by 58 million packs, respectively (table 1). Nonetheless, the revenues of all the four main TTCs operating in Taiwan increased remarkably, with JT making the highest real net revenue in absolute terms with an increase of \$NT4714 million from 2011 to 2016, followed by PMI with \$NT2421 million (figure 1).

Given that JT's Mevius is the most sold brand (22% share in 2016, table 2), the overall cigarette affordability in Taiwan, following the definition recommended by WHO,<sup>33</sup> is about 1.3% (see table 3), which is significantly lower than the 2.2% average for other high-income countries and the 4.2% average for upper middle-income countries in 2016.<sup>34</sup> Furthermore, it has remained the same during the study period because of the non-tax-induced increases in retail prices adopted by TTCs.

Since tobacco taxes were not changed during the period of analysis, the tobacco industry was able to adjust their retail prices entirely on a commercial basis instead of as a response to tax increases. This resulted in a strong trend of price rises from the TTCs, and those selling multiple brands considerably widened the price gap between their brands in different segments, a strategy also observed in the UK in a situation of regular tax rises.<sup>10</sup> The result was remarkable increases in average net revenues earned per pack. JT adopted an aggressive strategy by increasing the average real retail price per pack from \$NT79.12 in 2011 to \$NT89.89 in 2016, with the average RIP consequently increasing slightly from 1.28% in 2011 to 1.29% in 2016. In particular, according to our estimates, JT was able to increase the revenues from their flagship brand Mevius by 0.6% (data not shown) despite an increase in real price from \$NT80.00 to \$NT90.39 which was associated with a demand decrease of 22.30%. BAT was similar but less extreme, with the average retail price per pack increasing from \$NT69.94 in 2011 to \$NT75.77 in 2016, which resulted in the RIP decreasing slightly from 1.13% in 2011 to 1.09% in 2016. These figures therefore suggest that the TTC raise prices approximately in line with economic growth so smokers do not feel cigarettes are less affordable. In contrast, TTL made no price changes, so their average real retail price per pack decreased from \$NT64.88 in 2011 to \$NT61.62 in 2016, while the average RIP decreased from 1.05% in 2011 to 0.89% in 2016.

It seems like the TTCs were trying to take advantage of those smokers who were not sensitive to price, while also looking after price sensitive smokers by facilitating within-company brand switching to cheaper brands, following a strategy widely adopted in other countries.<sup>35,36</sup> Moreover, the lack of fiscal pressure from the government allowed a more complex price segmentation of the cigarette market and has possibly facilitated tacit collusion between the four TTCs on the most convenient price to assign to their premium most sold brands.

Such actions confirm the importance of increasing tobacco taxes, as they are needed to prevent cigarettes from becoming more affordable over time due to income growth and the tobacco

industry from taking advantage of overall economic growth with price-based strategies designed to enhance their profitability as well as to perpetuate the tobacco epidemic.

Our results show that TTL is the only tobacco company with declining net revenue (and likely profitability) in Taiwan, probably due to not being equipped to face the competition from TTCs. Indeed its two lower priced economy brands, Ace and New Paradise, have been increasing their sales volume, indicating a strategy of shifting towards the lowest segment of the market. State-owned tobacco companies like TTL are common in Asia, as well as in many developing countries. The Taiwanese experience suggests they may be less aggressive in promoting tobacco by using sophisticated pricing strategies, but they seem to be able to attract smokers by applying the lowest and most affordable prices. In this scenario, the importance of high excise taxes and other measures, such as minimum excise taxes, that increase the price of the cheapest brands to prevent low income smokers from switching to the lower price segment instead of quitting cannot be overlooked.

Investigating sales of cigarette brands across and within TTCs is important since it offers insight into smokers' behaviour and changes in their preferences that may be critical for planning further tobacco control interventions. In addition, monitoring trends in TTCs' market shares can help inform regulatory decision-making efforts. For instance, price-based regulation, such as price caps on manufacturers' pretax prices would address market failure and would limit their ability to deploy such pricing strategies and control the high-profit margins enjoyed by the industry without weakening essential tobacco control policies.<sup>37,38</sup> Other measures, such as the introduction of plain packaging would also be beneficial as it would prevent tobacco companies from using packaging as a vehicle for communication to consumers and might significantly eliminate some of the 'value' of brand segmentation.

WHO's best practices in tobacco tax policy include: applying simple equivalent taxes to all tobacco products, with at least 70% excise tax share in final consumer price; frequently adjusting upwards the taxes to avoid tobacco products become more affordable and minimising incentives for smokers to switch to cheaper brands or products in response to tax increases.<sup>33</sup> Our findings show that this was not being done in Taiwan during the study period and also highlight that when cigarettes become relatively cheaper over time due to static tobacco taxes, tobacco companies can freely implement non-tax-induced price increases. Had these instead been tax induced price rises, then the Taiwanese government could have benefitted from the generated increase in revenue.

The main limitations of our study are the methods we used to develop our market estimates, and the rough and ready nature of the elasticity numbers presented. We implicitly assumed that the factor driving the change in cigarette demand is solely the change in affordability, assuming that other causes remain unchanged, which seems unlikely. In particular, we acknowledge that consumer preferences might also have changed; however, in such a short study period (only 6 years) such changes might have been limited, given that cigarette brands exhibit higher loyalty compared with other common consumer categories.<sup>39</sup> For instance, the lower demand elasticity of foreign cigarette brands may result from their popularity with younger smokers who are less likely to quit,<sup>40</sup> from more attractive product package designs in comparison with the government-owned TTL and from more aggressive marketing strategies. In addition, TTL has a brand portfolio mainly focused on the economy end of the market and it is less capable of producing sophisticated

flavoured and ‘fancy’ cigarettes such as ‘click and roll’ which may undermine its market performance and limit its ability to manipulate prices to achieve higher revenue. Another important limitation was the impossibility of validating our estimates using alternative methods due to the low number of data available in our dataset. Such issues have likely affected our results, as they inevitably create inaccuracy in our calculations. Moreover, for the sake of simplicity, we opted to quantify affordability based on the RIP, while more sophisticated and individualised measures are actually available.<sup>41</sup> We did not consider that changes in cigarette demand in response to companies’ non-tax-induced price increases might be affected by smuggling and by duty-free sales, which represent 8%–9% of the total sales volume in Taiwan.<sup>42</sup> However, the results from ASBs show no sign of increased illicit tobacco purchases by smokers.<sup>15</sup> Furthermore, airport duty-free cigarette sales volume did not change during recent years.<sup>24</sup> The nature of our data did not allow us to explore individual brand switching behaviour. As such all we could do was to suggest an association between price increase of premium brands and switching towards economy brands, and that this most likely occurred within JT and within BAT brand portfolios (since PMI and TTL do not offer a full range of brands). We suggest this given the aforementioned smokers’ loyalty and the oligopolistic nature of tobacco market in that company market shares have not changed significantly over the study period. Finally, our study also did not account for variations in the availability of other nicotine products in the market, such as e-cigarettes and heated tobacco products, which, despite not being legal,<sup>43</sup> are easily purchased over the Internet. Nevertheless, only about 1% of adult’s smokers<sup>26</sup> and about 4% of teenager and adolescent smokers<sup>44</sup> have reported using e-cigarettes in the last 30 days so any impact was likely small.

## CONCLUSION

A low and static tobacco tax environment, such as that observed in Taiwan between 2011 and 2016, allows TTCs to increase price of their products significantly for their own benefit despite the slight decline in the cigarette market. This has enabled them to enhance their net revenue per pack and has allowed them to enhance brand segmentation over an increasing range of price points while also maintaining overall cigarette affordability and, most importantly, cigarette consumption. Therefore, in countries like Taiwan, tobacco tax needs to be continually monitored and raised periodically; at very least to the extent it offsets income growth to make sure cigarettes do not become more affordable over time, as also clearly stated in Article 6 of the WHO FCTC.<sup>45</sup> If governments fail to do so, an opportunity for

reducing significantly the smoking rate will be lost and tobacco companies will continue to take advantage of the opportunity to increase price, thus profiting itself rather than increasing governmental tax revenues from tobacco products.

**Contributors** WG conceived the study, designed the analysis, interpreted the results and drafted the manuscript. MS organised and analysed the data, interpreted the results and drafted the manuscript. JRB provided crucial feedback on both methodology and data interpretation. Moreover, he critically reviewed the manuscript. AW collected the data. H-YC, Y-HC and CPW provided critical feedback, reviewed the manuscript and helped to shape the research. All coauthors discussed the results, commented on the manuscript, approved the final version and agreed to be accountable for all aspects of the work.

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## What this paper adds

- ▶ Tobacco companies’ profits benefit handsomely from non-tax-induced price increases within a stagnant tobacco tax environment.
- ▶ Tobacco companies can implement non-tax-induced increases in cigarette prices without reducing consumption.
- ▶ Most smokers do not quit or reduce consumption because of non-tax-induced price increases, with some switching to cheaper brands within the same tobacco company.
- ▶ In Taiwan the former tobacco monopoly, despite leaving its nominal prices unaltered and consequently more affordable, continually lost market share to transnational tobacco companies.

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