The distribution of cigarette prices under different tax structures: findings from the International Tobacco Control Policy Evaluation (ITC) Project

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ABSTRACT

Background The distribution of cigarette prices has rarely been studied and compared under different tax structures. Descriptive evidence on price distributions by countries can shed light on opportunities for tax avoidance and brand switching under different tobacco tax structures, which could impact the effectiveness of increased taxation in reducing smoking.

Objective This paper aims to describe the distribution of cigarette prices by countries and to compare these distributions based on the tobacco tax structure in these countries.

Methods We employed data for 16 countries taken from the International Tobacco Control Policy Evaluation Project to construct survey-derived cigarette prices for each country. Self-reported prices were weighted by cigarette consumption and described using a comprehensive set of statistics. We then compared these statistics for cigarette prices under different tax structures. In particular, countries of similar income levels and countries that impose similar total excise taxes using different tax structures were paired and compared in mean and variance using a two-sample comparison test.

Findings Our investigation illustrates that, compared with specific uniform taxation, other tax structures, such as ad valorem uniform taxation, mixed (a tax system using ad valorem and specific taxes) uniform taxation, and tiered tax structures of specific, ad valorem and mixed taxation tend to have price distributions with greater variability. Countries that rely heavily on ad valorem and tiered taxes also tend to have greater price variability around the median. Among mixed taxation systems, countries that rely more heavily on the ad valorem component tend to have greater price variability than countries that rely more heavily on the specific component. In countries with tiered tax systems, cigarette prices are skewed more towards lower prices than are prices under uniform tax systems. The analyses presented here demonstrate that more opportunities exist for tax avoidance and brand switching when the tax structure departs from a uniform specific tax.

INTRODUCTION

Significant increases in cigarette excise taxes have been shown to be the most effective policy for reducing smoking.1 Tobacco excise taxes can be levied in two forms: specific and ad valorem taxes. A specific excise tax is a monetary tax levied based on the quantity of tobacco products (eg, per pack or by weight). While an ad valorem excise tax is a tax levied as a percentage of the value of tobacco products (eg, manufacturer’s price or retail price).2 Although most governments impose certain excise taxes on cigarettes, the structure of these taxes varies markedly by countries. For instance, while many high-income countries (HICs) rely solely on specific excise taxes on cigarettes, European Union (EU) countries are required by the Council of the EU to impose excise taxes consisting of specific and ad valorem components, with a minimum floor. In addition, individual EU countries decide on the share of each component in total taxes under rules stating that the specific component must be between 5% and 76.5% of the total tax share of the weighted average price of cigarettes.2,3 As a result, individual EU countries rely differently on the specific and ad valorem components of their total cigarette excise tax.

On the other hand, excise tax structures in low-income and middle-income countries (LMICs) are often more diverse than those in HICs. Unlike HICs where many non-EU countries employ a uniform specific tax system, a large number of LMICs impose ad valorem or mixed excise taxes on cigarettes. In addition, the tax structure may vary with the rates levied on cigarettes differing with the characteristics of the cigarette, such as retail and manufacturer’s price level, length or presence/absence of a filter, and/or with the characteristics of the producer, such as output. For example, China imposes tiered taxes based on manufacturer’s price level and, until July 2010, Egypt levied tiered specific excises based on ex-factory prices of cigarettes.2,4 In addition to these rules, many countries impose a minimum specific tax floor as well, with a few exceptions such as Russia, where the minimum tax floor is applied to the ad valorem and specific components. In general, cigarette excise tax structures can be grouped into categories of specific taxes only, ad valorem taxes only and the mixture of both taxes. Alternatively, any tax structure can be grouped according to whether it levies uniform or tiered taxes. According to a report by the WHO that documents the tax structure of 182 countries, other than the 19 countries where excise tobacco taxes have not yet been imposed, 55 countries employ a purely specific tax system, 60 countries use a purely ad valorem system and 48 use a mixed tax system.2

Despite these various excise tax systems, there is a lack of empirical evidence on how cigarette


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prices, through which taxation ultimately impacts smoking, are distributed in different systems. In particular, for LMICs where smoking is prevalent, the importance of tax structure as a factor mediating the effectiveness of tobacco taxation in controlling tobacco use has rarely been studied or discussed. For example, recent studies from China suggest that cigarette demand is relatively unresponsive to price, which might be a result of China’s complicated tiered tax structure that results in very low prices for some brands.\(^5\)\(^6\) Therefore, it is important to understand how cigarette prices are associated with tax structures in order to maximise the impact of tobacco taxation on tobacco use.

From an economic perspective, given that the cigarette market is usually dominated by a small number of companies in most countries, cigarette price distributions may largely depend on taxation systems. Economic models have implied that, compared with specific excises, ad valorem excises tend to lead to lower prices and may encourage trading down, for example, the purchase of cheaper cigarettes.\(^2\) This is because an ad valorem tax structure creates incentives for manufacturers to produce low quality, low price cigarettes. In contrast, specific excises, in the form of taxes or a tax floor, tend to lead to higher prices, in that producers have incentives to raise prices when they can claim all the increased revenue (which is not the case for ad valorem excises). In addition, specific excises would reduce consumers’ incentives to switch down when taxes increase by raising the relative price of lower-price to higher-price brands. In their examination of cigarette prices in 21 EU countries, Chaloupka et al.\(^7\) find that the price gap between premium and low-priced brands is smaller in countries with a greater specific component to excise taxes. However, that study is based on empirical evidence from EU countries that all use mixed taxation systems with different shares of specific and ad valorem taxes and, as a result, cannot directly compare pure specific, pure ad valorem and mixed systems, or tiered and uniform systems. Moreover, the price gap in that study is based on prices collected by the Economists Intelligence Unit for one leading international brand and one leading local brand, thus not reflecting the full distribution of cigarette prices in the market. Meanwhile, other than the aforementioned reasons, if the relative price of lower-priced brands relative to higher-priced brands increases, the market share of low-priced brands will likely fall. Therefore, compared with ad valorem excises, specific excises might lead to even higher prices with less price variability. The empirical evidence on the former hypothesis is shown in studies using data from HICs with purely specific tax systems. Nargis et al.\(^8\) used four waves of data from the International Tobacco Control Policy Evaluation (ITC) Surveys in Canada and the USA to examine the association between brand choice and relative prices and found that an increase in the relative price of lower-priced to higher-priced brands is associated with a decrease in purchasing of lower-priced brands in both countries. Sobel and Garrett\(^9\) also found that increases in the specific taxes in the USA lead to a lower market share for lower-priced generic brands.

Likewise, a taxation system that levies uniform tax rates, compared with differential rates based on brand characteristics, may reduce switching down and the incentive for manufacturers to reduce tax liabilities through their pricing strategies.\(^2\) In sum, it is likely that greater reliance on more complicated tax structures than uniform specific taxation is associated with a smaller price ratio of lower-price to higher-price brands and wider price distribution, which can allow for more tax avoidance and switching down.\(^10\)–\(^14\) Moreover, some recent studies constructed survey-derived cigarette prices using Global Adult Tobacco Survey (GATS) data from LMICs and showed that cigarette prices are widely distributed in these countries, indicating that complicated tax structures in LMICs could be a factor that broadens the price gap.\(^15\)\(^16\)

Several factors other than tax structures, such as tax avoidance and tax evasion, are likely to shape the cigarette price distribution as well. In some countries, taxes on tobacco are levied differently across jurisdictions such as states, provinces and Indian reservations. Therefore, cross-national-border and cross-jurisdiction-border shopping is one way to avoid taxes. For instance, in Canada and the USA, some excise taxes are exempted in aboriginal reserves and Native American reservations.\(^1\) In a recent paper Merriman et al.\(^17\) assessed the extent of avoidance/evasion by collecting littered cigarette packs around Chicago, and found that three-fourths of the packs collected in Chicago did not bear the Chicago tax stamp. Using data from 15 ITC countries, Guindon et al.\(^18\) found that more than 10% of smokers report engaging in tax avoidance or tax evasion in Canada, the UK and Malaysia.

Tax evasion, such as large-scale smuggling, could also contribute to an increase in the share of low-priced cigarettes. Although there is insufficient evidence that large-scale smuggling lowers average retail prices, some research has indicated that illicit trade could burden low-income countries disproportionately, where illicit cigarettes constitute 16.8% of the market compared with 9.8% of the market in HICs.\(^19\) The cigarette prices that we examine in this paper are survey-derived prices that reflect the combined effects of tax structures, tax avoidance and tax evasion. Although it is impossible in this study to disentangle the contribution of each to the distribution of cigarette prices, we hypothesise that the tax structure plays the most important role in cross-country differences in the price distribution. Moreover, unlike tax evasion and tax avoidance by switching to cheaper cigarettes, which may have a greater effect on prices at the lower end, differences in tax structures would have an effect in shifting the overall distribution of cigarette prices. In summary, a greater price gap among brands could reduce the effectiveness of taxation in reducing tobacco use by increasing opportunities for substitution to cheaper brands as taxes rise. Among many tax structures, the uniform specific tax structure simplifies the taxation system and has advantages in raising the average prices and the relative price of lower-priced to higher-priced cigarettes. As a result, a uniform tax structure can increase the effectiveness of tax increases in reducing smoking.\(^1\) Therefore, analysing the price distribution using survey-derived data will add to the empirical evidence on how price distributions and gaps differ under alternative tax structures. Tax structures that lead to higher average prices and smaller price gaps can lead to a more effective tax system for reducing smoking. In this paper, we use data taken from 16 countries of the ITC Project, which cover many types of tax structures, to describe and compare cigarette price distributions across different tax structures.

**DATA AND METHODOLOGY**

Cigarette prices were derived for each country using the most recent data from the ITC Project Surveys.\(^i\) The ITC Project consists of parallel longitudinal surveys of smokers and other

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\(^{i}\)These are 2011 surveys of the USA, Canada, Australia, The Netherlands, Germany, Uruguay, Mauritius and Mexico; 2010 surveys of the Republic of Korea, the UK and Bangladesh; 2009 surveys of Brazil, Malaysia, Thailand and China; and the 2008 Survey of France.
tobacco users (and non-users in most countries) conducted in 22 countries inhabited by more than 50% of the world’s population, 60% of the world’s smokers and 70% of the world’s tobacco users. The ITC Surveys are designed to evaluate the policies of the WHO Framework Convention on Tobacco Control. For the analyses reported in this paper, we selected ITC countries where cigarette purchase information was collected from smokers. The price per pack of 20 cigarettes was thereafter derived from the money spent in the last purchase and the number of cigarettes that were bought. In order to compare prices and their distributions across countries, we converted the derived prices in local currencies into constant 2010 international dollars using the purchasing-power parity and consumer price index of the country. Purchasing-power parity conversion factors and the consumer price index for each country were obtained from the International Monetary Fund World Economic Outlook database. In order to reflect the market share of cigarettes at different price levels, we use consumption weights to obtain aggregated measures of cigarette prices. Namely, for each individual smoker, we calculate how many cigarettes they smoke per day and construct a consumption weight as the ratio of his or her own consumption to the total consumption of respondents to the survey. These consumption weights are applied to cigarette prices when reporting mean, median and quartile prices.

Survey-derived prices are likely to better reflect the price distribution in the market than are other sources of prices, especially when we are interested in comparing the price distribution under different tax systems. These comparisons shed some light on the association between tax structure and price distribution, and resulting opportunities for tax avoidance under different structures. As discussed above, the tax structure could be exclusively specific, ad valorem, or a mixture of the two. Alternatively, taxes can also be levied uniformly or by tiers. Economic reasoning implies that tax structures with tiers or that rely more heavily on ad valorem excises will yield more opportunities for tax avoidance and branch switching. In the ITC Project sample of countries, a majority rely on uniform taxes, with only Brazil, Republic of Korea, China and Bangladesh applying tiered taxes. Most non-EU HICs including the USA, Canada, Australia and Republic of Korea, and some LMICs including Brazil, Uruguay and Mauritius solely rely on specific excises. In contrast, Bangladesh and Thailand rely on purely ad valorem excises; and China, Malaysia and EU countries apply mixed systems of specific and ad valorem excises, while individual countries may largely rely on one of the components.

We collected detailed information on tax structures including the type of structure (exclusively specific, exclusively ad valorem, and mixed structure, with either uniform or tiered rates), the shares of the specific and ad valorem component among total excises, and the amount of specific and ad valorem excises on a pack of 20 cigarettes in each country over years from a variety of sources. The majority of the tax information was obtained from a series of reports produced by the Bloomberg Global Initiative to Reduce Tobacco Use, Euro-monitor International’s country specific reports, the WHO Tobacco Free Initiative’s periodic reports on the global tobacco epidemic and government reports of tobacco excise taxes. The excise information for EU countries came from the Excise Duty Tables constructed by the European Commission. The excise information for Australia came from VicHealth Center for Tobacco Control. The excise information for the US was obtained from tax burden on tobacco by Orzechowski and Walker and is inclusive of federal and average state excise taxes. The tax information of Canada came from The Nova Scotia Provincial Tax Commission and is a population weighted average of the federal and provincial taxes. The type of structure for all countries in recent years has also been documented in the tax administration published by the WHO.

The analyses in this paper proceed as follows: In table 1, after ranking countries by tax structure, the percentage of the specific component among the total excise tax, and the amount of total excise taxes, we present comprehensive statistics for price distributions by countries. In particular, mean, median, SD and skewness of prices are reported to show how much prices are skewed towards lower prices under alternative tax structures. The first quartile, third quartile and IQR, which is measured by the difference between the first and third quartile, are also reported. In addition, we calculate and show the ratio of the IQR to the median, which shows price variability around the median price. Other important statistics such as the minimum price, maximum price, price range and the ratio of the price range to the mean are also shown in table 1. Also, in figure 1, we exhibit price distributions by countries using boxplot to visualise the statistics that are reported in table 1 and to present the price distribution and variability in one graph. In table 2 we show, by tax structure, countries where prices are skewed in different directions and those where prices are most heavily skewed (skewness statistics are greater than 1 or smaller than −1). Finally, in table 3 we select and pair countries that are close in income levels and in the amount of total excise tax but that employ different tax structures, in order to compare their mean and variance using a two-sample comparison test.

### RESULTS

In table 1, we categorise countries by their tax structures and the percentage of specific taxes among total excise taxes; VATs are excluded. Among countries with a mixed uniform tax structure, The Netherlands has the largest share of the specific component while France has the smallest (range: 9.4–67.3%). Although China imposes a small specific excise, the system largely relies on the tiered ad valorem component. And in general, for countries that impose a similar amount of total excises, those with simpler tax structures tend to have higher average prices. For instance, Mauritius and Mexico impose total excises of $2.45 and $2.29, respectively, but the mean price for Mauritius which uses a uniform specific tax structure is $1.29 higher than Mexico where a mixed tax structure is used. Among EU countries, The Netherlands and France impose total excises of $3.37 and $3.80, respectively, while The Netherlands with a larger specific share has a mean price $0.49 higher than France, which has a larger ad valorem share. The skewness statistics

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"The cigarette price is derived from price per carton, price per pack, price per stick and the number of cigarettes in each carton or pack.

"Throughout the paper, total excises do not include value added taxes (VATs). The amount of ad valorem taxes in China were imputed using the weighted average retail cigarette prices and average VAT and ad valorem tax rates reported in China Statistical Yearbook. The ad valorem tax in Thailand, Malaysia, Mexico and Bangladesh were imputed using ad valorem tax and VAT rates and average cigarette prices. Ad valorem taxes in EU countries were imputed using the ratio of ad valorem to specific components and the amount of specific taxes.

"From this point, taxes refer to the taxes for a pack of 20 cigarettes.

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i http://www.tobaccofreeunion.org/content/en/217/
ii http://www.euromonitor.com/
iii http://www.who.int/tobacco
show that in countries where tiered taxes are applied, prices are more likely positively skewed, indicating that there are fewer higher prices in the distribution. In contrast, most countries with a uniform tax structure have skewness statistics close to 0, suggesting prices are relatively symmetric. When comparing Malaysia and Mexico, where a mixed structure is applied in both cases but Malaysia has a larger share of the specific tax component, more prices in Mexico are lower while more prices in Malaysia are higher.

The ratio of the IQR to the median reported in table 1 shows how prices deviate around the median. In countries with a purely ad valorem tax system, such as Bangladesh and Thailand, and China, which largely employs ad valorem taxation, this ratio is as high as 0.51–0.89, which suggests greater price variability around median prices. On the other hand, other than Uruguay, the USA and Canada where cross-jurisdiction shopping opportunities are relatively available, countries with mixed and specific uniform structures tend to have prices that vary less

<table>
<thead>
<tr>
<th>Tax structure</th>
<th>Specific</th>
<th>Tiered</th>
<th>Mixed</th>
<th>ad valorem</th>
</tr>
</thead>
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<tr>
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<td>Uniform</td>
<td>Tiered</td>
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<td>5.69</td>
<td>5.54</td>
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<td>0.89</td>
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<td>5.24</td>
<td>5.24</td>
<td>3.70</td>
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<tr>
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<td>-0.42</td>
<td>-0.17</td>
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<td>11.1</td>
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<td>0.00</td>
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</tr>
<tr>
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<td>11.0</td>
<td>19.3</td>
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<td>1.76</td>
<td>4.21</td>
<td>1.80</td>
</tr>
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</table>

Prices and taxes are in 2010 constant international dollars. Country names in the column headers are presented using ISO 3166 two letter country codes as follows: AU (Australia), CA (Canada), MU (Mauritius), US (the USA), UY (Uruguay), KR (Republic of Korea), BR (Brazil), NL (The Netherlands), MY (Malaysia), UK (the UK), DE (Germany), MX (Mexico), FR (France), RC (China), TH (Thailand), and BD (Bangladesh). Cigarette price is the consumption-weighted price derived from price per carton, price per pack, price per stick and the number of cigarettes in each carton or pack. The total excise taxes are a sum of specific and ad valorem excises, and exclusive of VAT.

*Tax structures were grouped to three categories: specific, ad valorem and a mixed structure of the two.
†Tax structures were grouped to two categories: uniform and tiered.
around the median, with ratios less than 0.25. When looking into the price range measured by the distance between the maximum and minimum prices, there is no clear pattern by different structures. However, if we compare how great the range is in contrast to the mean, the results indicate that the range is six to nine times as large in Bangladesh, China and Brazil, where taxes are levied by tiers, while other countries have ratios in the range of 1–4. In addition, China has a price range of $17.6, which is extremely wide compared with its average price.

Table 2 summarises countries by comparing mean and median prices, as well as the skewness of prices. In the upper panel, we report countries where the mean price is higher than the median and those where the price mean is lower than the median, respectively. In contrast to the median, a higher mean suggests a positively-skewed price distribution that prices

Table 2  Countries by tax structure, mean and median comparison, and skewness

<table>
<thead>
<tr>
<th>Specific (N=7)</th>
<th>Mixed (N=7)</th>
<th>Uniform (N=2)</th>
<th>Tiered (N=4)</th>
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</thead>
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<td>Bangladesh, Thailand</td>
<td>Brazil, China, Bangladesh</td>
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<tr>
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<td></td>
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<td>F=1.53; P=0.00</td>
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<tr>
<td>DF=1013,211</td>
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</tr>
<tr>
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<td>Mean=4.79&lt;Median=4.01</td>
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<td>Mean=5.33&lt;Median=4.79</td>
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<td></td>
<td>Variation comparison test</td>
<td></td>
</tr>
<tr>
<td>Specific uniform vs mixed uniform</td>
<td>Specific uniform vs mixed uniform</td>
<td>Mixed uniform vs ad valorem uniform</td>
<td>Mixed-specific vs Mixed-ad valorem uniform</td>
</tr>
<tr>
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<td>H0: Mean (MU)&lt;Mean (MX)&lt;0</td>
<td>H0: Mean (MY)&lt;Mean (TH)&lt;0</td>
<td>H0: Mean (MY)&lt;Mean (MX)&lt;0</td>
</tr>
<tr>
<td>T=2.3; P=0.01</td>
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<td>T=39.5; P=0.00</td>
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<td>DF=2531</td>
<td>DF=3401</td>
</tr>
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<td>H0 rejected</td>
<td>H0 rejected</td>
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<td>H0 specific vs mixed uniform</td>
<td>Specific uniform vs mixed uniform</td>
<td>Mixed-specific vs mixed-ad valorem uniform</td>
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<td>Specific uniform vs mixed uniform</td>
<td>Specific uniform vs mixed uniform</td>
<td>Mixed uniform vs ad valorem uniform</td>
<td>Mixed-specific vs Mixed-ad valorem uniform</td>
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<td>H0: Mean (AU)&lt;Mean (FR)&lt;0</td>
<td>H0: Mean (NL)&lt;Mean (DE)&lt;0</td>
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<td>H0 not rejected</td>
<td>H0 rejected</td>
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</tbody>
</table>

Table 2 summarises countries by comparing mean and median prices, as well as the skewness of prices. In the upper panel, we report countries where the mean price is higher than the median and those where the price mean is lower than the median, respectively. In contrast to the median, a higher mean suggests a positively-skewed price distribution that prices
concentrate at lower values; and a lower mean suggests the opposite. These measures show that among the seven countries with the purely specific tax structure, four countries have mean prices larger than the median and three have mean prices smaller than the median. However, the mean and median prices are very close in magnitude for most countries with a specific tax structure. The skewness statistics reported in the lower panel show that prices are largely skewed to lower values in China, Brazil, Mexico, Bangladesh and Republic of Korea, where either tiered or ad valorem taxes (ad valorem component in mixed structures) are applied. This finding suggests that tiered and ad valorem taxes may distort cigarette prices towards lower values, increasing opportunities for switching to cheaper cigarettes at tax increases. In addition, prices are heavily skewed to lower values in the USA, which might reflect tax avoidance by cross-jurisdiction shopping.

Finally, we select and pair countries that are close in the amount of total excise taxes but that use different tax structures, to compare their mean and variance using a two-sample comparison test. The selected country pairs are as follows: for LMICs, Uruguay (specific uniform) and Brazil (specific tiered) are paired to compare uniform and tiered tax structures; Mauritius (specific uniform) and Mexico (mixed uniform) are paired to compare specific and mixed structures; Malaysia and Thailand are paired to compare mixed and ad valorem uniform structures; and Malaysia and Mexico are paired to compare mixed structures with different shares of specific components. For HICs, Australia and the UK/France are paired to compare specific and mixed uniform structures. In addition, The Netherlands and France/Germany are paired to compare mixed systems dominated by specific and ad valorem components, respectively. The hypotheses that more complicated tax structures tend to have a higher price mean and present a smaller price variance are tested, with the rejection of these hypotheses suggesting the opposite. The results of the two-sample mean and SD (variance) comparison tests are shown in table 3.

Although the mean comparison tests do not reject the hypothesis for one set of paired countries (Australia vs the UK), the remainder do. The rejection of this hypothesis for a majority of the comparisons indicates that countries where tax systems are simpler tend to have higher average prices than countries that impose similar total excise amounts but that have more complicated tax systems. The two-sample SD comparison tests of prices within each development group (HICs vs LMICs) yield similar results: cigarette prices show greater variability in countries where tax structures are more complicated. For example, the specific tiered system of Brazil has a higher SD than the specific uniform system of Uruguay. In particular, when comparing within the uniform tax structure, the mixed system of Mexico has a higher SD than the specific system of Mauritius, and the same conclusion holds for the SD comparison between Australia and the UK. Although the SD comparison of Australia and France suggests the SDs of the two countries are about the same, Australia has a much higher mean price than France. The mixed system of Malaysia has a higher price SD than the pure ad valorem system of Thailand, which suggests that mixed system in LMICs may not be superior to a pure ad valorem system in lowering price variability. The mixed system of France, which relies heavily on the ad valorem component, has a higher SD than The Netherlands, which relies heavily on the specific component. The same conclusions are found when comparing The Netherlands with Germany and Malaysia with Mexico. In sum, more complicated taxation systems tend to have greater price variability, and therefore are likely to provide more opportunities for tax avoidance by brand switching.

**DISCUSSION AND LIMITATION**

In this paper, we employed data for 16 countries taken from the ITC Project to construct survey-derived cigarette prices for each country. These self-reported prices were weighted by cigarette consumption and described using a comprehensive set of statistics. We further compared these statistics for cigarette prices under different tax structures. In particular, countries that are close in the amount of total excise taxes but that impose different tax structures were paired and compared in mean and variance using a two-sample comparison test.

There are a few limitations to these analyses. First, we presented direct evidence of price distribution in countries where different taxation systems are imposed. However, we did not estimate or analyse the associations between the type of tax structure and measures of the price distribution. Therefore, we cannot conduct a formal test of these associations. In addition, tax structures were grouped using two characteristics: the component of specific and ad valorem excise taxes, and if tiered rates are levied. As a result, it is difficult to disentangle the extent to which tiered and ad valorem tax structures distort the price distribution. Finally, we did not explicitly control for various forms of tax avoidance or evasion, such as cross-border shopping. Further research using times series data from many countries with different and changing tax structures is needed to address these limitations.

Our investigation illustrates that, compared with uniform specific taxation, other uniform tax structures (ad valorem uniform and mixed uniform structures) tend to have price distributions with greater variability. Also, compared with uniform taxation, tiered tax structures tend to have price distributions with greater variability. Countries that rely heavily on ad valorem and tiered taxes generally have greater variability in prices around the mean. Among mixed taxation systems, countries that rely more heavily on the ad valorem component tend to have greater variability in prices than countries that rely more heavily on the specific component. Among different tax structures that impose similar total excise taxes, simpler structures tend to have higher price means. In countries with tiered tax systems, cigarette prices are more skewed to lower prices than prices under uniform systems.

The analyses presented here demonstrate that when the tax structure departs from uniform specific taxes, more opportunities exist for tax avoidance by switching down to cheaper brands. These results also provide a potential explanation for why smokers in countries with a complicated tax structure, such as China, are often found to be relatively unresponsive to cigarette prices. In light of our findings, countries that solely rely on ad valorem excises would see tax increases have a greater impact on tobacco use if they were to switch to a pure specific taxation system. Similarly, for countries with a mixed taxation system such as Mexico, Malaysia and EU countries, increasing the share of the specific component or switch to a pure specific taxation system would enhance the effectiveness of the tax in reducing tobacco use. Finally, our findings indicate that tax structures have a substantial impact on price variability in cigarette markets, thus likely impacting smoking behaviours, including prevalence, consumption and cessation. Future research should explore how tax structures affect these smoking behaviours.

What this paper adds

- Economic models have suggested that a simple taxation system that applies a uniform specific excise tax has advantages in raising average cigarette prices, reducing tax avoidance and switching down, and discouraging manufacturer’s incentives for pricing strategies that lower market prices. However, there is insufficient empirical evidence on how prices are distributed under different tax structures.
- In this paper, we present and compare price distributions under alternative tax structures. We find that, compared with a uniform specific tax structure, tiered structures and other uniform tax structures tend to have price distributions with greater variability.
- Among mixed taxation systems, countries that rely more heavily on the ad valorem component of the total tax tend to have greater price variability than countries that rely more heavily on the specific component.
- In countries with tiered tax systems, cigarette prices are skewed more towards lower prices than are prices under uniform tax systems.

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Contributors

The findings and conclusions in this article are those of the authors.

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Ethics approval

All ITC Surveys were conducted with the approval of the Office of Research Ethics Committee at the University of Waterloo, Canada and the respective internal ethics board for each country.

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不同税收结构下卷烟价格的分布：国际烟草控制政策评估项目（ITC）的研究结果

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摘要

背景：现有研究很少涉及不同税收结构下的卷烟价格分布这一课题。来自不同国家卷烟价格分布的描述性证据可以帮助了解在不同税收结构下的避税行为和品牌转换的机会。上述两种行为会影响到通过增加烟草税来控烟的政策有效性。

目的：本文的目的在于描述不同国家间卷烟价格的分布情况，并依据卷烟税收结构来比较这些国家间该分布的差异。

方法：本文使用国际烟草控制政策评估项目（ITC项目）中16个国家有关卷烟价格的调查数据来进行研究。我们首先计算用卷烟使用量来进行加权的自报卷烟价格，并通过一组统计对其进行全面描述，进而比较不同税收结构下卷烟价格的统计学差异。特别是将收入水平相似的国家以及消费税额类似但实行不同税收结构的国家进行配对，再使用双样本检验比较均值和方差。

结果：本次研究显示，如果将其他税制结构与从量统一的税收结构相比，其他税收结构下的价格具有更大的分布波动性和差异。这些其他的税制结构包括单一从量、混合（同时使用从价和从量的税收制度）以及分级征收。严重依赖于从价税和分级税的国家，其围绕中位价格的价格变化也往往更大。在混合税收结构中，从价比重大的国家其价格波动往往比从量税比重大的国家大。与单一税收结构的国家相比，分级税收结构的国家其卷烟价格更容易趋向于低价分布。本文提供的分析表明，不采用单一的税收结构提供了更多的避税和品牌转换机会。

前言

增加卷烟消费税已被大量研究证明是减少吸烟最有效政策之一。烟草消费税有两种征收形式：从量和从价。从量税是基于烟草产品的数量（如每包或一定重量）所征收的货币税，而从价税是基于卷烟产品的价格（如制造商定价或零售价）按一定比率计征的税。世界范围内，虽然大部分政府都会征收卷烟消费税，但其税收结构在不同国家间差异很大。例如，许多高收入国家（HICs）仅征收从量卷烟消费税，但欧盟各国及从价从量混合税。其他税收结构包括单一从价、混合（同时使用从量和从价的税收制度）以及分级征收。严重依赖于从价税和分级税的国家，其围绕中位价格的价格变化也往往更大。在混合税收结构中，从价比重大的国家其价格波动往往比从量税比重大的国家大。与单一税收结构的国家相比，分级税收结构的国家其卷烟价格更容易趋向于低价分布。本文提供的分析表明，不采用单一的税收结构提供了更多的避税和品牌转换机会。
从经济学角度来看，大多数国家的卷烟市场通常由少数大企业主导，因此卷烟价格的分布可能在很大程度上取决于税收结构。经济模型也显示，与从量消费税比较，从价消费税会使卷烟价格更低且更可能鼓励消费低价卷烟。这是因为从价税体制使制造商更倾向于生产低质量、低价格的卷烟。相比之下，从量消费税或从量税最低限额会相对提升价格。这是因为生产商会根据提高价格来增加收益（从量消费税则不同）。此外，从量消费税会减小廉价品牌和高价品牌的相对价格差进而减少消费者购买廉价卷烟的意愿。通过对比21个欧盟国家卷烟价格的调查，Chaloupka发现，一个国家如果从量税在消费税中占较大比例，高价品牌和廉价品牌间的价格差距较小。然而，这些研究是基于欧盟国家的数据分析得出的并且这些欧盟国家均采用从价税和从量税构成份额不一的混合税收结构，因此这些结论可能不适用于其他国家。此外，这些研究仅限于21个欧盟国家，因此不能反映市场上所有卷烟价格的整体分布情况。

同上所述，如果廉价品牌较高价品牌的相对价格提高，廉价品牌的市场份额将有可能减少。因此，与从量消费税相比，从价消费税可能会减少价格的波动并且提升价格。例如，Nargis使用加拿大和美国ITC项目的4轮数据以验证品牌选择与相对价格间的关联，结果发现，廉价品牌较高价品牌的相对价格升高与这两个国家间廉价品牌的购买量下降有关。也就是说，美国从量税增加可以减少较低类品牌的市场份额。

除税收结构外，其他因素，如避税、逃税行为也可能影响卷烟价格分布。在一些国家中，不同行政区划（如州、省和印第安人保留地）征收的税种是不同的。因此，跨国或者跨地区购买也是一种避税方式。例如，美国和加拿大共享了印第安人保留地的税收政策。在近期文献中，Merriman通过收集芝加哥市周边被丢弃的烟草信息，发现有3/4的烟草没有印有加拿大印花税。另一方面，Gundon等分析了ITC项目中15个国家的数据，发现在美国和马来西亚，超过50%的吸烟者承认有避税或逃税的行为。

逃税或逃税行为（如大规模走私）同样也会造成卷烟价格市场分布的变化。尽管尚没有充分的证据证明大规模走私会降低市场零售价格，但是一些研究者认为非法交易会造成低收入国家的负担。因为这些国家非法交易的卷烟市场占到了市场总份额的大约16.8%，而在高收入国家中这一比例仅为9.8%。本文所讨论的卷烟价格是基于调查数据所得的价格，反映了税收结构和避税逃税行为对于价格的综合效应。尽管很难分清税收结构和避税逃税行为对卷烟价格争夺各自影响，我们仍假设税收结构在不同国家间的市场价格分布上扮演着最重要的角色。此外，购买廉价卷烟的避税逃税行为很有可能对最低价格产生较大影响。相比之下，税收结构的差异将改变卷烟价格的总体分布。

综上所述，不同品牌间较大的价格差异，会降低税收作为控制价格的有效性。这表现为随着税收增加，吸烟者交换到廉价品牌的几率增加。在众多税收结构中，统一从量税收简化了税收结构，提高了平均价格和廉价卷烟较高价卷烟的相对价格。因此，从这个角度来看统一税收结构会增加税收作为控制政策的有效性。通过研究调查数据的价格分布，我们可以得出不同税收结构下价格分布和价格差不同。这一结论提供经验证据。此类分析会帮助阐明何种税收结构会增加平均价格和减小价格差异——这样的税收结构可以增加税收对价格控制的有效性。在本文中，我们使用来自ITC项目中16个国家的数据（包含了多种税收结构），来描述和比较不同税收结构下卷烟价格的分布情况。

**数据与方法**

各国的卷烟价格从ITC项目调查的近期数据中获得。ITC项目是为卷烟和其他烟草使用者（以及大多数国家的非烟草使用者）进行的平行纵向调查。该项目在22个国家展开，涵盖了45%的世界人口、60%的卷烟使用者和超过70%的烟草使用者。其一个重要目的就是研究全球各地实施《烟草控制框架公约》所推荐的控烟政策的有效性。在本文的分析报告中，我们选择了那些能从消费者身上收集到卷烟购买信息的国家，并根据过去购买卷烟的花费和所买的卷烟数量计算每包（20支）卷烟的价格。为了比较不同国家间的卷烟价格及分布情况，我们采用购买力平价和居民消费价格指数来调整价格并将该价格转换为2010年的国际货币常量。另外，为反映不同价格水平下卷烟的市场分布，我们采用消费量作为权重来计算平均价格，即计算每个吸烟者每人每天的吸烟数量，并根据个体自身的消费量与所有调查者的总消费量之比构建消费权重。这些权重也应用于报告卷烟价格的均值、中值和四分位数。

通过调查得来的价格会比其他来源的价格更好地反映市场价格分布。特别是当我们将不同的税收结构下的价格分布情况比较时。这些比较阐明了税收结构和价格分布间的联系。这有助于我们了解不同避税行为的发生几率。例如，美国和加拿大共享了印第安人保留地的税收政策。在近期文献中，Merriman通过收集芝加哥市周边被丢弃的烟草信息，发现有3/4的烟草没有印有加拿大印花税。另一方面，Gundon等分析了ITC项目中15个国家的数据，发现在美国和马来西亚，超过50%的吸烟者承认有过避税或逃税的行为。

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、加拿大、澳大利亚和韩国）以及某些中低收入国家（包括巴西、乌拉圭和毛里求斯）实行完全从量税；相反，孟加拉国和泰国实行完全从价税；而中国、马来西亚和欧盟国家实行的是从量税和从价税两者的混合税收结构。在实行混合税制结构的国家中，个别国家可能很大程度上依赖混合税中的某个税收成分。

我们从多个途径收集了各个国家多年来税收结构的详细信息，包括体制类型（完全从量结构、完全从价结构还是混合结构，按统一税率征收还是按分级税率征收）、总消费税中从量税和从价税的份额以及每包20支装卷烟的从量税和从价税的数量。大部分税务信息来源于Bloomberg Global Initiative to Reduce Tobacco Use、Euro-monitor International’s country specific reports以及WHO无烟行动倡议关于全球烟草流行的周期性报告以及政府报告中的烟草消费税等一系列报告。欧盟国家的税务信息来自欧盟委员会颁布的《消费税表》；澳大利亚的税务信息源自维多利亚烟草控制健康中心；加拿大的税务信息由Nova Scotia省级税收委员会提供，是联邦和省级人口加权平均税率。WHO发布的《税收管理》也记录了近年来所有国家的税收结构类型。

本文的分析结果如下：表1中，我们将不同国家根据税收结构和从量税占总消费税的百分比进行分类（不包含VAT增值税）。在混合统一税收结构的国家中，拥有从量税比重最高的是荷兰，而法国最低（范围从9.4-76.3%）。尽管中国施行从价税，其税额较小而且税收结构很大程度上依赖于分价从价税。一般而言，征收总消费税税额相近的国家，税收结构越简单，其卷烟的价格往往更高。例如，毛里求斯和墨西哥分别征收2.45美元和2.29美元的总消费税，而意大利(从量征税结构)的平均价格比墨西哥（混合税收结构）高0.29美元。在欧盟国家中，法国的总消费税分别为3.37美元和3.80美元，但荷兰（从价比重较大）的平均价格比法国（从价比重较大）高0.49美元。偏度系数显示，分级征税的国家，其价格更可能右偏，表明价格分布中高价较少。相反，大多数统一征税的国家，其偏度系数更接近于0，表明价格相对对称。马来西亚和墨西哥均采用混合税收结构，但马来西亚的从量税比重更大，比较两者的价格发现，墨西哥的价格多少低于马来西亚的价格数量较多。

表1中IQR与中值的比值显示了价格在中值附近波动的程度。实行单纯从价税收结构的国家，如孟加拉国和泰国，以及其他主要征收从价税的中国，IQR与中值的比值可达0.51-0.89。表明价格在中值附近波动的程度较小。另一方面，除乌拉圭和跨越交易机会相对较多的国家（美国和加拿大）外，实行混合税收结构和从量税收结构的国家中，价格在中值附近波动的程度较大，该比值可小于0.25。当通过最大值与最小值之差衡量价格区间时，不同税收结构间尚没有明确的模式。但是，如果我们根据价格区间与均值有多样区别，会发现马来西亚、中国和巴西等分级征税的国家，其价格区间大小约为均值的6-9倍，而其他国家价格在1-4之间。此外，中国的价格区间为17.6，明显高于其平均价格。

表2比较不同国家的平均价格、中位价格及价格偏度。在表格上半部分，我们分别报告了平均价格大于中位价格的国家和平均价格小于中位价格的国家。相对于中位价格，较高的平均价格暗示价格分布呈正偏态，即价格集中在较小值；而较低的平均价格正好相反。这些数据显示，在这7个国家中，4个国家的平均价格高于中位价格，3个国家的平均价格低于中位价格。但是，平均价格和中位价格在大多数国家实行从量税收结构的国家中非常接近。表2中下部分报告的偏度系数显示，采用分级税收或从量税收（混合税收结构中的从价份额）的中国、巴西、墨西哥、孟加拉国和韩国，其价格严重偏向于较小值。这可能显示了分级税收和从量税收结构可使卷烟价格偏向较小值。在此情况下，当税收增加时，通过购买低价卷烟来避税的机会会减少。此外，美国的价格严重偏向较小值，这可能反映了跨州/跨界交易的避税行为。
<table>
<thead>
<tr>
<th>税收结构*</th>
<th>从量税</th>
<th>从价税</th>
<th>混合税</th>
</tr>
</thead>
<tbody>
<tr>
<td>税收结构†</td>
<td>统一</td>
<td>分级</td>
<td>统一</td>
</tr>
<tr>
<td>国家</td>
<td>AU</td>
<td>CA</td>
<td>MU</td>
</tr>
<tr>
<td>均数</td>
<td>6.52</td>
<td>5.41</td>
<td>5.65</td>
</tr>
<tr>
<td>中位数</td>
<td>6.44</td>
<td>5.69</td>
<td>5.54</td>
</tr>
<tr>
<td>标准差</td>
<td>1.00</td>
<td>1.78</td>
<td>0.89</td>
</tr>
<tr>
<td>偏度系数</td>
<td>-0.44</td>
<td>-0.42</td>
<td>0.75</td>
</tr>
<tr>
<td>第一分位数</td>
<td>5.85</td>
<td>4.42</td>
<td>4.99</td>
</tr>
<tr>
<td>第四分位数</td>
<td>7.18</td>
<td>6.56</td>
<td>5.54</td>
</tr>
<tr>
<td>IQR=第三四分位数-第一四分位数</td>
<td>1.33</td>
<td>2.13</td>
<td>0.55</td>
</tr>
<tr>
<td>IQR/均值</td>
<td>0.21</td>
<td>0.37</td>
<td>0.10</td>
</tr>
<tr>
<td>最小值</td>
<td>0.68</td>
<td>0.40</td>
<td>1.11</td>
</tr>
<tr>
<td>最大值</td>
<td>12.4</td>
<td>13.3</td>
<td>11.1</td>
</tr>
<tr>
<td>全距</td>
<td>11.7</td>
<td>12.9</td>
<td>9.97</td>
</tr>
<tr>
<td>全距/均值</td>
<td>1.79</td>
<td>2.38</td>
<td>1.76</td>
</tr>
<tr>
<td>从量税</td>
<td>4.27</td>
<td>3.67</td>
<td>2.45</td>
</tr>
<tr>
<td>从价税</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>混合税</td>
<td>4.27</td>
<td>3.67</td>
<td>2.45</td>
</tr>
<tr>
<td>从量税占总税的比重</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

价格和税收转化为2010年国际货币常量。数据列标题中的国家名根据ISO 3166编码为两位字母，如下所示：AU（澳大利亚）、CA（加拿大）、MU（毛里求斯）、US（美国）、UY（乌拉圭）、KR（韩国）、BR（巴西）、NL（荷兰）、MY（马来西亚）、UK（英国）、DE（德国）、MX（墨西哥）、FR（法国）、RC（中国）、TH（泰国）和BD（孟加拉国）。卷烟价格是根据每条价格、每包价格、每根价格以及每条或每包中的卷烟数量进行消费量加权后得到的价格。总消费税是排除VAT后，从量税和从价税的总和。

*税收结构划分为三种：从量税、从价税和前两者的混合税。
†税收结构划分为两种：统一税和分级税。
### Table 2: Different countries according to tax structure, mean and median comparison, skewness coefficient grouping

<table>
<thead>
<tr>
<th>Tax Structure</th>
<th>Mean&gt;Median</th>
<th>Mean&lt;Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>From-quantity (N=7)</td>
<td>USA, Mauritius, Australia, Brazil</td>
<td>Uruguay, Canada, South Korea</td>
</tr>
<tr>
<td>Mixed tax (N=7)</td>
<td>Mauritius, China</td>
<td>Malaysia, Thailand</td>
</tr>
<tr>
<td>From-quantity (N=2)</td>
<td>Brazil, China</td>
<td>Malaysia, Thailand</td>
</tr>
<tr>
<td>Unified tax (N=12)</td>
<td>USA, Mauritius, Australia, Mexico, Malaysia, Thailand</td>
<td>Uruguay, Malaysia, China, Canada, UK, Germany, France</td>
</tr>
<tr>
<td>分级税 (N=4)</td>
<td>Brazil, China, Macao, Malaysia</td>
<td>Malaysia, Thailand</td>
</tr>
</tbody>
</table>

### Table 3: Different tax structures in some countries of cigarette prices comparison

#### Low-income countries (LMICs)

<table>
<thead>
<tr>
<th>Country</th>
<th>From-quantity VS From-quantity</th>
<th>From-quantity VS Mixed tax</th>
<th>Mixed tax VS Unified tax</th>
<th>Mixed tax VS Mixed tax, Unified tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2.748</td>
<td>5.898</td>
<td>4.894</td>
<td>4.894</td>
</tr>
<tr>
<td>Brazil</td>
<td>2.512</td>
<td>4.795</td>
<td>3.142</td>
<td>4.795</td>
</tr>
<tr>
<td>Mauritius</td>
<td>1.058</td>
<td>1.081</td>
<td>0.917</td>
<td>1.551</td>
</tr>
<tr>
<td>Malaysia</td>
<td>212</td>
<td>1739</td>
<td>1712</td>
<td>1739</td>
</tr>
<tr>
<td>Thailand</td>
<td>1014</td>
<td>530</td>
<td>1712</td>
<td>1712</td>
</tr>
</tbody>
</table>

#### High-income countries (HICs)

<table>
<thead>
<tr>
<th>Country</th>
<th>From-quantity VS Mixed tax</th>
<th>From-quantity VS Unified tax</th>
<th>Unified tax VS From-quantity, Mixed tax</th>
<th>Unified tax VS Mixed tax, Unified tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>6.611</td>
<td>6.611</td>
<td>5.613</td>
<td>5.613</td>
</tr>
<tr>
<td>China</td>
<td>7.634</td>
<td>5.133</td>
<td>5.133</td>
<td>5.133</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.179</td>
<td>1.179</td>
<td>0.849</td>
<td>0.849</td>
</tr>
<tr>
<td>China</td>
<td>952</td>
<td>1322</td>
<td>1322</td>
<td>1322</td>
</tr>
</tbody>
</table>

双样本比较检验时未对价格进行加权。双样本方差不等时进行均值比较检验。当发现研究国家的总体价格方差不齐时，对报告中不齐的方差进行Satterthwaite自由度校正以取代常规方差。混合方差表示该国家从量消费税份额比其配对国家更高。混合方差表示该国家从量消费税份额比其配对国家更高。HICs, 高收入国家; LMICs, 中低收入国家。

最后，我们选择总消费税额相近但税收结构不同的国家
进行配对，并用双样本检验比较他们的均数和方差。从低收入国家（LMICs）, 乌拉圭（从量统一）和巴西（从价分级）配对，比较统一税收结构和混合税收结构；毛里求斯（从量统一）和墨西哥（混合统一）配对，比较从量税收结构和混合税。马来西亚和
泰国配对，比较混合税收结构和从价税收结构；马来西亚和
墨西哥配对，比较从量税额所占比例不同的混合税收结构。

对于高收入国家（HICs）, 澳大利亚和英国或法国配对，
比较从量税收结构和混合税收结构。此外，荷兰和法国或
德国配对，分别比较从量税占主导或从价税占主导的混合税收结构。我们对税收结构越复杂，其平均价格越高，方差越小
的假设进行检验，结果显示拒绝原假设。双样本均数和标准差（方差）的比较结果如表所示。

讨论和局限性

在本文中，我们采用ITC项目中16个参与国的数据，获取各
国吸烟来源的卷烟价格。自报价格经卷烟消费量进行加权，
并运用一系列统计量进行综合描述。我们进一步比较不同税收结构下这些卷烟价格的统计量，特别是将总消费税额相近
但税收结构不同的国家进行配对后，用双样本检验比较均值
和方差。

此过程存在一些局限性。首先，我们为实行不同税收结构的国家提供了价格分布的直接依据，但并未估计或分析税收结构类型与价格分布指标间的关联性，因此不能统计评估这些关联的大小。其次，税收结构依据两个特征进行分组：从量消费税与从价消费税的构成比例，以及是否征收分
级税率。因此，难以严格区分分税结构与从价税收结构
对价格分布的扭曲度。最后，我们没有明确控制避免逃税
行为的多种形式，如跨境/跨区交易。在今后研究中应使用
来自许多国家的时间序列数据，最好是税收结构不同且存在
税制结构变化的时间序列数据作进一步分析，以解决这些
局限性。

本文分析结果表明，当税收结构偏离统一从量税收结构时，转到廉价品牌而避税的机会更多。这些结果可能也解释了
为什么在复杂税收结构国家（如中国）吸烟者对卷烟价格
相对较不反应。根据我们的发现，单纯依赖从价税收结构的
国家其税收结构从量税占主导的混合税收结构，其税收增加将
对烟草使用量产生更大的影响。同时，复杂税收结构的国家
（如马来西亚、墨西哥和欧盟国家），增加从量税的份额或
者转变为完全从量税收结构，将提高税收对于降低烟草使用
的效率。最后，研究显示税收结构对烟草市场的价格波动
性影响较大，进而可能影响吸烟行为，包括吸烟率、消费量
和政策。今后的研究应继续探讨税收结构如何影响这些吸烟
相关行为。

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National Health and Medical Research Council of Australia
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(104831-002), the International Development Research Centre

经济学模型已经表明，征收统一从量税的简单税收结
构有下列优势：可增加卷烟平均价格、减少品牌转换
和税收逃税行为，以及减少制造商实施那些以降低市
场价格为目的的定价策略的积极行为。然而迄今为止，
尚没有足够的经验证据说明价格在不同税收结构下是
如何分布的。

在本文中，我们展示和比较了不同税收结构下的价格
分布情况。结果发现，与统一从量税收结构相比，分
级税收结构和其他统一税收结构下价格分布的波动性
往往更大。

本文贡献

利益冲突 无。

知情同意 已获得。

伦理审核 所有的ITC调查均被加拿大University of Waterloo研究伦理委员会办公室及各国内部的伦理委员会批准。

出处和同行审查 未开展；外部同行已评审。

参考文献