# 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[i].[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

[i]Ex-factory price means the price at the factory, and does not include any other charges, such as delivery costs or taxes imposed later in the distribution chain.

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[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.[ii] The ITC Project consists of parallel longitudinal surveys of smokers and other

[ii]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.[20] 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.[iii] 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.[21] 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[iv], 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[v]. The majority of the tax information was obtained from a series of reports produced by the Bloomberg Global Initiative to Reduce Tobacco Use[vi], Euro-monitor International's country specific reports[vii], the WHO Tobacco Free Initiative's periodic reports on the global tobacco epidemic[viii] 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.[22] 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.[2]

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 distribution 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

[iii]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.
[iv]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.
[v]From this point, taxes refer to the taxes for a pack of 20 cigarettes.

[vi]http://www.tobaccofreeunion.org/content/en/217/
[vii]http://www.euromonitor.com/
[viii]http://www.who.int/tobacco/

**Table 1** Summary statistics of the price distribution of cigarettes by International Tobacco Control Policy Evaluation (ITC) countries with different tax structures

| Tax structure* | Specific | | | | | | | Mixed | | | | | | | ad valorem | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tax structure† | Uniform | | | | | Tiered | | Uniform | | | | | | Tiered | Uniform | Tiered |
| Country | AU | CA | MU | US | UY | KR | BR | NL | MY | UK | DE | MX | FR | RC | TH | BD |
| Mean | 6.52 | 5.41 | 5.65 | 4.49 | 2.75 | 3.10 | 2.24 | 5.62 | 4.79 | 7.49 | 5.29 | 4.36 | 5.13 | 1.98 | 3.02 | 1.42 |
| Median | 6.44 | 5.69 | 5.54 | 4.37 | 3.18 | 3.13 | 1.98 | 5.73 | 5.17 | 7.75 | 5.58 | 4.33 | 5.37 | 1.51 | 2.78 | 1.41 |
| SD | 1.00 | 1.78 | 0.89 | 1.62 | 1.06 | 0.78 | 1.40 | 0.94 | 1.34 | 2.00 | 1.20 | 1.24 | 1.17 | 1.55 | 0.92 | 0.86 |
| Skewness | −0.44 | −0.42 | 0.75 | 1.37 | −0.31 | 8.24 | 5.21 | −0.07 | −0.96 | −0.29 | −1.17 | 1.51 | −0.82 | 3.61 | 0.19 | 2.01 |
| Q1 | 5.85 | 4.42 | 4.99 | 3.55 | 1.85 | 3.13 | 1.65 | 5.20 | 4.34 | 6.93 | 4.90 | 3.65 | 5.15 | 1.13 | 2.28 | 0.70 |
| Q3 | 7.18 | 6.56 | 5.54 | 5.24 | 3.70 | 3.13 | 2.44 | 5.97 | 5.50 | 8.73 | 6.08 | 4.33 | 5.82 | 2.47 | 3.70 | 1.93 |
| IQR=Q3−Q1 | 1.33 | 2.13 | 0.55 | 1.70 | 1.85 | 0 | 0.79 | 0.77 | 1.16 | 1.81 | 1.18 | 0.68 | 0.67 | 1.35 | 1.42 | 1.23 |
| IQR/median | 0.21 | 0.37 | 0.10 | 0.39 | 0.58 | 0 | 0.40 | 0.13 | 0.22 | 0.23 | 0.21 | 0.16 | 0.12 | 0.89 | 0.51 | 0.87 |
| Minimum | 0.68 | 0.40 | 1.11 | 0.50 | 0.34 | 1.50 | 0.66 | 1.05 | 0.52 | 0.37 | 0.12 | 0.91 | 0.67 | 0.03 | 0.19 | 0.04 |
| Maximum | 12.4 | 13.3 | 11.1 | 19.4 | 5.29 | 12.5 | 13.2 | 12.6 | 11.5 | 19.6 | 7.75 | 11.4 | 12.6 | 17.6 | 6.17 | 10.5 |
| Maximum–Minimum | 11.7 | 12.9 | 9.97 | 18.9 | 4.95 | 11.0 | 12.6 | 11.6 | 11.0 | 19.3 | 7.63 | 10.5 | 11.9 | 17.6 | 5.98 | 10.5 |
| Maximum–Minimum/mean | 1.79 | 2.38 | 1.76 | 4.21 | 1.80 | 3.55 | 5.63 | 2.06 | 2.30 | 2.58 | 1.44 | 2.41 | 2.32 | 8.87 | 1.98 | 7.39 |
| Specific taxes | 4.27 | 3.67 | 2.45 | 2.41 | 2.00 | 1.65 | 0.52 | 2.27 | 1.15 | 3.11 | 1.95 | 0.80 | 0.36 | 0.02 | 0 | 0 |
| Ad valorem taxes | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.10 | 0.70 | 1.97 | 1.44 | 1.49 | 3.44 | 0.54 | 1.98 | 0.45 |
| Total taxes | 4.27 | 3.67 | 2.45 | 2.41 | 2.00 | 1.65 | 0.52 | 3.37 | 2.25 | 5.08 | 3.39 | 2.29 | 3.80 | 0.56 | 1.98 | 0.45 |
| % specific of total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 67.3 | 62.1 | 61.2 | 57.5 | 34.9 | 9.42 | 2.94 | 0 | 0 |

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.

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

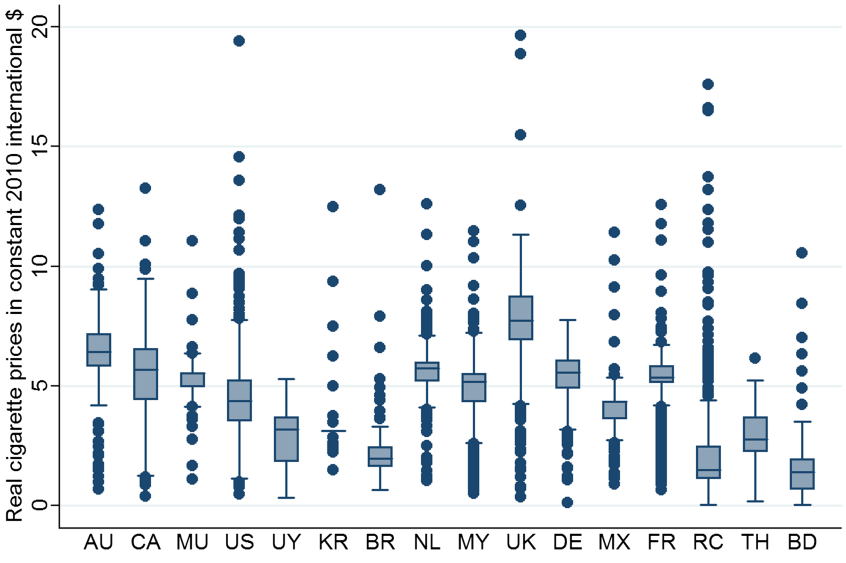


**Figure 1** Boxplot of cigarette price distributions by country. AU (Australia), CA (Canada), MU (Mauritius), US (the USA), UY (Uruguay), KR (Republic of Korea), BR (Brazil), NL (The Netherlands), MY (Malaysia), UK (the UK), DE (Germany), MX (Mexico), FR (France), RC (China), TH (Thailand) and BD (Bangladesh).

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

| | Mean>Median | Mean<Median |
|---|---|---|
| Specific (N=7) | USA, Mauritius, Australia, Brazil | Uruguay, Canada, Republic of Korea, |
| Mixed (N=7) | Mexico, China | The Netherlands, Malaysia, UK, Germany , France |
| Ad valorem (N=2) | Bangladesh, Thailand | |
| Uniform (N=12) | USA, Mauritius, Australia, Mexico, Thailand | Uruguay, The Netherlands, Malaysia , UK, Germany, France |
| Tiered (N=4) | Brazil, China, Bangladesh | Republic of Korea |
| | Skewness>1 | Skewness<−1 |
| Specific (N=7) | USA, Republic of Korea, Brazil | – |
| Mixed (N=7) | China, Mexico | Germany |
| ad valorem (N=2) | Bangladesh | – |
| Uniform (N=12) | USA, Mexico | Germany |
| Tiered (N=4) | Republic of Korea, Brazil, China, Bangladesh | – |

Tax structures were first grouped to three categories: specific, ad valorem and a mixed structure of the two, and then 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 as the mean 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 3** Comparison tests of cigarette prices in selected countries by different tax structures

| LMICs | Specific uniform vs specific tiered | | Specific uniform vs mixed uniform | | Mixed uniform vs ad valorem uniform | | Mixed-specific vs Mixed-ad valorem, Uniform | |
|---|---|---|---|---|---|---|---|---|
| Countries | UY | BR | MU | MX | MY | TH | MY | MX |
| Mean | 2.748 | 2.512 | 5.898 | 4.795 | 4.894 | 3.142 | 4.894 | 4.795 |
| SD | (1.058) | (1.130) | (1.081) | (1.551) | (1.355) | (0.917) | (1.355) | (1.551) |
| N | 1014 | 212 | 530 | 1739 | 1712 | 937 | 1712 | 1739 |
| Variation comparison test | H0: SD (UY)/SD (BR) >1<br>F=0.56; P=0.00<br>DF=1013,211<br>H0 rejected | | H0: SD (MU)/SD (MX)>1<br>F=0.49; P=0.00<br>DF=529,1738<br>H0 rejected | | H0: SD (MY)/SD (TH) >1<br>F=2.18; P=1.00<br>DF=1711,936<br>H0 not rejected | | H0: SD (MY)/SD (MX) >1<br>F=0.76; P=0.00<br>DF=1711,1738<br>H0 rejected | |
| Mean comparison test | H0: Mean (UY)−(BR)<0<br>T=2.30; P=0.01<br>DF=263<br>H0 rejected | | H0: Mean (MU)−(MX)<0<br>T=18.4; P=0.00<br>DF=1252<br>H0 rejected | | H0: Mean (MY)−(TH)<0<br>T=39.5; P=0.00<br>DF=2531<br>H0 rejected | | H0: Mean (MY)−(MX)<0<br>T=2.0; P=0.02<br>DF=3401<br>H0 rejected | |
| HICs | Specific uniform vs mixed uniform | | Specific uniform vs mixed uniform | | Mixed-specific vs mixed-ad valorem, uniform | | Mixed-specific vs Mixed-ad valorem, Uniform | |
| Countries | AU | UK | AU | FR | NL | FR | NL | DE |
| Mean | 6.611 | 7.634 | 6.611 | 5.133 | 5.613 | 5.133 | 5.613 | 5.336 |
| SD | (1.179) | (1.966) | (1.179) | (1.212) | (0.849) | (1.212) | (0.849) | (1.195) |
| N | 869 | 592 | 869 | 1322 | 968 | 1322 | 968 | 383 |
| Variation comparison test | H0: SD (AU)/SD (UK) >1<br>F=0.36; P=0.00<br>DF=868,591<br>H0 rejected | | H0: SD (AU)/SD (FR) >1<br>F=0.95;P=0.19<br>DF=868,1321<br>H0 not rejected | | H0: SD (NL)/SD (FR) >1<br>F=0.40;P=0.00<br>DF=967,1321<br>H0 rejected | | H0: SD (NL)/SD (DE) >1;<br>F=0.51;P=0.00<br>DF=967,382<br>H0 rejected | |
| Mean comparison test | H0: Mean (AU)−(UK)<0<br>T=-11.3; P=1.00<br>DF=880<br>H0 not rejected | | H0: Mean (AU)−(FR)<0<br>T=28.2; P=0.00<br>DF=2189<br>H0 rejected | | H0: Mean (NL)−(FR)<0<br>T=11.1; P=0.00<br>DF=2284<br>H0 rejected | | H0: Mean (NL)−(DE)<0<br>T=4.14; P=0.00<br>DF=541<br>H0 rejected | |

Prices were unweighted when conducting two-sample comparison test. Mean comparison tests were performed by allowing the variance of the two sample to be different. When unequal population variances of prices were detected for studied counties, Satterthwaite's degrees of freedom that accommodate the unequal variances are reported instead of usual ones. Mixed-specific represents the country where the share of specific excise component is greater than their paired country in the comparison. And mixed-ad valorem represents the country where the share of ad valorem excise component is greater than their paired country in the comparison.
HICs, high-income countries; LMICs, low-income and middle-income countries.

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 as 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 median. 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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# 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烟草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价、混合（同时使用从价和从量的税收制度）税收结构以及分级征收。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，从价税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的政策[1]。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，而从价税是对烟草产品的价格（如制造商的定价或零售价）按照一定比率计征的税[2]。世界范围内，虽然大部分政府都会征收某种卷烟消费税，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，但欧盟要求欧盟（EU）国家应征收包含从量和从价两部分的消费税，并且两种税都要设定一个最低限额。此外，从量税份额必须占加权平均价格的5%~76.5%[2,3]。如果此条件得到满足，各个欧盟国家可以自行决定每种税在总税额中的比例。因此，各个欧盟国家对于从量税以及从价税的依赖性有很大差异。

另一方面，中低收入国家（LMICs）的消费税制度与高收入国家（HICs）相比更多样。不同于许多非欧盟发达国家采用统一的从量税收结构，很多中低收入国家征收卷烟从价税或混合税。此外，税收结构可能会根据卷烟类型（比如零售价与制造商定价梯度、过滤嘴的长度或有无）和/或生产商的特点（如出口）使用不同的税率。例如，中国根据制造商的定价梯度实行分级征税；在2010年7月之前，埃及一直根据卷烟的出厂价分级征收从量税[i] [2,4]。除这些规定外，许多国家也规定最低从量税额，只有少数国家例外（如俄罗斯的从价税和从量税都有最低税额）。一般而言，卷烟消费税结构可以分为完全从量税、完全从价税和两者皆具的混合税三种。另外，任何税收结构还可根据是统一征税还是分级征税来区分。根据WHO一份记录182个国家税收结构的报告，除19个国家尚未征收烟草税之外，55个国家实行完全从量税收结构，60个国家采用完全从价税收结构，48个采用混合税收结构[2]。

尽管消费税收结构各有不同，但仍缺乏数据论证在不同税制中卷烟价格如何分布。研究此类数据非常重要，因为增加卷烟税收需要通过提升卷烟价格去最终影响吸烟行为。特别是当前中低收入国家吸烟盛行，税收结构作为烟草消费税有效控制烟草使用的关键一环，其重要性很少被研究或讨论。例如，中国最近的研究表明，卷烟需求量对价格反应不敏感，这可能是中国实行复杂的分级税收结构致使某些品牌十分廉价的结果[5,6]。因此，为了使烟草税收对烟草使用的影响最大化，理解卷烟价格与税收结构有何种关联十分重要。

[i]出厂价指的是工厂生产的成本费，不包括任何其他费用（如运费或之后销售过程中征收的税额）。

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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，从价消费税往往会使卷烟价格更低且更可能鼓励消费廉价卷烟[2]。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。这是因为生产商可以通过提高价格来增加收益（从价消费税则不同）。此外，从量消费税会减小廉价品牌和高价品牌的价格差距进而减少消费者购买廉价卷烟的意愿。通过对21个欧盟国家卷烟价格的调查，Chaloupka等[7]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，该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，因此该研究结论不能推广于直接比较完全从价税、完全从量税和混合税收结构，或比较分级税收结构与统一税收结构。而且，该研究的价格差异是基于《经济学家》信息部所收集的某个国际畅销品牌和某个本地畅销品牌的价格而分析得出的，因此不能反映市场上所有卷烟价格的整体分布情况。

除上述原因外，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，与从价消费税相比，从量消费税可能会减少价格变动并且提升价格。上述假设亦已通过完全从量税收结构的高收入国家的数据证明。Nargis等人[8]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。Sobel和Garrett[9]也发现，美国从量税增加可减少较低价类品牌的市场份额。

同样，与基于品牌特征的分级税率相比，征收统一税率的税收结构可能会减少品牌转换，以及减少制造商通过改变价格策略逃避纳税责任的意愿[2]。总而言之，相对更依赖复杂的税收结构而不是统一从量税收结构很有可能与廉价品牌较高价品牌的相对价格比降低及价格分布变宽有关，而后者容易造成更多的避税行为和品牌转换[10-14]。此外，一些近期研究使用中低收入国家全球成人烟草调查（GATS）的数据去描述卷烟价格分布图，结果显示卷烟价格在这些国家中分布较广，表明中低收入国家复杂的税收结构可能是导致价格差异变大的一个因素[15,16]。

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，不同行政辖区（如州、省和印第安人保留地）所征收的烟草税是不同的。因此，跨国或者跨地区购买也成为一种避税方式。例如，美国和加拿大免除了印第安人保留地的一些烟草消费税[1]。在近期文章中，Merriman通过收集芝加哥市周围被丢弃的烟盒数量评估避税/逃税程度，结果发现有3/4的烟盒没有芝加哥印花税票。Guindon等人[18]分析了ITC项目中15个国家的数据，发现在加拿大、英国和马来西亚，超过10%的吸烟者承认有过避税或逃税的行为。

逃税行为（如大规模走私）同样也会造成廉价卷烟的市场份额增加。尽管尚没有充分的证据证明大规模走私会降低平均零售价格，但一些研究者认为非法交易会造成低收入国家的负担，因为这些国家中非法交易的卷烟数量已占到了市场总份额的16.8%，而在高收入国家中这一比例仅为9.8%[19]。本文所讨论的卷烟价格是基于调查数据所得到的价格，反映的是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分布的各自影响，我们仍假设税收结构在不同国家间的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只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，会降低税收作为控烟政策的有效性。这表现为随着税收增加，吸烟者转换到廉价品牌的几率增加。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，从这个角度来说统一税收结构会增加税收作为控烟政策的有效性[1]。通过分析调查数据的价格分布，可以为“不同税收结构下价格分布和价格差不同”这一问题提供经验证据。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于控烟的有效性。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[ii]。ITC项目是对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个国家开展，涵盖了全世界超过50%的总人口、60%的卷烟使用者和70%的烟草使用者。其一个重要目的是研究世界卫生组织《烟草控制框架公约》所推荐的控烟政策的有效性[20]。在本文的分析报告中，我们选择了那些能从吸烟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[iii]。为了比较不同国家间的卷烟价格及其分布情况，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其转换为用2010年的国际货币常量来表示的价格。上述调整中的数据是从国际货币基金组织世界经济展望数据库中获得的各国购买力平价转换因数和居民消费价格指数。并且，为了反映不同价格水平下卷烟的市场份额，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的价格分布，特别是当我们希望比较不同税收结构下的价格分布情况时[21]。这些比较阐明了税收结构和价格分布间的关系，以及不同体制下避税行为的发生几率。正如上面所讨论的，税收结构可以通过从量税、从价税或两者的混合税来区分。另外，税收也可通过统一征收或分级征收来区分。经济学推论显示，分级税收结构或更依赖于从价税的税收结构，这为避税行为和品牌转换提供更多的机会。参与ITC项目的国家，多数依靠统一税，仅有巴西、韩国、中国和孟加拉国采用分级税。大多数非欧盟组织的高收入国家（包括美国

[ii]来源于2011年美国、加拿大、澳大利亚、荷兰、德国、乌拉圭、毛里求斯和墨西哥的调查；2010年韩国、英国和孟加拉国的调查；2009年巴西、马来西亚、泰国和中国的调查；2008年法国的调查。

[iii]卷烟价格来自每条价格、每包价格、每支价格以及每条或每包中卷烟的数量。

、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[iv]以及每包20支装卷烟的从量税和从价税的数量[v]。大部分税务信息来源于Bloomberg Global Initiative to Reduce Tobacco Use[vi]、Euro-monitor International's country specific reports[vii]、WHO无烟行动倡议关于全球烟草流行的周期性报告[viii]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；美国的税务信息从Orzechowski和Walker关于烟草税收负担一文获得，包括联邦消费税和各州消费税[22]；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[2]。

本文的分析结果如下：表1中，我们根据税收结构、从量税占总消费税的百分比以及总消费税的数额对国家进行排序，并提供不同国家价格分布情况的综合统计量。我们特别报告了价格的均值、中值、标准差和偏度系数，用以说明在不同税收结构下有多少价格被低估。我们同时报告了第一个四分位数、第三个四分位数和IQR（衡量第一个四分位数和第三个四分位数之差）。另外，我们计算了IQR与中值的比值，该比值可显示价格围绕中位价格的分布情况。其他重要的统计变量，如最低价格、最高价格、价格区间以及价格区间与均值的比值，也可见于表1。同样，在图1中，我们采用箱线图直观表现表1中的统计量，并在同一图表中提供了价格的分布情况和变化情况，以展示不同国家的价格分布情况。表2中我们展示的是，不同税收结构下，价格偏倚方向不同的国家及存在严重价格偏倚的国家（偏度系数大于1或小于-1）。最后，在表3中，我们选择收入水平和总消费税税额相近但税收结构不同的国家进行配对，并通过双样本检验比较他们的均值和方差。

# 结果

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9.4-67.3%）。尽管中国施行从量税，其税额较小而且税收结构很大程度上依赖于分级从价税。一般而言，在征收总消费税税额相近的国家，税收结构越简单，其卷烟的平均价格往往更高。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，但毛里求斯（统一从量税收结构）的平均价格比墨西哥（混合税收结构）高1.29美元。在欧盟国家中，荷兰和法国的总消费税分别为3.37美元和3.80美元，但荷兰（从量税比重较大）的平均价格比法国（从价税比重较大）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，表明价格相对较对称。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，墨西哥的价格多数较低而马来西亚的价格多数较高。

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，以及主要征收从价税的中国，IQR与中值的比值可高达0.51-0.89，表明了价格在中值附近波动的程度较大。另一方面，除乌拉圭和跨区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其价格在中值附近波动的程度往往较小，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，如果我们比较价格区间与均值有多大区别，会发现孟加拉国、中国和巴西等分级征税的国家，其价格区间的大小约为均值的6-9倍，而其他国家该比值在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；较低的平均价格正好相反。这些数据显示，在这7个实行单纯从量税收结构的国家中，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实行从量税收结构的国家中非常接近。表格下半部分所报告的偏度系数显示，采用分级税收或从价税收（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，其价格严重偏向较小值。该研究体制显示，分级税收和从价税收可使卷烟价格偏向较小值，因此意味着当税额增加时，通过购买低价卷烟来避税的机会越多。此外，美国的价格严重偏向较小值，这可能反映了跨州/跨区交易的避税行为。

[iv]整篇文章中，总消费税均不包括增值税（VATs）。《中国统计年鉴》报告了中国的从价税率，后者是通过加权平均卷烟零售价格、平均增值税和从价税率估算所得。泰国、马来西亚、墨西哥和孟加拉国的从价税是根据从价税、增值税和平均卷烟价格估算出来的。欧盟国家的从价税是依据从价税与从量税的比值和从量税额估算所得。

[v]在此处，税收指的是每包20支卷烟的税额。

[vi] http://www.tobaccofreeunion.org/content/en/217/
[vii] http://www.euromonitor.com/
[viii] http://www.who.int/tobacco/

**表1 国际烟草控制政策评估项目中不同税收结构的国家卷烟价格分布描述性统计**

| 税收结构* | 从量税 | | | | | | | 混合税 | | | | | | | 从价税 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 税收结构† | 统一 | | | | | 分级 | | 统一 | | | | | | 分级 | 统一 | 分级 |
| 国家 | AU | CA | MU | US | UY | KR | BR | NL | MY | UK | DE | MX | FR | RC | TH | BD |
| 均数 | 6.52 | 5.41 | 5.65 | 4.49 | 2.75 | 3.10 | 2.24 | 5.62 | 4.79 | 7.49 | 5.29 | 4.36 | 5.13 | 1.98 | 3.02 | 1.42 |
| 中位数 | 6.44 | 5.69 | 5.54 | 4.37 | 3.18 | 3.13 | 1.98 | 5.73 | 5.17 | 7.75 | 5.58 | 4.33 | 5.37 | 1.51 | 2.78 | 1.41 |
| 标准差 | 1.00 | 1.78 | 0.89 | 1.62 | 1.06 | 0.78 | 1.40 | 0.94 | 1.34 | 2.00 | 1.20 | 1.24 | 1.17 | 1.55 | 0.92 | 0.86 |
| 偏度系数 | -0.44 | -0.42 | 0.75 | 1.37 | -0.31 | 8.24 | 5.21 | -0.07 | -0.96 | -0.29 | -1.17 | 1.51 | -0.82 | 3.61 | 0.19 | 2.01 |
| 第一四分位数 | 5.85 | 4.42 | 4.99 | 3.55 | 1.85 | 3.13 | 1.65 | 5.20 | 4.34 | 6.93 | 4.90 | 3.65 | 5.15 | 1.13 | 2.28 | 0.70 |
| 第三四分位数 | 7.18 | 6.56 | 5.54 | 5.24 | 3.70 | 3.13 | 2.44 | 5.97 | 5.50 | 8.73 | 6.08 | 4.33 | 5.82 | 2.47 | 3.70 | 1.93 |
| IQR=第三四分位数-第一四分位数 | 1.33 | 2.13 | 0.55 | 1.70 | 1.85 | 0 | 0.79 | 0.77 | 1.16 | 1.81 | 1.18 | 0.68 | 0.67 | 1.35 | 1.42 | 1.23 |
| IQR/均值 | 0.21 | 0.37 | 0.10 | 0.39 | 0.58 | 0 | 0.40 | 0.13 | 0.22 | 0.23 | 0.22 | 0.16 | 0.12 | 0.89 | 0.51 | 0.87 |
| 最小值 | 0.68 | 0.40 | 1.11 | 0.50 | 0.34 | 1.50 | 0.66 | 1.05 | 0.52 | 0.37 | 0.12 | 0.91 | 0.67 | 0.03 | 0.19 | 0.04 |
| 最大值 | 12.4 | 13.3 | 11.1 | 19.4 | 5.29 | 12.5 | 13.2 | 12.6 | 11.5 | 19.6 | 7.75 | 11.4 | 12.6 | 17.6 | 6.17 | 10.5 |
| 全距 | 11.7 | 12.9 | 9.97 | 18.9 | 4.95 | 11.0 | 12.6 | 11.6 | 11.0 | 19.3 | 7.63 | 10.5 | 11.9 | 17.6 | 5.98 | 10.5 |
| 全距/均数 | 1.79 | 2.38 | 1.76 | 4.21 | 1.80 | 3.55 | 5.63 | 2.06 | 2.30 | 2.58 | 1.44 | 2.41 | 2.32 | 8.87 | 1.98 | 7.39 |
| 从量税 | 4.27 | 3.67 | 2.45 | 2.41 | 2.00 | 1.65 | 0.52 | 2.27 | 1.15 | 3.11 | 1.95 | 0.80 | 0.36 | 0.02 | 0 | 0 |
| 从价税 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.10 | 0.70 | 1.97 | 1.44 | 1.49 | 3.44 | 0.54 | 1.98 | 0.45 |
| 混合税 | 4.27 | 3.67 | 2.45 | 2.41 | 2.00 | 1.65 | 0.52 | 3.37 | 2.25 | 5.08 | 3.39 | 2.29 | 3.80 | 0.56 | 1.98 | 0.45 |
| 从量税占总税的比重 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 67.3 | 62.1 | 61.2 | 57.5 | 34.9 | 9.42 | 2.94 | 0 | 0 |

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。

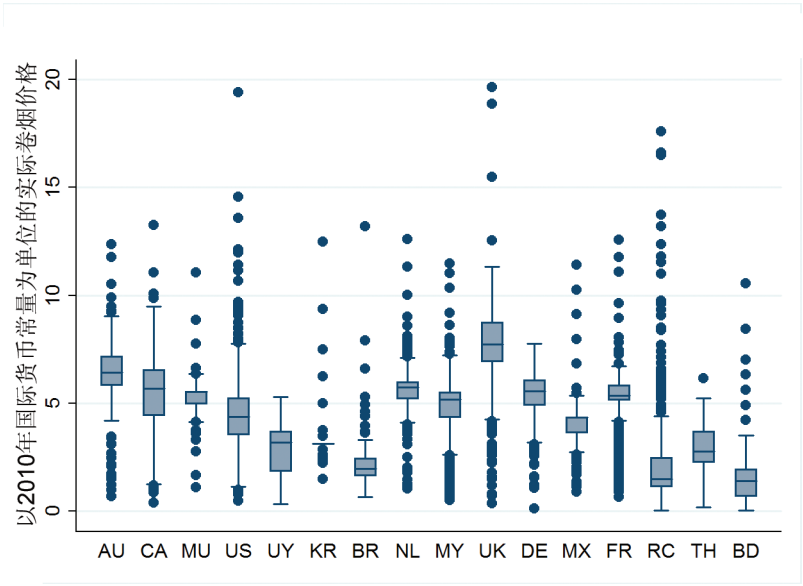


图1
不同国家间卷烟价格分布的箱线图。AU（澳大利亚）、CA（加拿大）、MU（毛里求斯）、US（美国）、UY（乌拉圭）、KR（韩国）、BR（巴西）、NL（荷兰）、MY（马来西亚）、UK（英国）、DE（德国）、MX（墨西哥）、FR（法国）、RC（中国）、TH（泰国）和BD（孟加拉国）。

**表2 不同国家根据税收结构、均值和中位数的比较、偏度系数分组**

| | 均数>中位数 | 均数<中位数 |
|---|---|---|
| 从量税 (N=7) | 美国, 毛里求斯, 澳大利亚, 巴西 | 乌拉圭, 加拿大, 韩国 |
| 混合税 (N=7) | 墨西哥, 中国 | 荷兰, 马来西亚, 英国, 德国, 法国 |
| 从价税 (N=2) | 孟加拉国, 泰国 | |
| 统一税 (N=12) | 美国, 毛里求斯, 澳大利亚, 墨西哥, 泰国 | 乌拉圭, 荷兰, 马来西亚, 英国, 德国, 法国 |
| 分级税 (N=4) | 巴西, 中国, 孟加拉国 | 韩国 |
| | 偏度系数>1 | 偏度系数<-1 |
| 从量税 (N=7) | 美国, 韩国, 巴西 | -- |
| 混合税 (N=7) | 中国, 墨西哥 | 德国 |
| 从价税 (N=2) | 孟加拉国 | -- |
| 统一税 (N=12) | 美国, 墨西哥 | 德国 |
| 分级税 (N=4) | 韩国, 巴西, 中国, 孟加拉国 | -- |

税收结构首先划分为三种：从量税、从价税及两者的混合税。之后再划分为两种：统一税和分级税。

**表3 不同税收结构下部分国家的卷烟价格比较检验**

| 中低收入国家（LMICs） | 从量统一VS从量分级 | | 从量统一VS混合统一 | | 混合统一VS从价统一 | | 混合从量VS混合从价，统一 | |
|---|---|---|---|---|---|---|---|---|
| 国家 | 乌拉圭 | 巴西 | 毛里求斯 | 墨西哥 | 马来西亚 | 泰国 | 马来西亚 | 墨西哥 |
| 均值 | 2.748 | 2.512 | 5.898 | 4.795 | 4.894 | 3.142 | 4.894 | 4.795 |
| 标准差 | (1.058) | (1.130) | (1.081) | (1.551) | (1.355) | (0.917) | (1.355) | (1.551) |
| 样本量 | 1014 | 212 | 530 | 1739 | 1712 | 937 | 1712 | 1739 |
| 方差（SD）比较检验 | H0: SD(UY)/SD(BR) >1<br>F= 0.56; P=0.00<br>DF=1013,211<br>拒绝H0 | | H0: SD(MU)/SD(MX)>1<br>F=0.49; P=0.00<br>DF=529,1738<br>拒绝H0 | | H0: SD(MY)/SD(TH) >1<br>F= 2.18; P=1.00<br>DF=1711,936<br>不拒绝H0 | | H0: SD(MY)/SD(MX) >1<br>F= 0.76; P=0.00<br>DF=1711,1738<br>拒绝H0 | |
| 均值（Mean）比较检验 | H0: Mean (UY)-(BR)<0<br>T=2.30; P=0.01<br>DF=263<br>拒绝H0 | | H0: Mean(MU)-(MX)<0<br>T=18.4; P=0.00<br>DF=1252<br>拒绝H0 | | H0: Mean(MY)-(TH)<0<br>T=39.5; P=0.00<br>DF=2531<br>拒绝H0 | | H0: Mean (MY)-(MX)<0<br>T=2.0; P=0.02<br>DF=3401<br>拒绝H0 | |
| **高收入国家（HICs）** | **从量统一VS混合统一** | | **从量统一VS混合统一** | | **混合从量VS混合从价，统一** | | **混合从量VS混合从价，统一** | |
| 国家 | 澳大利亚 | 英国 | 澳大利亚 | 法国 | 荷兰 | 法国 | 荷兰 | 德国 |
| 均值 | 6.611 | 7.634 | 6.611 | 5.133 | 5.613 | 5.133 | 5.613 | 5.336 |
| 标准差 | (1.179) | (1.966) | (1.179) | (1.212) | (0.849) | (1.212) | (0.849) | (1.195) |
| 样本量 | 869 | 592 | 869 | 1322 | 968 | 1322 | 968 | 383 |
| 方差（SD）比较检验 | H0: SD(AU)/SD(UK) >1<br>F= 0.36; P=0.00<br>DF=868,591<br>拒绝H0 | | H0: SD(AU)/SD(FR) >1<br>F= 0.95;P=0.19<br>DF=868, 1321<br>不拒绝H0 | | H0: SD(NL)/SD(FR) >1<br>F=0.40;P=0.00<br>DF=967,1321<br>拒绝H0 | | H0: SD(NL)/SD(DE) >1<br>F=0.51;P=0.00<br>DF=967,382<br>拒绝H0 | |
| 均值（Mean）比较检验 | H0: Mean (AU)-(UK)<0<br>T=-11.3; P=1.00<br>DF=880<br>不拒绝H0 | | H0: Mean(AU)-(FR)<0<br>T=28.2; P=0.00<br>DF=2189<br>拒绝H0 | | H0: Mean(NL)-(FR)<0<br>T=11.1; P=0.00<br>DF=2284<br>拒绝H0 | | H0: Mean(NL)-(DE)<0<br>T=4.14; P=0.00<br>DF=541<br>拒绝H0 | |

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。混合从量表示该国家从量消费税份额比其配对国家更高。混合从价表示该国家从价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。入选国家的配对方式如下：对于中低收入国家（LMICs），乌拉圭（从量统一）和巴西（从量分级）配对，比较统一税收结构和分级税收结构；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收结构；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3所示。

除一组配对国家（澳大利亚VS英国）的均值比较检验结果未拒绝零假设外，其余配对国家均拒绝零假设。多个比较结果拒绝该假设表明，税收结构简单的国家其平均价格往往高于那些总消费税额相似但税收结构复杂的国家。类似于以上方法，我们根据发展状况（HICs vs LMICs）来分组，在每组国家中还进行了双样本价格标准差（SD）比较检验，得到相似结果：国家税收结构越复杂，其卷烟价格的波动性越大。例如，实行从量分级税收结构的巴西其标准差高于实行从量统一税收结构的乌拉圭。特别是统一税收结构间比较，实行混合体制的墨西哥其标准差高于实行单纯从量税收结构的毛里求斯，并且比较结果同样适用于澳大利亚与英国间的标准差比较。尽管澳大利亚与法国间标准差比较结果提示两国的标准差相同，但澳大利亚的平均价格高于法国。实行混合体制的马来西亚其价格标准差高于实行单纯从价体制的泰国，表明如果在中低收入国家的价格波动性上进行比较，混合体制可能并不优于单纯从价体制。实行混合体制且从价税所占比例很高的法国其价格标准差高于从量税所占比例较高的荷兰。同样结果发生在荷兰与德国、马来西亚与墨西哥间的比较。总之，税收结构越复杂，价格波动性越大，因此通过品牌转换而避税的可能性也越大。

## 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，获取各国调查来源的卷烟价格。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。

此分析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。此外，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，难以严格区分分级税收结构与从价税收结构对价格分布的扭曲程度。最后，我们没有明确控制避税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众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。

本次调查表明，与统一从量税收结构相比，其他统一税收结构（从价统一税收结构和混合统一税收结构）价格分布的波动性往往更大。与统一税收结构相比，分级税收结构价格分布的波动性也往往更大。严重依赖从价税收结构和分级税收结构的国家其中位价格周围的波动性通常更大。在混合税收结构中，严重依赖从价成分的国家其价格波动性往往比严重依赖从量成分的国家更大。总消费税额相似但税收结构不同的国家中，税收结构越简单，平均价格往往越高。分级税收结构的国家其卷烟价格比统一税收结构的国家更容易偏向低价。

本文分析结果表明，当税收结构偏离统一从量税收结构时，转换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无反应。根据我们的发现，单纯依赖从价税收结构的国家如果将税收结构变为完全从量税收结构，其税收增加将对烟草使用量产生更大的影响。同理，复杂税收结构的国家（如墨西哥、马来西亚和欧盟国家），增加从量税的份额或者转变为完全从量税收结构，将提高增税对于降低烟草使用的有效性。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、消费量和戒烟。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。

## 本文贡献

- ▶ 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、减少品牌转换和避税逃税行为、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性。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。
- ▶ 在混合税收结构中，总税额中依赖从价成分的国家其价格分布的波动性往往比依赖从量成分的国家更大。
- ▶ 在分级税收结构的国家中，相对于统一税收结构国家，其卷烟价格更偏向低价。

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**出处和同行审查** 未开展；外部同行已评审。

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