UNDERSTANDING AND MEASURING

CIGARETTE TAX AVOIDANCE AND EVASION

A METHODOLOGICAL GUIDE

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Executive Summary

THIS METHODOLOGICAL GUIDE

updates and expands the 13-year-old World Bank Toolkit on how to estimate the scope of tobacco smuggling. It draws on the results of numerous empirical studies that tested the applicability of five methods described in the Toolkit while critically evaluating new methods that emerged in response to the evolving nature of illicit tobacco trade, the policy debates surrounding the issue, and the development of new technologies.

This guide covers not only smuggling of tobacco products, but also tax evasion related to illicit tobacco trade and legal tax avoidance, since the methods to estimates these phenomena are often intertwined. It also provides guidance on how to assess the quality of existing estimates, including those offered by the tobacco industry. Unlike the World Bank Toolkit, this guide does not cover the topic of how to reduce tax avoidance and tax evasion and instead refers the reader to the WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products.

THE DEFINITIONS SECTION

begins by defining key variables. It explains the difference between "smuggling", "illicit trade", "tax evasion" and "tax avoidance", and describes behaviors that constitute either tax evasion or tax avoidance. Tobacco products that avoid/evade all or a portion of the required taxes are defined as "low-tax" products, while the rest of tobacco products fall into the category of "full-tax" products.

1 THE FIRST CHAPTER

lays the theoretical foundation for the methods and describes the impact of tax avoidance and tax evasion on the supply of and demand for tobacco products, on tax revenue, on the price elasticity of demand, and on the affordability of tobacco products. We provide insight into the economic, social, and political determinants of tax avoidance and tax evasion, including factors such as price/tax differences, the tax structure, the costs of obtaining low-tax products, the costs of overcoming legal and regulatory obstacles, informal distribution networks, and the level of corruption. This chapter demonstrates how tax avoidance and tax evasion impact average cigarette prices, the price elasticity of tobacco demand, brand proliferation, and other tobacco control policies.

This chapter concludes that tax avoidance/evasion may reduce, but do not eliminate, the effectiveness of tobacco tax increases in reducing tobacco use and raising revenues. The motivation for a government to address tax avoidance/evasion is directly linked to the size of the revenue loss while the effectiveness of the interventions depends on the level of enforcement. The level of enforcement is directly linked to the level of investment to combat tax evasion/avoidance.

2 THE SECOND CHAPTER

is central to the Guide and describes 11 methods of measuring the scope of tax avoidance and tax evasion: surveys of tobacco users, examination of cigarette packs obtained from smokers, examination of discarded cigarette packs, examination of cigarette packs obtained from retail, comparison of sales with consumption (gap analysis), econometric modeling, comparison of tax paid sales with estimated consumption, comparison of actual and projected tobacco tax revenue, key informant interviews, monitoring tobacco trade, and analyzing seizures of illegally transported tobacco.

The chapter begins with a brief overview of the main principles of conducting research, which are applicable to all methods. It then provides a step-by-step description of the specifics of each the method, starting with those most frequently discussed in the literature, followed by approaches that are unique to certain market conditions and approaches suffering from multiple weaknesses. Each method has a background section that links it to theory, a list of pros and cons, and a recommendation when a particular method should be used. The application of each method is demonstrated by examples.

The chapter concludes that there is not a single method that will produce a definitive estimate, because all of them have advantages and disadvantages. Since the weakness of a particular approach can be exacerbated by specific market conditions, it is important to use local specific knowledge and creativity when applying these methods. Given the complexity of tobacco tax avoidance and evasion and the methods' limitations, it is important to triangulate the estimates of the scope of the problem using different methods. Many studies apply the same method over time in order to capture changes in the scope of tax avoidance/evasion rather than generating a single point estimate

of its scope. Such an approach addresses some methodological weaknesses of the methods and is useful for evaluating the impact of policies and other factors with a possible impact on tax avoidance/evasion.

3 THE THIRD CHAPTER

guides the reader through a series of studies and analyses the quality and reliability of their estimates while taking into account the agendas of those who fund and/or conduct research on tobacco tax avoidance/evasion. It outlines a set of criteria and then applies them to evaluate eight studies.

It concludes that studies supported by the tobacco industry cannot be trusted due to lack of transparency and the use of potentially contaminated data. The industry estimates are consistently and substantially higher compared to those produced by independent researchers.

IN CONCLUSION

this Methodological Guide recommends using multiple methods that suffer from the minimum weaknesses, executing them according to the principles of rigorous research, and triangulating the results in order to cross-validate the estimates and minimize the methodological limitations of individual methods. Such an approach will result in methodologically sound and objective quantitative estimates of tobacco tax avoidance and tax evasion.

Introduction

The purpose of this document is to update the World Bank Toolkit #7 "Understand, Measure, and Combat Tobacco Smuggling"[1] published more than 13 years ago.

Toolkit #7 was a part of a series of methodological guides for conducting tobacco control research. It described five methods on how to measure the scope of illicit trade in tobacco and provided guidance on how to address the issue, including various policy options. Toolkit # 7 influenced not only the research community, but also NGOs and policy makers. Its methods have been applied and tested in numerous empirical studies and the lessons learned from those efforts informed this Methodological Guide.

The tobacco industry has also learned from the Toolkit #7. They learned how their illicit activities can be detected, what to do in order to disguise them, and how to use (and misuse) the methods to provide alternative estimates of illicit trade. This helped the industry to position itself as a stakeholder in the debate about combating illicit trade while offering solutions that are in most cases damaging to public health.

The methods described in Toolkit #7 have been applied and tested in many empirical studies.[2] Lessons learned from those studies led to the refinement and improvement of the methods, and pointed to new ways to study tax avoidance and tax evasion that take into account the evolving nature of illicit tobacco trade, the policy debates surrounding the issue, and the development of new technologies.

This Methodological Guide captures this newly gained knowledge. Application of the methods described in the Guide will result in methodologically sound and objective quantitative estimates of tobacco tax avoidance and tax evasion. The Guide also provides assistance with assessing the quality of existing estimates which are useful for educating policymakers and the general public while countering results generated to manipulate the public opinion.
We hope that the methods described in this Guide will motivate the research community to use them, build upon them, and test new ones in order to advance our understanding of the scope of tax avoidance and tax evasion.

Unlike World Bank Toolkit #7, this Guide does not provide guidance on how to reduce tax avoidance and tax evasion. IARC Handbooks, Volume 14[2] and the WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products[3] provide a comprehensive overview of that topic.

The Guide begins by defining the key variables of interest and explains how they fit into the commonly-used terminology relevant for tax avoidance and tax evasion. Chapter 1 provides the theoretical foundation for the Guide and describes the impact of tax avoidance and tax evasion on the supply of and demand for tobacco products. Chapter 2 provides an overview of the methods of measuring the scope of tax avoidance and tax evasion, and Chapter 3 discusses how to assess the quality of various estimates. The last section summarizes the main points and provides some concluding remarks.

Definitions

The tobacco control community, policy makers, and the general public are mostly familiar with expressions "smuggling" or "illicit trade" when the issue of not paying all tobacco taxes is being discussed. However, the complexity of the phenomenon calls for use of more precise terminology. Being familiar with and using the proper terms when debating this issue will help to advance the discourse and to determine the correct approaches to measuring the scope of the problem.

The *Merriam-Webster Dictionary* defines **SMUGGLING** as importing or exporting secretly, contrary to the law, and especially without paying duties imposed by law.

The term **ILLICIT TOBACCO** trade is defined by Article 1 of the WHO Framework Convention on Tobacco Control[4] as a practice or a conduct prohibited by law which relates to production, shipment, receipt, possession, distribution, sale or purchase of tobacco products, including any practice or conduct intended to facilitate such activity. Therefore, the term "illicit tobacco trade" covers all illegal activities related to the tobacco trade, not just the circumvention of tobacco taxes.

ILLICIT TRADE can occur anywhere along the tobacco supply chain, from manufacturing, through distribution, to the retail stage. Diversion from legal to illegal trade typically occurs before the point where taxes are assessed, particularly when diversion is motivated by tax evasion.

CIRCUMVENTION OF TAXES is classified as either tax avoidance (legal methods of circumventing tobacco taxes) or tax evasion (illegal methods for circumventing tobacco taxes).

TAX AVOIDANCE includes legal activities and purchases in accordance with customs and tax regulations, most of which include the payment of some tobacco taxes, and are done mostly by individual tobacco users (e.g., cross-border shopping, duty-free shopping, Internet and mail/phone purchases), but tobacco companies also engage in it (e.g., changing some product features or its production process in order to reduce tax liability).

CROSS-BORDER SHOPPING refers to individuals purchasing tobacco products which are not intended for resale in a lower price (or lower tax) jurisdiction (country, district, Native American reservation, etc.). If these purchases are within the limits imposed by the customs regulations, tax may have been legally avoided. The purchases in excess of the limits constitutes illegal tax evasion.

DUTY-FREE SHOPPING involves the purchase of limited amount of tax-free tobacco products in duty free shops (e.g., at airports, on-board planes and boats, etc.).

INTERNET AND MAIL/PHONE PURCHASES may result in either tax avoidance or tax evasion depending on the law applicable in the product's destination. If tax on a product is not paid in its destination, but the purchase is not forbidden by the law, the tax has been avoided. If the buyer or sellers are legally obligated to pay taxes on such purchases, this transaction is qualifies as tax evasion. Unlike the sellers, the buyers often do not realize that they are committing an illegal act.

TOBACCO INDUSTRY REFORMULATION, REPOSITIONING, FORESTALLING takes advantage of the country's tax system in order to reduce its tax payments. In a country with a multi-tiered tax structure, a company can change some features of its products in order to reclassify them to a lower tax tier. For example, the industry can reduce the size of cigarettes (in a specific tax regime with different tax rates based on product length or weight; reformulation) or their prices (in an *ad valorem* tax regime when tax rates vary with price; repositioning) and pay less taxes. Where allowed by law, the industry can pre-purchase tax stamps before a tax increase and use them after the new tax rate is in place to reduce their tax liability (forestalling).

TAX EVASION consists of illegal activities intended to avoid paying some or all taxes. It includes smuggling cigarettes across borders, selling genuine cigarettes that were manufactured illegally, selling counterfeit[i] or illicit white cigarettes[ii], or selling or buying cigarettes via Internet, phone or mail without paying the appropriate taxes.

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[i] Counterfeit cigarettes are cigarettes manufactured without authorization of the rightful owners of the trademarked brand, with intent to deceive consumers and to avoid paying duty

[ii] Illicit white cigarettes are brands manufactured legally, but distributed to large extend via illegal supply channels for the purpose to evade taxes.

SMUGGLING OF CIGARETTES involves both small and large scale operations. Small scale smuggling occurs when the quantity of cigarettes moved across the border is in excess of the allowable limits (but is still relatively small) and/or when products purchased in another jurisdiction are intended for resale without paying appropriate taxes in the destination jurisdiction (although some taxes are usually paid in the country of origin). This activity is also called bootlegging. Large scale smuggling involves large quantity of products and generally results in avoiding all taxes. It involves disguising or hiding products and moving them by means of often expensive operations orchestrated by criminal networks. It may take advantage of "in-transit"[iii] regimes and tax-free zones, and often transports counterfeit cigarettes, or genuine cigarettes with counterfeit tax stamps, or illicit white cigarettes. It is associated with various kinds of fraud, including intentional mislabeling of cigarettes as other products to evade tariffs, falsification of the true country of origin of a shipment in order to gain preferential tariffs, and overt evasion of Customs duties and taxes.[5]

ILLICIT MANUFACTURING means the production of tobacco products without complying with applicable laws such as licensing, tax law, and other government regulations that govern the manufacture of tobacco. This also includes underreporting of actual production quantities by licensed manufacturers with the difference between reported and actual production being diverted through illegal channels. Counterfeit tax stamps are often applied to illegally manufactured products. The destination of the illegally manufactured cigarettes can be the domestic or a foreign market.

COUNTERFEITING is a form of illicit manufacturing that involves using a trademark without the approval of the trademark owner. Counterfeit cigarettes often bear counterfeit tax stamps and are distributed through criminal networks.

ILLICIT WHITES (also called "cheap whites") are cigarettes manufactured by legitimate business enterprises, but a large share of the production is sold illegally, usually outside the jurisdiction where they are produced.

Selling or buying cigarettes via Internet, telephone, or mail-order usually involves vendors based in low-tax states or in tax-exempt locations and the buyer based in jurisdictions where prices are higher compared to those offered via these channels. These sales constitute tax evasion if the seller and/or the buyer is legally obligated to pay taxes on such purchases in accordance with the law applicable to the destination jurisdiction.

While manufactured cigarettes comprise the majority of tobacco goods channelled via illicit trade, tobacco leaf and other tobacco products (and possibly e-cigarettes) may also be the subject to tax avoidance and tax evasion.

In this report, low-tax products are products that escape paying some or all of the taxes on them, either via tax avoidance or via tax evasion. They are the result of either tax avoidance or tax evasion, and can be either legal (if tax is avoided) or illegal (if tax is evaded). Full-tax products are products that pay all taxes as intended by the tax law/regulations. These are legal products.

[iii] In-transit regime applies to goods that cross the territory of another country on their journey between the departure and the final destination country

Theory of Tax Avoidance and Tax Evasion and Its Impact

1.1 Overview

Tax avoidance and tax evasion have been studied by scholars from many disciplines. Economists, political scientists, criminologists, and other social scientists have examined them from a wide range of perspectives with the main focus on measuring the scope of tax avoidance and tax evasion, analyzing the motivation for engaging in them, developing measures to curb them, and studying how these behaviors affect and are affected by the political process.

A theoretical framework can provide insight into the economic, social, and political determinants of tax avoidance and tax evasion, including the role played by price/tax differences, the tax structure, the costs of obtaining low-tax products, the costs of overcoming legal and regulatory obstacles, the role of informal distribution networks and the grey economy, the level of corruption, and the involvement of global and new firms. Theory is also the point of departure for measuring the scope of tax avoidance and tax evasion and their impact on the overall supply of and demand for tobacco products, on tax revenue, on the price elasticity of demand, and on the affordability of tobacco products. Some studies have offered possible solutions to the problem by analyzing various aspects of the illicit cigarette supply and governance strength, including the role of tax administration, the level of law enforcement, anticorruption efforts, the certainty, swiftness and severity of punishment if convicted, the advantages and disadvantages of using administrative rather than criminal sanctions, and the level of coordination and collaboration among different authorities within the government.

The scientific community also analyzes the degree to which tax avoidance/evasion influences and is influenced by political processes, public policy formulation, and international negotiations. The vested interests of various stakeholders such as the tobacco industry, governments, and the tobacco control community, can interfere with the line of inquiry into tax avoidance/evasion including the study design, the choice of methods, the objectivity of the research results and their presentation.

This section will describe the theoretical models underlying empirical studies measuring the scope and impact of tax avoidance and tax evasion. It will not discuss the link between the theory and measures designed to curb tax avoidance/evasion. IARC Handbooks, Volume 14[2] and the WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products[3] provide a comprehensive overview of that topic.

1.2 Theory of Tax Avoidance and Tax Evasion

According to economic theory, customers (i.e., current or potential tobacco users) allocate their income among full-tax (i.e., legal) tobacco products, low-tax tobacco products (i.e., products that avoided/evaded some or all tax; can be both legal and illegal), and other goods and services. Consumers choose how much of their income to allocate to each category on the basis of relative monetary prices, perceived quality, ease and costs of purchase, expected legal costs associated with purchasing illegal products, social norms, and other relevant variables. Tobacco users treat low-tax cigarettes as (potentially imperfect) substitutes for full-tax tobacco products and consider their full price when determining quantity demanded. The full price consists of the amount of money the buyer pays to the seller in exchange for the product (i.e., monetary price), the costs of convenience of obtaining the product (e.g., time needed to get the product, travel distance, purchasing experience), and the risk associated with the transaction and consumption of the product. The non-monetary component of the full price represents transaction costs. For example, the point of sale can be a well-kept store near the place of residence (lower transaction costs) or a dark alley in an unsafe part of town (higher transaction costs). Those who purchase illegal cigarettes may face legal sanctions and uncertainty about the quality of the product, (e.g., they might not be able to distinguish between genuine and counterfeit products).

Given the higher transaction costs of illicit cigarettes, their monetary (i.e., sale) price must be lower compared to legal cigarettes, unless the perceived quality of illicit cigarettes is higher or a particular brand is not supplied via legal channels. The degree of substitution between legal and illegal products also depends on availability of a particular brand, individual taste and income.

The price differences between legal and illicit cigarettes can be observed in many markets. For example, individuals offering low-tax cigarettes in the United Kingdom in 1999 were selling them for £1.00 less compared to full-tax cigarettes sold in recognized outlets, yet 17% of adult smokers still preferred to buy their cigarettes in stores.[6] This indicates that their transaction costs were equal or higher than £1.00 assuming that they perceived low-tax and full-tax products as close substitutes. In 2013, a pack of Camel cigarettes smuggled to New York City from Virginia was bought for $8, while the fully-taxed Camel cigarettes cost around $12 per pack.[7] In some markets, however, the price of lower-taxed cigarettes can be higher. In Viet Nam, for example, the price of the smuggled brand 555, manufactured in the United Kingdom, was higher than the locally produced 555, because the smuggled cigarettes were perceived as being of higher quality.[8]

Potential suppliers of low-tax tobacco, motivated both by the expected profit margin and the expected total amount of profit, choose the quantity supplied (which can be zero) and price based on interaction of supply and demand. This interaction is affected by the cost of manufacturing and/or obtaining low-tax cigarettes, transportation and distribution costs, and costs associated with the illegal or semi-legal nature of the operations, competitive conditions, and other variables.

The theory holds that the greater the perceived consumer's net benefit and the greater the supplier's estimated profit, the greater the probability that an individual or a company will engage in tax avoidance and tax evasion. The size of the profit determines the way low-tax products are supplied to the market. Small-scale smuggling, or bootlegging that generally offers lower profit is negatively related to the distance to travel, the opportunity costs of time spent obtaining the products (i.e. foregone salaries), but positively related to the relative price differences between adjacent geographical areas.[9] Factors related to overcoming the legal and regulation obstacles play an important role in the decision to supply the market via large scale smuggling that has the potential to generate larger profit.[2,10] Large scale tax evasion is usually present in countries where corruption is high, the control of the authorities is lax, and commodities other than tobacco are also being smuggled.[11] Since corruption is usually more pervasive in low- and middle-income countries, these countries are at greater risk for large-scale smuggling activities.[12] These countries often have weaker governance and tax administration, which reduce the costs of supplying low-tax products. Large scale tax evasion is usually associated with criminal networks.[13]

1.3 Impact of Tax Avoidance and Tax Evasion

The impact of tax avoidance and tax evasion on the overall supply and demand for tobacco products is an important issue since it is related to the effectiveness of tobacco taxes both as a revenue generating mechanism and as a public health intervention. This impact can be classified as the impact on average cigarette prices, on brand proliferation, on tobacco industry investments, and on other tobacco control policies.

Even though cigarette markets are not fully competitive, and low-tax and full-tax cigarettes are not perfect substitutes[14], there can be some competition that could result in lower average cigarette prices and, therefore, in higher consumption.[15]

Evidence suggests that the consumption of tobacco products is higher than it would be in the absence of tax avoidance/evasion. Joossens and colleagues[12] estimated that in 2007 the global average cigarette price was about 3.75% lower due to illicit cigarette trade and predicted that this price difference was responsible for about 164,000 premature deaths a year. The impact of tax avoidance/evasion on cigarette demand varied by country and it depended not only on the degree of tax avoidance/evasion, but also on population characteristics, including the degree of responsiveness to cigarette prices. Another study found that the presence of tax avoidance/evasion in the UK lowered the average cigarette price by about 11.6%, increased cigarette consumption by 5.0–8.2%, and increased the tobacco death toll by 4,000–6,500 premature deaths a year.[16] The taxes/prices difference across US states and the possibility to purchase low-tax cigarettes on Native American reservations increased consumption by 4.0–8.2% and smoking prevalence by 2.0–4.3% in the period of 1992–2002, but the degree of impact varied with the distance from the residence to a border with a lower-price state.[17] This demonstrates that transaction costs impact the full price of low-tax cigarettes.

One highly debated issue is whether a tax/price increase will change the degree of tax avoidance/evasion. Theory suggests that a tax increase will lower the consumption of tobacco products even in the presence of tax avoidance/evasion since the prices of both full-tax and low-tax cigarettes increase. The reasons for the low-tax cigarette price increase are an upward shift in the demand for low-tax cigarette and upward sloping supply curve (due to higher marginal costs of supplying larger quantities of these products). In addition, the suppliers of low-tax products see an opportunity to gain extra profit while keeping the price gap between full-tax and low-tax

cigarettes constant. A tax increase may also prompt enhanced enforcement efforts in anticipation of higher levels of tax evasion, which raises the cost of supplying low-tax products, and their prices. On the other hand, the competition between legal and illegal products could result in a lower impact of a tax increase on the legal products' prices.[12]

In an effort to prevent tax increases, the tobacco industry asserts that higher taxes and prices will motivate customers to buy illegal products rather than smoking less or quitting. The industry claims that the higher demand for low-tax products will increase their supply as well as the level of crime, and that there will be no decline in tobacco use and tax revenue will be hurt.[18]

The overall impact of a tax increase in terms of tobacco use and tax revenue is a matter of empirical evidence since it depends on the price elasticity of tobacco demand, the cross-price elasticity for the full-tax and low-tax products, and their new full prices. Numerous studies have concluded that higher taxes lead to higher prices of cigarettes sold via legal channels.[2] The responsiveness of illegal cigarette prices to tax increases has been studied less, but there is some evidence that the prices of both legal and illegal cigarettes go up after a tax increase.[14,19] Research demonstrates that an increase in cigarette taxes can lead to more tax avoidance/evasion, but also to a decline in overall cigarette consumption and higher tobacco tax revenue, since the observed reduction in full-tax products after a tax increase is only partially offset by substitution towards low-tax cigarettes.[9,20,21]

In Sweden, for example, cigarette tax increased by 43% between December 1996 and August 1997, while the share of illegal cigarettes consumption rose from 2.3% to 5.8% of total consumption between 1996 and 1998. However, the overall demand for cigarettes also declined and the prevalence dropped by 19.1% and 4.4% among men and women, respectively. The largest decrease in cigarette demand was among youth and young adults (16–24 years old), whose prevalence fell by 25% and 17.4% among males and females, respectively. In addition, tobacco tax revenue rose by 9% in 1997 compared to 1996.[11,2]

Canada had a similar experience when both cigarette consumption and smoking prevalence dropped sharply after significant cigarette tax and price increases in the 1980s and early 1990s, despite an increase in the share of illicit cigarettes on the market. Per-capita cigarette consumption declined by 43% from 1979 to 1993, youth smoking prevalence (15–19 years old) fell by 47% from 1981 to 1991[23], and just between 1990 and 1993 the tobacco tax revenue grew by 13%.[24]

In France, on the other hand, a sizeable tax increase that doubled its cigarette prices from 1991 to 1996 did not increase tax avoidance/evasion, but lowered adult smoking prevalence, which decreased from 40% in 1991 to 34% in 1997[25], and youth smoking prevalence (12–18 years old), which went from 30% in 1991 to 25% in 1997.[2] Tobacco tax revenue rose by 78% during that period, while the share of illicit cigarettes on the market stayed low around 2%.[25] The relatively low degree of tax avoidance/evasion was attributed to a tightly controlled retail environment in which all tobacco retailers must be licensed.

Similarly, a significant 1999 cigarette tax increase in California that resulted in relatively large price differences with all its bordering states (including Mexico) motivated only 5% of all smokers to purchase tax-free cigarettes. The study demonstrated that a cigarette tax increase can achieve the public health objective of reducing smoking despite the presence of tax avoidance/evasion.[27]

A study of the impact of a 83% tax increase in New York City in 2008[21] found that the share of littered packs that had an appropriate tax stamp fell from 55% prior to the tax increase to 49% after the tax increase, but the overall cigarette consumption in the city also felt from about 22.1 million to between 20.5 and 19.8 million packs per month. The impact of the tax increase on taxable sales was small, which resulted in a substantial increase in tax revenue.

These examples demonstrate that tax avoidance/evasion may reduce, but do not eliminate, the effectiveness of tobacco tax increases in reducing tobacco use and raising revenues.[2]

On the other hand, lowering taxes for the purpose of reducing tax avoidance/evasion led to reductions in tax revenues and higher tobacco use.[15] When the Swedish government reduced the cigarette tax in 1998 in an effort to curb tax avoidance/evasion, the demand for cigarettes measured by legal tax paid sales went up, but tax revenue went down.[15] As in Sweden, the Canadian government responded to political pressure to reduce cigarette smuggling and in 1994 reduced cigarette taxes. This led to a 27% increase in per-capita consumption between 1993 and 1998, higher smoking prevalence among both youth and adults, and tax revenue losses.[23]

Given the importance of the price elasticity of tobacco demand when assessing the impact of a proposed tax increase, researchers examined consumers' price responsiveness when faced with an opportunity to buy low-tax products. They concluded that the presence of tax avoidance/evasion leads to significant overestimating

of the price elasticity of demand when using tax paid sales data.[14,29,30] There is some evidence that the price elasticity of tax paid sales has increased with the rise of on-line shopping.[31]

Some studies have examined whether tax avoidance/evasion disproportionally affects youth and the poor. Theory predicts that low income smokers and youth will more likely buy low-taxed tobacco products due to their lower transaction costs — the value of their time is lower compared to high income smokers. In addition, both youth and the poor are more price sensitive compared to the general population.[32,15] On the other hand, a minimum set of resources might be necessary for a person to have access to low/untaxed cigarettes. These resources are related, for example, to travel costs or to costs of getting Internet access.[33-35]

The empirical results of the impact of tax avoidance/evasion on these vulnerable populations are mixed and likely influenced by a country's specific context. Wiltshire *et al.*[36] found that the availability of cheaper illicit cigarettes in socioeconomically deprived areas of the United Kingdom undermined the desire of many smokers to quit, thus undermining the potential impact of tobacco tax policy on their consumption. Moodie et al[37] studied a cross sectional sample of 11-16 year olds living in the UK in 2008 and found that a quarter of ever-smokers claimed to have been offered and 14% claimed to have purchased cigarettes or hand-rolled tobacco that they believed were smuggled in the previous 6 months. Those from lower social strata were more likely to have been offered smuggled tobacco and to have purchased tobacco products they believed were smuggled. In Taiwan, low-income and poorly-educated smokers were more likely to purchase smuggled cigarettes.[38] Using data from Canada, Gruber et al.[39] concluded that cigarette smuggling disproportionally affects low-income groups and, therefore, increases smoking-related disparities. There is some evidence that young smokers are more likely to engage in tax avoidance, that they consume more cigarettes if they consume illegal cigarettes, and that those who avoid taxes are less likely to change their smoking behavior in response to a tax increase.[40,41] On the other hand, studies from the US showed that those with higher income[33] and higher education[33,35] are more likely to engage in tax avoidance.

The supply of low-tax products has broadened the choices for tobacco users and increased brand proliferation in some markets. The international trade journal World Tobacco reported in 1996 that "smuggling has helped to promote some of the world's leading brands in markets which had remained closed to foreign imports."[42] Traditionally, illicit cigarette brands have been products of the multinational tobacco companies, because these are easier to market and have a price advantage over less-known brands.[43] Marlboro, for example, represented 66% of all seized cigarettes worldwide in 2005.[44] The supply of illegal international brands has been an important component of British American Tobacco's market entry strategy in Africa[45], while the supply of contraband enabled access to closed markets in many Asian countries in the 1980s and 1990s.[46] Markets in Argentina, the Islamic Republic of Iran, Lebanon, Bulgaria, and former Soviet Republics have also been opened using a similar strategy.[47-53]

The legitimate brands still dominate the illicit US market, since bootlegging accounts for most or nearly all of the US illicit market. European illicit trade, however, experienced a shift from genuine products to illicit whites (brands such as Jin Ling and Classic) and counterfeit products (primarily from China) since the early 2000s. For example, the illicit white brand Classic produced by the Imperial Tobacco in Ukraine was the third most seized cigarette brand in the European Union in 2008,[54] and the majority of UK large seizures in 2012 – 2013 were of illicit whites.[55] However, there is some evidence that the seizure data overestimate counterfeit cigarettes. The major tobacco companies in Europe are obligated to pay penalties for the seizure of genuine products according to the agreements with the EU, and since the companies themselves determine the origin of a product, there are doubts regarding the reported higher rate of counterfeit seizures.[56]

The existence of tax avoidance/evasion may interfere with public health policies other than tax, such as youth access laws, bans on cigarette advertising, and laws pertaining to product labelling, ingredients disclosure, and retail environment.[15,57-60] In addition, the existence of underground retailers can result in a competitive disadvantage for legitimate retailers, increasing their motivation not to comply with tobacco-control laws.[15] There are also concerns about the relationship between illicit tobacco trade, public safety, and the general level of corruption.[61,62] The tobacco industry is using evidence of avoidance/evasion in order to scare governments not only from increasing tobacco taxes, but also from implementing other tobacco control policies such as warning labels, plain packaging, and ban on flavouring.[43,63]

The degree of government effort to combat tax avoidance and evasion is motivated by the potential tax revenue gain. The higher per unit taxes and the larger the size of the market, the greater the government incentive is to invest in these activities. A system with clear responsibilities and incentives for all parties involved in tax administration and law enforcement is important, because a lack of clarity can create loopholes to be exploited by those who engage in tax

avoidance and tax evasion. For example, a change in enforcement responsibilities between the US state and US federal authorities in 1978 generated a loophole in the tax audit procedure that led to more tax evasion by underreporting of the number of cigarettes released to distribution.[64] A problem also arises if the different government levels/agencies are not equally motivated to enforce the law.

In gauging the effectiveness of public policies, it is useful to know how compliance varies with the level of enforcement activities. Theory holds that resources should be allocated to law enforcement up to the level where their marginal benefit is equal to their marginal cost, and when enforcement is cost effective compared with alternative approaches.[65] Therefore, it might be efficient for society to tolerate some level of tax avoidance/evasion if the additional cost of achieving no avoidance/evasion exceeds the benefit.

To conclude this chapter, the relevant studies are summarized in Table 1.

Table 1
Theory of tax avoidance and tax evasion: summary of resources

TOPIC	STUDY / SOURCE
Full price and transaction costs	Merriman *et al.*, 2000; Coleman, 1998; Goel, 2008; Lovenheim, 2007; DTZ Pieda Consulting, 2000; Goolsbee *et al.*, 2007; Liber *et al*, 2015; Joossens, 2003
Cost of supplying illegal products	Becker, 1968; Levy, 2002; Thursby & Thursby, 2000; Campaign for Tobacco-Free Kids, 2008; Merriman *et al.*, 2000; IARC, 2011; Joossens, 1998; Joossens, 1999
Competition & substitution between legal and illegal products	Joossens *et al.*, 2000; Duffy, 2006
Impact of tax avoidance/evasion on the overall tobacco use	Joossens *et al.*, 2009; West *et al.*, 2008; Lovenheim, 2007
Impact of tax increase on tax avoidance/evasion (and on demand for tobacco products)	IARC, 2011; Duffy, 2006; Merriman *et al.*, 2000; Merriman, 2002; Chernick and Merriman, 2013; Liber *et al*, 2015; Gilmore et al, 2013; Wendleby & Nordgren, 1998; Joossens, 1999; Canadian Cancer Society, 1999; Baudier, 1997; Comité Français d'Education pour la Santé, 1998; Emery *et al.*, 2002
Impact of tax decrease on tax avoidance/evasion (and on demand for tobacco products)	Joossens *et al.*, 2000; Canadian Cancer Society, 1999
Impact of tax avoidance/evasion on price elasticity of tobacco demand	Duffy, 2006; Baltagi and Levin, 1986; Licari and Meier, 1997; Galbraith and Kaiserman, 1997; Gruber et al., 2002; Goel, 2004; Licari and Meier, 1997; Goolsbee *et al.*, 2007
Impact of tax avoidance/evasion on vulnerable population	Joossens *et al.*, 2009; Joossens *et al.*, 2000; Hyland, et al., 2005; DeCicca et al., 2010; Fix et al, 2014; Wiltshire *et al.*, 2001; Moodie et al., 2010; Gruber et al., 2002; Callaghan et al., 2009; Cantreill et al., 2008
Impact of tax avoidance/evasion on brand proliferation	Joossens & Raw, 1998; World Customs Organization, 2007; LeGresley, *et al.*, 2008; Collin et. al., 2004; ; World Health Organization, 2003; Gilmore and McKee, 2004a; Gilmore and McKee, 2004b; Gilmore et al, 2007; Nakkash and Lee, 2008, Skafida et al, 2012; Walton, 2009; HC, 2014; Joossens et al., 2014
Impact of tax avoidance/evasion on tobacco policies other than tax	Joossens *et al.*, 2000; Ribisl *et al.*, 2001; Ribisl *et al.*, 2006; Stephens *et al.*, 2005; Pappas *et al.*, 2007; Fleenor, 2003; Joosens and Raw, 1998; Fooks et al., 2014

How to Measure the Scope of Tax Avoidance and Evasion

The illegal nature of tax evasion and the possible social stigma attached to tax avoidance make the task of measuring the scope of these activities extremely difficult. Yet various stakeholders are interested in understanding the phenomena, their magnitude, and the degree of market disruption they potentially represent. Reliable quantitative measures of tobacco tax avoidance and tax evasion can enhance public discourse and policy making. This has motivated the development of methods for estimating the scope of tax avoidance and tax evasion.

A lack of reliable data is a major challenge, since those engaged in tax avoidance and tax evasion do not keep public records, are not willing to provide the data, and/ or are not interested in cooperating with researchers. Enforcement authorities may have some data, but are often bound by confidentiality. Therefore, those who estimate the scope of tax avoidance/evasion either find a way to creatively use the existing data that have been collected for other purposes, or collect new data with the main goal to assess the scope of tax avoidance/ evasion.

This section describes various methods employed to estimate the magnitude of tax evasion and tax avoidance, discusses their pros and cons, suggests when it is appropriate to apply them, and provides examples of studies that have employed these methods.

To begin with, we briefly review the main principles of conducting research, which apply (with some modifications) to all the approaches described below. Following these steps will result in sound and well documented studies.

1. Establish research goals, define the final product and your target audience.
2. Select the method(s) you want to apply based on the available resources (both financial and human).
3. Develop a research protocol. This is a grand plan of how to execute the study including the data collection, data analyses, and the presentation of the results. Seek feedback from your colleagues and those experienced with the type of research you want to conduct. You do not want to waste your effort on a study that might be later criticized due to a research design flaw.
4. Many studies require obtaining ethical clearance before the projects starts, particularly if human subjects are involved. This procedure varies by country. If you are not certain whether you need ethical clearance, enquire with the local authorities. It is better to be safe, because you might not be able to publish your results if you do not follow the required procedure.
5. If needed, hire and train the research staff and make sure they understand and know how to follow all steps of the research protocol.
6. Conduct a pilot study of your research protocol and fine-tune it based on the experience in the pilot test. Once this step is completed there should be no deviation from the research protocol unless absolutely necessary, and if there are deviations, these should be thoroughly documented.
7. Execute the research protocol according to the principles of the obtained ethical clearance and carefully document each step (e.g., non-participation rate, the date, time, and place of the interviews). Try to collect the data in a relatively short period of time to avoid their contamination by a policy or a market change. Take into account any seasonal variation in cigarette consumption (e.g., New Year's Eve resolutions, summer travel season, etc.).
8. Clean the data (e.g., analyze missing, incomplete and inconsistent responses as well as outliers) and analyze them using the appropriate software. Products/purchases that cannot be definitely categorized as low-tax or full-tax products according to the set of established criteria need to be marked as uncertain and excluded from the main analysis. A separate analysis can be performed to study whether the uncertain products are distributed randomly or not and to what extent this effects the main results. Carefully document all steps of the data analysis so that the results can be replicated.
9. Report results. In most studies you will report some measures of a central tendency such as mean (both weighted and unweight), and measures of dispersion (e.g., the standard error or confidence interval). Express the estimated scope of tax avoidance and tax evasion as a percentage of the total market, which is the market that consists of both full-tax and low-tax cigarettes.

10. Present the results in the context of the existing literature/studies. Clearly articulate all weaknesses of the data, the method applied and any problems in its application. Ideally, propose how the study/research/method can be improved in the future.
11. Disseminate the results.
12. If your goal is to evaluate the impact of a policy change (e.g., a tax increase, higher level of enforcement, an implementation of a tracking and tracing protocol) or assess the trend in tax avoidance/evasion over time, repeat the same data collection at various time points and compare the results. The best time to repeat a study is a few months before and a few months after a policy change. The timing is critical since repeating a study too soon after a change will capture a short-run response that could overstate the reaction (e.g., tax avoidance) due to an initial response to the new policy. A long-run, more permanent response is better assessed a few months after the change.

Various methods of quantifying tax avoidance/evasion are described below starting with approaches most frequently discussed in the literature (survey of tobacco users, examination of cigarette packs, gap analysis, econometric modelling), followed by approaches that are unique to certain market conditions (comparison of tax paid sales with estimated consumption, comparison of actual and projected tobacco tax revenue, key informant interviews) and approaches suffering from multiple weaknesses (monitoring tobacco trade, analysing the seizures).

2.1 Survey of Tobacco Users

Background

Certain characteristics of tobacco packs (e.g., the presence/absence of a tax stamp, a health warning, price paid, etc) as well as their sources (e.g., a duty free store) are good indicators of tax avoidance/evasion. Such data collected either directly from tobacco users via surveys and/or by inspecting tobacco users' packs (a method described in the next section) can help us determine how many tobacco users consume low-tax products and then estimate the extent of various forms of individual tax avoidance, including cross-border shopping, direct purchases, and duty-free purchases. Some tax evasion can also be detected. Information on the quantity and the frequency of these purchases will help to quantify the share of low-tax products in total consumption. Surveys can also collect data on the characteristics of those purchasing and consuming low-tax products as well as solicit a subjective opinion as to whether the full-tax has been collected.

Principles

It is crucial that the survey design (including the sampling plan and the sample weights) and the questionnaire be reviewed by an experienced statistician/researcher, otherwise the results could be uninformative.

First, decide the survey mode. Surveys can be conducted by interviewing subjects face-to-face, by telephone, by mailing in a questionnaire, or via the Internet. Computer-assisted interviewing methods such as CAPI (computer assisted personal interviewing), CATI (computer assisted telephone interviewing), or CASI (computer assisted self-interviewing), tend to improve data quality and appear to encourage more complete reporting of sensitive behaviors such as tax avoidance and tax evasion. However, the computer-assisted methods are also more expensive. The survey mode has implications for the accuracy and representativeness of the data as well as for the cost of the survey, with face-to-face being the most expensive.

Second, consult a statistician about the sampling frame and sample size. Surveys can be expensive and a good statistician will make sure that the money dedicated to the survey is not wasted on collecting data with very little explanatory power. Compromising on the sample size in order to save money is possible to the extent that valid results can still be obtained. Use sampling techniques that produce an accurate representation of all tobacco users. It is important that the geographical area surveyed be representative of the tobacco market in the entire country or the area of interest. Selecting neighborhoods where low-taxed cigarettes are known to be prevalent will generate biased estimates.[66] Select the unit of observation, which can be a tobacco consuming household or a tobacco consuming individual. The household is a common unit of observation and can provide information on the overall consumption pattern of a family, but it disguises the individual level behavior if only one person is interviewed on behalf of the entire household. Therefore, all family members who consume tobacco should be interviewed if possible, or one of them can be randomly chosen. Selecting only those who consume low-tax products will not generate an accurate estimate of the scope of tax avoidance/evasion.

Since participation in the survey is voluntary, those carrying low-taxed cigarettes might be less likely to participate due to fear of legal prosecution, confiscation, or embarrassment. This will result in underestimating the scope of tax avoidance/evasion. Therefore, it is important to protect interviewees' anonymity, particularly in countries where there is a stigma attached to buying/using low-tax tobacco products[67] and/or there is a probability of being caught and punished.[68] To improve the response rate, the questions on tax avoidance/evasion can be imbedded

into a larger survey that collects data on a broader range of tobacco-related issues. Often, statisticians recommend oversampling; that is, collecting data from more than absolutely needed number of participants since not all subjects will be willing to complete the survey.

Third, develop a standard questionnaire that will be administered to all survey participants. The set of local specific criteria for identifying low-tax products will guide the type of questions included in the survey, because full-tax and low-tax packs will look different in different jurisdictions. It is important to focus on objective criteria for identifying tax avoidance/evasion such as the source of the product (i.e., places of purchases), the distance travelled to get the product, price paid, etc. Very low price and suspicious purchase location, for example, are all possible signs of tax avoidance/evasion and will determine if you categorize the product as full- or low-tax. You may need to combine several criteria in order to determine the pack's correct category. For example, in some countries missing a tax stamp or a very low price might not be a sufficient sign of a low-tax product. On the other hand, missing a tax stamp and a very low price and place of purchase associated with tax evasion (e.g., a street market) might be sufficient evidence to categorize a product as a low-tax product. The information about the place of purchase can help to distinguish between tax avoidance and tax evasion. For example, tax avoidance occurred if the permissible number of products was purchased in a duty free store; tax evasion would be suspected if a product was purchased outside the established retail system (e.g., on a street) and had other signs of a low-tax product (e.g., very low price, incorrect health warning). You will also need to collect information about the type and amount of product purchased and the frequency of its use in order to determine the share of low-tax products in the total consumption. Of a particular interest is the frequency of use of products that can be defined as low-tax. For example, you will want to know how often a product with certain characteristics is purchased, are there tobacco products with different characteristics purchased as well, how often are these products obtained from a particular source, etc. Sample questionnaires that include questions designed to estimate the scope of tax avoidance/evasion can be found on the website of the International Tobacco Control Policy Evaluation (ITC) Project (www.itcproject.org/surveys), or on the website of the Tobacco Use Supplement to the Current Population Survey (TUS-CPS) (http://appliedresearch.cancer.gov/tus-cps/info.html).

Subjective questions related to the awareness of low-tax product purchase, knowledge of sources of low-tax products in the area, etc. are less desirable since the survey participants might not be familiar with or be able to distinguish between different types of tax avoidance/evasion. Therefore, there is a danger that they would, for example, report the same purchase as a contraband and as a counterfeit, which would overestimate the scope of tax evasion if these two categories were added to calculate the total size of illegal market. In addition, tobacco users may not be aware of a low-tax purchase if the product was obtained via a legitimate distribution channel.

The questionnaires should also collect data on social and demographic characteristics and other aspect of smoking behavior. This data will determine how representative the sample is of all tobacco users. If the sample you collect is not representative, weights can sometimes be developed with the help of a statistician to correct for this. Be mindful of survey fatigue – the survey needs to collect essential information, but cannot be so long that it discourages participation or provides incentive to give incorrect answers just to get the survey done. The number of questions will also drive the cost of the survey.

Fourth, collect and analyse the data based on the principles of conducting research outlined above. The data analysis will consists of calculating the share of smokers who possessed low-tax cigarettes and the share of low-tax cigarettes consumed by those who possessed them (since they might also consume full-tax products), which will make it possible to estimate the share of low-tax cigarettes among those surveyed and among the entire population, after applying the appropriate weights.

Advantages and Disadvantages

Surveys are one of the most direct methods of obtaining estimates of the scope of tobacco tax avoidance and of availability of low-tax products via various supply channels. However, this method is relatively expensive. It also relies on self-reported data and all self-reported studies have validity problems. Participants could under-report low-tax purchases due to social norms. Even when the purchases are legal, consumers are known to under-report purchases of cigarettes on surveys.[69] If the degree of underreporting of consumption, rather than being random, is systematically greater among heavier smokers, and heavier smokers are more likely to purchase low-tax products,[70] then surveys of smokers may underestimate the amount of tax avoidance/evasion. The method is prone to understate tax evasion since tobacco users might be uncertain in some cases if the cigarettes they purchased were legal or not (e.g., may not be able to detect counterfeit cigarettes) and whether appropriate taxes were paid. To mitigate some of the weaknesses of this method, it is recommended to combine it with an independent examination of cigarette packs, a method described in the next section.

When This Method Should Be Used

Use this method when it is possible to determine whether taxes were paid by analysing tobacco users' purchasing behaviour and/or the self-reported features of a cigarette pack. Since this method can be rather expensive, it is important to secure sufficient resources. Conducting surveys and analysing the data can be time consuming. Therefore, this method should not be used if results are needed quickly.

2.2 Examination of Cigarette Packs

Background

This method is based on classifying packs as low-tax or full-tax products given the law and regulations applicable to the jurisdiction where they were found. The features that allow this distinctions are the absence of the correct tax stamp, an incorrect health warning, markings of a duty-free store, missing price information (if required by the law), low price, and some other features of a pack required by the law. The data are objectively recorded from the packs. Therefore this method belongs to the category of observational studies. Packs can be obtained from tobacco users, from retail outlets, or collected on the street and in trash.

Principles

First, develop a sampling frame to make sure that collected packs are representative of the entire population. If this is not possible (e.g., due to budget constrain), consult with a statistician to determine if there are ways to correct for this, or how best to present the results if the sample is not representative.

Second, train those who will be examining the packs to become familiar with characteristics of low-tax products so that they can determine if a pack is a low- or full-tax product. Test these examiners with packs of known origin to ensure that they received clear instructions and that they are able to identify package successfully. Independent experts (e.g., staff of a government lab) can detect genuine and counterfeit products and/or tax stamps.

Third, collect the data. Specifics of obtaining packs from different sources are described below.

Fourth, inspect each pack and record the data. The data collection can be organized by using a standard questionnaire that captures characteristics of each pack such as cigarette brand, pack size, presence of a tax stamp, health warning, price, markings of a duty-free store, and other pack markings that can determine if the correct excise taxes have been paid and/or a possible origin of the pack.

Fifth, categorize the packs as low- or full-tax based on the set established local-specific criteria. The presence of a tax stamp on a pack is the best evidence that taxes were paid. However, tax stamps are not required in all countries or jurisdictions, or they might have been removed or lost in the process of opening the pack (for example, if they are affixed to outer cellophane wrap) or discarded before the pack ends up on the street or a garbage bin. Therefore, it is desirable to inspect an unopened pack[35] or obtain it for later detailed inspection that could generate more definite answers. Help from independent experts is often required to identify counterfeit tax stamps or counterfeit cigarettes.[71]

Another sign of tax avoidance/evasion is an incorrect health warning (e.g., health warning in another language or text warning instead of pictorial health warning), a very low price paid for the product or a product that was obtained from a source known to be associated with tax avoidance/evasion (e.g., another country/jurisdiction, a street seller, etc.). You may want to combine several low-tax products features if one of them is not sufficient to determine low-tax product with certainty. For example, a missing tax stamp might not be sufficient sign of tax avoidance/evasion if the stamp can be easily removed in the process of opening a pack. However, a missing tax stamp and a very low price could be sufficient evidence of a low-tax pack. The particular combination of pack features will be local specific. Packs that cannot be classified as low-tax products with certainty should be classified as uncertain and excluded from the study.

Six, analyse the data based on the principles of conducting research outlined above. The data analysis will consists of calculating the share of packs categorized as low-tax cigarettes among all collected packs. If you have a statistically representative sample, you can generate an estimate of a share of low-tax cigarettes on the market by applying the appropriate weights. If packs are obtained from tobacco users, you need to account for the share of low-tax cigarettes consumed by those who provided them similarly to the way it was done in the survey of tobacco users' method. This will determine the share of low-tax among those surveyed, and among the entire population after applying the appropriate weights.

Advantages and Disadvantages

Since this is an observational study, it eliminates the validity problems associated with self-reported data. However, examining cigarette packs alone without additional information from those who possessed them or from a counterfeit expert cannot distinguish between legal tax avoidance and illegal tax evasion with the exception of packs obtained from retailers, where all low-tax packs represent tax evasion. It can detect some illegal tax evasion, but must rely on expert inspection

(in case of counterfeit products or counterfeit tax stamps) or combine the data with consumers' self-reports if the pack is obtained from tobacco users (e.g., how a pack was obtained, how much it costs). However, since the survey of tobacco users relies on self-reported information, there might be differences between estimates generated by a survey of tobacco users and by examination of cigarette packs. Discarded packs from street/garbage bins or packs obtained from stores usually provide results for limited geographical areas. Therefore, the generalization of the results is limited. However, a statistician can help to design a sampling frame so that the data can sometimes provide more information.

When This Method Should Be Used

Use this method when it is possible to determine whether the correct taxes were paid by studying features of a cigarette pack. Collecting packs and analysing the data can be time consuming. Therefore, this method should not be used if results are needed quickly. The costs of this method will depend on the sources of packs and the representativeness of the sample. Collecting packs from tobacco users can be expensive, but the costs can be cut substantially if inspecting packs is an add-on into an existing survey. Collecting packs from streets, garbage bins or retail stores in one city/town is generally cheaper than collecting packs from survey participants, but the generalization of such results is limited. Obtaining a national representative sample from these sources can be expensive.

2.2.1 Specifics of Obtaining Packs from Tobacco Users

Cigarette packs can be obtained during a face-to-face interview, by mail, or by intercepting smokers in public places.

Obtaining packs during an interview requires following the same steps described for the survey method. Ask for all presently opened packs since some smokers may have both a legal and an illegal pack open at the same time.[72] Packs can then be either inspected in the presence of those being surveyed or at a remote site if the subjects are willing to surrender their packs (usually in an exchange for a reward). Obtaining a pack for future detailed examination is desirable since it will increase the precision with which packs are classified.[35] Another option is to photograph all sides of the pack for later inspection of the images.

If inspecting the pack is not feasible (for example, if the survey is conducted via phone or via Internet), the survey participants can send pictures of packs, or mail them for inspection. The mail-back should be done at no cost to those mailing the packs and can be motivated

by a reward. However, anonymity could be a concern when mailing cigarette packs, if those who mail in their packs receive a reward in exchange. In addition, mailing cigarette packs is rather time consuming, making it likely that those with a high opportunity cost of time (that is those with high income) will not participate. These individuals would be also less likely to consume low-tax products, because their financial resources simply make it not worth the risk. Therefore, this method can both understate (concerns of anonymity) or overstate (high-income smokers who consume few illicit cigarettes will not participate) the scope of tax avoidance/evasion. Despite these limitation, there are mail-in pack samples that are reasonably representative of the smoking population.[35]

A relatively new method is obtaining cigarettes packs from smokers by intercepting them in public places and offering them a new pack for the pack they are currently smoking (pack swaps). This approach is a combination of the method of obtaining cigarette packs from smokers during a survey and the methods of obtaining discarded packs from the streets. An advantage of this method is that surveyed respondents may retain anonymity, but the selection of the location of the intercepts is problematic, as it is with any convenience sampling approach. Some industry-funded studies have used this approach, but do not provide sufficient details about how it was executed. We have not identified any peer–reviewed publication that has applied this method.

Once collected, the packs data are entered into a standardized form. This will facilitate the data analysis.

2.2.2 Specifics of Obtaining Discarded Packs

Packs are collected from a random sample of discarded cigarette packs from the ground (litter) and/or from garbage (properly disposed trash). The goal is to obtain a representative sample of cigarette packs being consumed in a relatively concise geographical location. The representativeness of the sample is key in this method since it will otherwise produce ambiguous information about the population being studied.

First, select a geographical area of interest. The size of the area will depend on the resources available for the project. If possible, gain cooperation with local public authorities in this area such as revenue departments, police departments and sanitation departments. Getting these authorities involved will be useful in case there is a need to collect discarded packs from appropriately disposed garbage and/or if the data collectors run into any difficulties when collecting trash on the streets. Revenue authorities might be interested in the results and can help with their dissemination.

Second, develop a statistically valid plan to collect a representative sample of discarded cigarette packs being consumed in the given area. The geographical area of interest will be divided into sub-areas that completely cover it, and then you will randomly select among them to determine where the discarded packs will be collected. Weights are often used during the process of selecting sub-areas in order to account for population commuting patterns and/or tourists' presence. Trash from commuters, visitors and tourist can make the results more difficult to interpret since their litter packs legitimately purchased in their jurisdiction/country would be illegal if purchased in the study area. Collecting packs in locations that are frequented by visitors/tourists (e.g. tourist markets, football stadiums) or by those with a higher propensity to use low-tax tobacco products (e.g. near the border with a lower tax jurisdiction) should be generally avoided.

Select routes in each selected sub-area along which the discarded packs will be collected while taking into account the possibility of finding littered cigarette packs, the possibility of being able to physically walk the entire route, and safety. Even though walking along all streets in the selected sub-areas is desirable, different studies have used different approaches in selecting routes (e.g., walking perimeters of study areas[21], randomly selecting routes throughout the study area[73], and walking along all sidewalks within each study area[71]). The route selection has implications for the final estimates. For example, the perimeter approach is likely to overstate the problem given that the proximity to lower tax jurisdictions is one of the key determinants of tax avoidance.

Third, begin collection of discarded packs. A typical collection involves data collectors (a team of 2 or 3 people) to walk a certain distance (e.g., one mile) along the selected route. All littered packs are collected and well-documented. Cigarette packs can be put into pre-labeled bags with the route location, date, time, and names of the collection team members. Each pack must be uniquely labelled.

If resources permit, conduct a separate survey of appropriately discarded cigarette packs (e.g., in garbage bins) within the same areas and compare the results. This comparison provides information about whether littered packs systematically differ from properly disposed of empty packs. This method generates unbiased estimates if these two groups are not systematically different. Existing empirical evidence suggests little difference between littered packs and properly disposed of packs.[73,74]

An important weakness of this method is the lack of sample representativeness when data is collected in a limited geographical area. This can be addressed by expanding the scope of the study, which could require substantial resources. A statistician can help with a sampling frame that will generate an acceptable representativeness of a sample given the available resources.

Another concern is related to the sample being contaminated by commuting patterns and tourists. Researchers have dealt with these concerns in different ways. Some used different weights when selecting the pack collection sites, and some repeated the data collection at different points in time focusing on estimating the change in tax avoidance/evasion rather than its scope.[21]

2.2.3 Specifics of Obtaining Packs from Retail Outlets

This method is similar to the survey of tobacco users except for the unit of observation, which is now a store selling tobacco products. First, develop a sampling frame and calculate the sample size taking into account the density of tobacco retail outlets, which might be easier to get in places that require licensing to sell tobacco products. Alternatively, the area of interest needs to be first surveyed to identify all outlets that sell tobacco products. The information on the density and type of outlets can be used to calculate the sampling weights. It is important that the geographical area surveyed is representative of the tobacco market in the entire area of interest. Selecting neighborhoods where low-taxed cigarettes are known to be sold or consumed will generate biased estimates.

Second, develop a standard protocol for selecting a retail outlet and for steps taken during the visit, with the goal of purchasing low-tax product if available. The availability of a low-tax product can be determined during an interaction with the sales person by asking for the cheapest tobacco product available and then verifying with the sales person that this is truly the cheapest product available.

Third, conduct the store visits. Collect information about the store type, the size of the store, its location, and the gender and approximate age (and race if relevant) of the clerk administering the sale. This data can then be analyzed to determine if the store sample represents all tobacco retail outlets in the area, and if there is a possible gender/age/race bias in the willingness to sell low-tax products. If the sample is not representative, weights can be developed with the help of a statistician.

Fourth, calculate the share of stores that sold low-tax products based on the set of low-tax product criteria described above. Since these products were sold in outlets not designated to sell these products (i.e., these are not duty-free stores), all of them evade taxes and are considered illegal.

This method cannot determine the scope of tax evasion because it does not provide information about the portion of total tobacco sales at that store that is illicit, nor does it allow us to estimate the store's share of tobacco sales in the overall tobacco market. In addition, this method will most likely underestimate the share of stores that sell illegal products since clerks might be less willing to sell these products to an unknown person conducting the study as opposed to a regular customer. In many places, it could be rather challenging to get good data on the density and type of tobacco outlets, particularly if street vendors represent an important part of the distribution system. Despite these limitations, it is one of the most direct methods of obtaining estimates of availability of illegal products via legal distribution channels and can provide important information about the role of these channels in supplying illegal low-tax products. If repeated over time, the method can inform about changes in the role retail outlets play in the distribution of illegal low-tax products.

Examples for Survey of Tobacco Users and for Examination of Cigarette Packs Methods

Guindon et al (2014)[75] assessed the levels and trends in tax avoidance/evasion in 16 countries using longitudinal cohort survey data from the International Tobacco Control Policy Evaluation Project (ITC) 2002 – 2011 and combining the survey method with the examination of cigarette packs. Countries used probabilistic sampling but the survey mode differed by country (face-to-face, telephone interviewing, web-based interviewing), with some countries using mixed survey modes. Sampling weights accounting for the survey mode and the survey non-response were employed to generate nationally representative estimates (with the exception of China and Mexico where the surveys were conducted only in large cities).

The extent of tax avoidance/evasion was measured using two approaches. One was based on self-reported information about the source of a smoker's last cigarette purchase. Cigarettes that came from a Native American reservation[iv], out of state/province/country, a duty-free outlet, a direct purchase (mail, telephone or Internet), 'someone else' (such as an independent seller or a military commissary) were classified as low-tax

products. The individuals who reported that their last source for cigarettes was from a friend or a relative or who reported not knowing or refused to answer were excluded from the calculation. The second approach was based on packaging information (self-reported or observed during a face-to-face interview). Packs that did not have a warning label, a tax stamp, and/or a security ink required by the applicable law were classified as low-tax products.

The authors calculated the share of low-tax purchases in individual countries and how it evolved over time. In high-income countries such as Canada, France and the UK, this share was about 10%, but the share was much higher in some low-income countries. For example, up to 40% of all purchases in Malaysia were classified as low-tax purchases. There was a decline in tax avoidance/evasion in the UK, an initial large increase—more than fourfold—in Canada followed by a small decrease, and relatively stable levels of tax avoidance/evasion in the USA. The sources of low-tax cigarettes were very much country-specific, highlighting the importance of country-specific contextual factors. The study could not disentangle tax avoidance from tax evasion and could not capture sales of low-tax cigarettes in legitimate stores, counterfeit cigarettes, or cigarette with counterfeit stamps. The major drawback of the study is that the data did not document the frequency and amount of purchases from low-tax sources. This led to underestimation of the extent of tax avoidance/evasion, because the data revealed that those who buy cigarettes from low or untaxed sources tend to be heavier smokers. The estimates based on self-reports were substantially different compared to the estimates based on pack inspection. This difference could have been driven by social desirability bias (when respondents provide socially desirable answers) and/or imperfect recall. This suggests that self-reported information may not be always reliable.

Joossens et al. (2014)[76] collected data on cigarette packs during a 2010 household survey of adults conducted in 18 European countries while also examining cigarette packs in order to study tax evasion. Different sampling methods across countries took into account the local specific setting and generated a representative sample of 18056 subjects interviewed face-to-face (a computer-assisted personal interview). Those classified as current smokers (5114 observations) provided information on the pack's provenance and price. Then they were asked to show their latest purchased pack of cigarettes (manufactured, hand-rolled or other types) to a trained interviewer who recorded information about health warnings and a tax stamp. A pack was identified as illicit if it had at least one of the following characteristics: it was bought from

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[iv]   Reserves sell low-tax cigarettes that are intended for its inhabitants only. However, they also sell to visitors

a known illicit source (e.g., from individuals selling cigarettes at local markets or in the streets, delivery service, door-to-door sale), had an inappropriate tax stamp given its self-reported origin, had an inappropriate health warning given its self-reported origin, or its price was 70% below the lowest price of a cigarette pack in the country as reported by WHO. Packs with destroyed or removed tax stamps were not classified as illicit due to the possibility that the stamp was removed in the process of opening the pack. The study could not detect counterfeit tax stamps or counterfeit products; thus, it may have underestimated the size of tax evasion. However a counterfeit product was still classified as an illicit product if it possessed other characteristics such as very low price, inappropriate health warning, or was obtained from a known illicit source. The smokers may have tried to hide or may not have known the origin of the pack generating a potential downward bias in the estimates. In order to address this issue, the interviewers avoided using words such as 'smuggling' or 'illicit trade' in order to decrease the perceived sensitivity of the issue.

About a quarter of smokers were not willing to show their pack. If the willingness to show a pack was negatively associated with the probability of owning an illegal pack, the study would underestimate the rate of tax evasion. To study this possibility, the rate of tax evasion was compared between those who showed the pack and those who just described the pack but did not show it. No substantial difference between the two groups was found. In addition, the multiple signs of tax evasion were cross-validated, showing a high degree of consistency. The likelihood of possessing illicit cigarette was estimated using regression analysis that took into account sex, age, education, the number of cigarettes consumed per day, and the heterogeneity between the 18 European countries.

Results showed that about 6.5% of smokers in the 18 EU countries possessed a pack classified as illicit, with the highest estimate in Latvia (37.8%) and the lowest in Portugal (0.0%). The country level estimates were compared with a study based on empty packs collection from streets and public bins.[77] Since the empty packs method could not separate tax evasion from tax avoidance, the KPMG (2010)[77] estimates were larger compared to Joossens et al.[56] that focused only on the tax evasion. This demonstrates the importance of correctly differentiating between legal tax avoidance and illegal tax evasion.

Nagelhout et al. (2014)[78] focused on legal tax avoidance in Europe. They also used a cross-sectional survey of adult smokers, but surveyed only five European countries and relied only on self-reported

data on the frequency of cigarette purchases outside the country in the last six months. They found that cross-border cigarette purchasing is more common in European regions bordering countries with lower cigarette prices. For example, 24% and 13% of smokers living in near a lower-priced border in France and Germany, respectively, reported purchasing cigarettes frequently outside their country. On the other hand, only 2–7% smokers living in the non-border regions of France and Germany reported frequent purchasing of cigarettes outside the country. The data did not allow for estimating the scope of tax avoidance due to missing information on the share of cross-border purchases in total cigarette consumption among those who engaged in tax avoidance.

Fix et al (2014)[35] combined survey data on smokers with mail-in pack collection to estimate the prevalence of cigarette packs that were not taxed by the US state in which the participant lived.[v] A nationally representative sample of the daily smoker cohort participating in the 2009 and 2010 waves of the USA International Tobacco Control United States Survey was asked during a telephone interview to send an unopened pack of their usual brand of cigarettes purchased at their usual outlets. Those who agreed to send in a pack were mailed a data collection kit, which included an information sheet, cover letter, instructions, a short questionnaire, a plastic zip-top bag for the pack and a postage-paid return envelope. Participants received US$25 in order to compensate them for their time and effort. The response rate among those who initially agreed to take part in the pack collections was 79% and 75% in 2009 and 2010, respectively, and the researchers were able to visually inspect 684 packs for the presence of a tax stamp. If there was no stamp or the stamp did not match the participant's state of residence, the pack was classified as low-tax. This selection criteria disqualified participants from three US states (North Carolina, North Dakota and South Carolina) that do not use tax stamps. Self-reported usual brand and its pack Universal Product Code (UPC) obtained during the telephone interview was compared with the brand family and UPC printed on the pack sent for analysis in order to address concerns over whether a participant might have reported smoking a more expensive brand, but sent a less expensive brand. There was 97.2% and 92.6% agreement with respect to the brand variety in 2009 and 2010 surveys, respectively, but a lower agreement between the self-reported and the observed UPC in both surveys. Further analysis found that the majority of the mismatched UPCs were a result of the participants making a mistake in reporting the UPC digits over the phone.

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[v]   In the USA tobacco tax rates vary by state

The results showed that 20% of the packs in 2009 and 21% in 2010 were classified as low-tax with the prevalence higher in states with higher-excise taxes. Smokers who did not plan to quit were significantly more likely to have sent a pack that was classified as untaxed.

A particular strength of this analysis is that the data collection was conducted in a similar fashion at two different points in time from a nationally representative sample of US smokers. The high rates of participation and replication of findings over time suggest that this type of data collection is feasible and relatively cost-effective. However, the study has several limitations. First, the method yields an estimate of tax avoidance and tax evasion without being able to separate them. This limitation could have been addressed if those who were sending packs also provided information about their purchase behavior (e.g., where was the pack purchased). Second, the sample size was small. Third, smokers who knowingly avoid taxes by purchasing cigarettes from unlicensed tobacco outlets might be less likely to answer a survey or send a cigarette pack for inspection. The prevalence of packs that did not show evidence of tax avoidance or evasion was higher among those who sent a pack when compared with the information provided over the phone, lending some support to this hypothesis. The study was unable to measure the distance between a participant's residence and the tobacco outlet from which the cigarette pack sent for inspection was purchased. This limited the possibility to test whether the proximity of lower-priced sources is an important factor in motivating tax avoidance/evasion behavior.

Scollo et al. (2014)[79] evaluated changes in the availability of illicit tobacco in small retail outlets following the December 2012 introduction of plain packaging in Australia. The sample of 303 stores was obtained from randomly selected postcode-based areas stratified by socioeconomic status in four large cities. Fieldworkers who were demographically similar to known users of illicit tobacco started to walk from a predetermined starting point in each area and sampled every eligible store they encountered. A minimum of six stores per area were visited at the time when the store was not too busy with other customers. In each store, the fieldworker asked for a particular brand of low-cost cigarettes in a small pack size so that the retailer knew that the purchaser was interested in cheap cigarettes. After the retailer retrieved the requested pack, the fieldworker enquired whether a cheaper pack of cigarettes was available and purchased the cheapest pack offered. In a subset of 179 stores, the retailer was also asked about the availability of chop-chop (an illegal low-tax tobacco) in the area. The same stores

were visited six times during the study period: two times prior to implementation of plain packaging, once during the implementation period, and three times well after the period of initial implementation. Fieldworkers rotated across stores.

Collected packs were later examined to assess any divergence from Australian packaging regulations, and their prices were compared with tax liability and recommended retail price (RRP) for the particular brand and pack size. Prices that were more than 20% cheaper than the RRP, packs cheaper than the tax liability, and packs with incorrect packaging were considered illegal products. The retailer responses regarding the availability of chop-chop were aggregated into three categories: (1) positive responses — offered to sell or provided information where to get it; (2) negative responses — did not offer to sell, did not know of a source or confused chop-chop with roll-your-own tobacco (RYO); and (3) suspicious — the retailer behaved as if they were suspicious about the fieldworker's request. Logistic regression analyses examined differences between waves in the likelihood of encountering a negative, positive, and suspicious response.

The results showed that 13 (2.2%) of 598 packs purchased pre-plain packaging were classified as low-tax. Four packs (1.3%) of 297 were illegal in December, the implementation month, and five (0.6%) of 878 in the three collections following implementation. The availability of chop-chop in small retail outlets was low — it was offered directly only on six occasions (0.6%), 5.8% enquiries resulted in information about where to get it, while in 88.5% cases retailers either did not know what chop-chop tobacco was, did not know where it could be purchased, or they confused unbranded tobacco with RYO tobacco. The authors concluded that there was no change in availability of illicit tobacco observed following the implementation of plain packaging.

The study acknowledged its weaknesses: the survey did not include specialist tobacconists and informal sources. If retailers are more willing to sell illegal products to known regular customers, this study would have underestimated the size of the problem. In 5.2% of cases the retailer became suspicious of the fieldworker and did not give a response. The repeated surveys thus mostly assess a change over time, which was critical for evaluating the impact of plain packaging.

Merriman (2010)[73] collected discarded packs in the city of Chicago in 2007 to study how tax avoidance/ evasion varied with the level of tax and the distance to lower tax neighbouring jurisdictions. Chicago was

selected for the study due to its close proximity to several jurisdictions with different cigarette tax rates, and due to the fact that the city requires that all packs have both the state and the city/county stamp affixed to each pack. This feature assisted with classifying packs as low-tax or full-tax. The total of 135 zones were randomly selected from the sample of all city zones and zones in neighbouring jurisdictions, with the probability of a zone selection being weighted by population (100% weight) and employment size (49% weight). In each selected zone, a one-mile data collection route was selected based on being a safe place to walk as well as an appropriate place to find littered packs. This method generated 2,391 littered cigarette packs. Since the tax stamp is attached to the cellophane wrap, only 1,141 packs (47.7 %) with a wrap were considered for the analysis. To control the quality of data, the tax stamp information from each pack was recorded twice by different researchers and the records were cross-verified to detect any discrepancies. The packs with mismatched records were retrieved and correct coding was determined.

Data on commuting flows and the ratio of residents versus non-resident workers was used to obtain predictions of the share of the packs from different jurisdictions that might be expected if there was no tax avoidance/evasion. To address a potential bias of the discarded pack method based on the notion that litterers may be systematically different than non-litterers with regard to tax avoidance behaviour, a separate survey of appropriately disposed cigarette packs from some of the same areas was also conducted. Further, the distribution of cigarette brands sold in Chicago by legal vendors was compared with the littered sample. Both tests demonstrated that littered cigarette packs are representative of cigarette consumption in the area. The study found that 75% of packs found in within the city boundary did not display the correct Chicago tax stamp, but it could not distinguish between tax avoidance and tax evasion.

Chernick and Merriman (2013) employed the discarded pack method to study the impact of an 83% state tax increase in New York State in 2008. To narrow the geographical focus of the study, the researchers selected New York City (NYC) where the combined state and city tax reached $4.25 per pack after the tax increase. The tax rates in neighboring states of New Jersey, Connecticut, and Pennsylvania were $2.70, $3.00, and $1.35, respectively, which may have provided incentives for tax avoidance. Discarded packs were collected on the periphery of a randomly selected sample of 30 census tracts in NYC. They were assigned equal weights, but the census tracts were selected proportionally to the number of residents and the workers employed in them. The generated sample

of littered packs was therefore representative of packs smoked by residents and those who worked in the area. Since the tax stamp is attached to the cellophane wrap, only the discarded packs with a wrap were considered for the analysis. Packs without cellophane were also collected to determine whether there was a systematic difference in the distribution of brands with and without cellophane. The results show that the share of littered packs that had an appropriate tax stamp fell from 55% prior to the tax increase to 49% immediately after the tax increase. The 49% share was essentially unchanged in subsequent rounds of data collection (three and 15 months after the tax increase). By collecting data both before and after the tax increase, the study estimated the impact of a policy change while limiting the potential influence of unrelated factors (e.g. the presence of tourist, the higher propensity to avoid taxes among those who litter) on the estimate. Presenting data from several rounds of pack collection after the tax increase demonstrated the stability of the tax avoidance measure over time while data collected 15 months after the tax increase captured long-term market adjustments. As in Merriman[73], the study couldn't distinguish between tax avoidance and tax evasion.

2.3 Compare Tobacco Sales and Consumption (Gap Analysis)

Background

This method, also called "gap analysis", estimates tax avoidance/evasion as the difference between estimated consumption of cigarettes at national and/or local levels and tax-paid sales for the corresponding area. It draws on data that most governments collect and can be deployed with little methodological variation across countries/regions. The estimates can serve as a benchmark for existing estimates, and may allow for a better understanding of the relation between policy changes, including tax changes, and changes in low-tax consumption.

The method is based on a simple arithmetical model. The total market for cigarettes is defined as:

$$Q = QL + Q$$

Where Q is the total quantity of cigarettes consumed, QL is the quantity of legal cigarettes consumed and QI is the quantity of illicit cigarettes consumed. The number of people in the population who smoke, i.e., the smoking population (PS), can be calculated by multiplying the population (P) by smoking prevalence (R):

$$PS = P \times R$$

The smoking population (PS) multiplied by the average consumption per smoker or smoking intensity (A) gives us the size of the total market.

$$Q = PS \times A$$

Substituting equation 3 into equation 1 and making QI the subject of the formula gives us:

$$QI = (PS \times A) - QL$$

The method assumes that the smoking population (PS), the smoking intensity (A) and the size of the legal market (QL) are known.

This method is primarily used to detect deviations from the trend. For example, a sudden increase in the gap following a tax increase would be evidence of an increase in tax avoidance/evasion. It could also estimate the magnitude of tax avoidance/evasion if it is possible to safely assume that there was no tax avoidance/evasion in a country at some period of time, for which data is also available.

Principles

First, obtain several years of reliable data on physical quantities of tax paid sales (QL). The best source is government agencies responsible for tobacco tax collection such as the Tax Administration and Customs Department.

Second, obtain data on cigarette consumption (R and A) from national representative surveys for the same years as QL. If you are estimating tax avoidance/evasion within a smaller geographical area (for example to address tax avoidance/evasion of taxes that are levied locally), use the appropriate local survey. Surveys usually report tobacco use prevalence R and smoking intensity A, but it may be necessary to adjust both variables using weights so that they are representative of the population of interest.

When using prevalence data, be sure to account for non-daily smokers if they are reported separately from daily smokers. If the survey covers only the adult population, the adult smoking prevalence will be multiplied by the total number of adult population P to generate the number of adult tobacco users PS. Estimate the smoking youth population by using youth tobacco survey and follow the same approach as for adults, only this time using the total youth population instead of the adult population. Make sure there is no age overlap between the adult and the youth survey. If there is an age overlap, adjust the population size accordingly.

Estimate smoking intensity for adults and the youth separately. Smoking intensity needs to correspond to the time frame of reported sales data QL. In most cases, this time frame is one year, so you will need to estimate an average yearly consumption of cigarettes based on survey answers. Most surveys ask about daily or weekly consumption, and these will need to be aggregated to obtain yearly consumption. If daily consumption is reported in ranges (e.g., 5 – 10 cigarettes/day), use linear interpolation of the mid-distribution function (using, for example, command iquantile in Stata) to estimate the average daily cigarette use. Be careful distinguishing between overall tobacco use, manufactured cigarette use and roll-your-own cigarette use. If this method is used for estimating manufactured cigarette tax avoidance/evasion, use only manufactured cigarette prevalence.

Third, multiply the smoking population PS by smoking intensity A separately for adults and youth. Add the two estimates to generate an estimate of the size of the total market Q for the year in which the survey was taken.

Fourth, repeat the estimate of Q for all survey years. Carefully investigate any changes in the wording of survey questions or the sampling strategy over time, since even small changes in survey procedures can significantly affect reported consumption. Ideally, the consumption data would have been collected systematically over time. If this is not the case, consult with a statistician as to how these changes may have affected the survey results and adjust the estimates accordingly. Document all steps and all assumptions made when calculating total consumption.

Fifth, compare the tax paid sales QL with the estimated consumption Q and study how the gap evolved over time. This can be done by calculating the percentage change in tax paid sales and the percentage change in reported consumption over time. Estimates of changes over time are more useful and reliable than estimates of the scope of tobacco tax avoidance/evasion due to inherent weaknesses of this method (see below). If there is a period when it can be safely assumed that there was no tobacco tax avoidance/evasion (e.g., due to historical events), the gap between the tax paid sales QL and the estimated consumption Q, if there is any, would have been caused by other factors such as underreporting. Any increase in this gap would measure the magnitude of tobacco tax avoidance/evasion.

Advantages and Disadvantages

This method is transparent, replicable, and relatively inexpensive since it relies on secondary data. However, it cannot distinguish between tax avoidance and tax evasion and cannot determine whether illicit cigarettes

are counterfeit or contraband. It is primarily used to detect deviations from the trend, not to estimate the scope of tax avoidance/evasion. However, the magnitude of tax avoidance/evasion could be assessed if there was a period with no tax avoidance/evasion, for which data exists.

In many countries it is relatively easy to obtain reliable statistics about tax-paid sales of tobacco products, but there might be countries where this type of data is not publically available. Even more problematic is the lack of nationally representative survey data on tobacco use for multiple years. In addition, the quality of the data collection may be questionable in some countries, especially in countries that lack resources for data collection. Poor data quality will result in estimates that are highly unstable over time and might be erroneously interpreted as volatile changes in the extent of tax avoidance/evasion.

Estimates of consumption from surveys can suffer from problems other than the reliability of the survey data. The data might be contaminated, for example, by consumption underreporting, recall bias when the survey participants do not remember correctly how many cigarettes they consumed, and the problem of "rounding" when smokers report smoking a pack or half a pack per day even though the actual number of cigarettes consumed per day was different (e.g., 23 instead of a pack or 7 cigarettes instead of a half pack). It has been documented that respondents consistently understate the quantity of tobacco consumed when responding to surveys. An adjustment for underreporting is possible if there are independent estimates of the level of underreporting. If the exact level of underreporting is unknown, one can use several possible scenarios based on evidence from other countries. However, underreporting is often related to the social acceptability of smoking and if smoking is becoming less socially acceptable, underreporting of consumption may increase over time. Therefore, assuming the same level of underreporting over time might not be accurate. To the extent that underreporting varies across countries (potentially reflecting differences in social norms about smoking), differences in the size of the gap between total market size Q and tax-paid sale QL won't necessarily reflect cross-country differences in avoidance/evasion. If there is no tax avoidance/evasion, this method can be used to estimate the degree of consumption underreporting.

Estimates of consumption Q can be distorted by the presence of tourists and immigrants. If these populations are buying tobacco products, but are not included in the calculation, the consumption estimates will be biased downwards, leading to lower estimates of tax avoidance and tax evasion.

The comparison between cigarette consumption and legal sales is further complicated by the presence of roll-your-own (RYO) cigarettes that might not be included in the official sales statistics, but are reported as cigarette consumption during the survey. Consequently, the comparison of consumption (that may also include RYO cigarettes) with manufactured cigarette sales would overestimate the level of tax evasion/avoidance.

In the case that some tax-paid cigarettes were illegally exported from a country, the gap between sales and estimated consumption will provide a downward-biased estimate of tax avoidance/evasion.

There can be some temporal biases in tax-paid sales measures, as these generally reflect shipments from factories wholesale rather than actual consumption. It can be particularly profound if the industry is trying to offload cigarettes before a tax increase in an attempt to reduce their tax liability.

When This Method Should Be Used

This method is well-suited for countries with reliable and consistent estimates of tobacco consumption over time and with unbiased records of tax-paid sales. The estimates can be generated relatively quickly.

The best candidates for this methods are countries with known period of virtually no tax avoidance/evasion for which data exist. Otherwise, the baseline scope of tax avoidance/evasion will need to be estimated using another method and this method will used to estimate changes in tax avoidance/evasion over time.

Example for Gap Analysis

This method has been applied in many countries, but the most successful example is the United Kingdom.[80]

HM Revenue and Customs Department[80] in the United Kingdom has been employing gap analysis to estimate the size of tax avoidance/evasion and the associated tax revenue loss for several key commodities, including tobacco (cigarettes and hand-rolled tobacco) since 2004. The sales data consists of tax paid sales and sales in duty free stores, and are adjusted for legal cross-border shopping. The legal cross-border purchases are estimated based on the International Passenger Survey (IPS) and commercial data about deliveries of cigarettes to duty free stores on ferries. The sales data are further corrected for stockpiling before a tax increase by using a three-month average. Total consumption is calculated using estimates of prevalence of cigarette smoking, the average cigarette consumption per smoker, and the size of the adult population.

This consumption is then adjusted for underreporting by an "uplift factor". This factor is a ratio of adjusted sales and estimated consumption in a year which is believed not to be affected by tax avoidance/evasion (i.e., the fiscal year 1994–95). Since the factor is greater than 1, the adjusted consumption is larger than the consumption estimated based on the survey. HM Revenue and Customs calculates two estimates of consumption. The lower-bound estimate assumes that the level of underreporting has not changed since 1994/95 and uses the current smoking intensity as reported by smokers. The upper-bound estimate assumes an increase in underreporting over time and uses smoking intensity as reported in 1994/95 even though there is evidence of declining smoking intensity since that year. The consumption is further adjusted for underreporting of smoking prevalence using survey and lab data on the share of the non-smoking population that hides the fact that they smoke.

HM Revenue and Customs is transparent about the weaknesses of the methodology and admits that the estimates are subject to both random errors due to sampling employed by the national survey and systematic errors due to assumptions used to derive the estimates (e.g., the degree of tobacco use underreporting). Therefore, all results are presented with upper and lower bounds, and a calculated midpoint. The midpoint estimates over time are interpreted as an indicator of long term trends rather than a precise estimate of year-to-year changes. The fiscal year 2012-13 midpoint estimate revealed that taxes were not paid on 9% of cigarettes consumed by the UK population (with the associated revenue losses of £1.1 billion), a continuation of a declining trend since 2001.[55] HM Revenue and Customs continues to review the methodologies in light of new information and data, and revises the older estimates accordingly.

2.4 Econometric Modeling

Background and Principles

This method is used to infer tax avoidance/evasion on the basis of estimated demand functions for cigarettes using regression analysis and either micro or macro level data. Demand is usually measured by official tax-paid sales, which is estimated as a function of a set of variables affecting demand, including variables measuring incentives for tax avoidance and evasion. These incentives, typically modelled as a function of price differences across jurisdictions, population density near borders, the extent of cross-border or tourist traffic, Internet penetration, and other factors such as the level of corruption, are expected to have negative impacts on tax-paid sales.

Coefficient estimates from the resulting models can be used to predict what tax-paid sales would have been if the variables reflecting the tax avoidance/evasion incentives were set to zero, with the difference between predicted sales and actual sales measuring the extent of tax avoidance/evasion. Since statistical estimates have some margin of error, it is possible to generate a confidence interval on estimates of the scope of tax avoidance/evasion.

Advantages and Disadvantages

The method can assess the sensitivity of tax avoidance/evasion to changes in variables that are hypothesized to influence it. It can distinguish between tax avoidance and tax evasion if researchers can find a variable that impacts one type of low-tax consumption but not others. For example, the price difference between a country average price and the average price for which the tobacco industry is selling its cigarettes would measure tax evasion since this difference is likely not related to price difference with a neighboring state, which would motivate legal cross border shopping (i.e., tax avoidance). This method can be inexpensive if it uses the existing data, but quite expensive if the data needs to be collected. It requires high quality, preferably nationally representative data, excellent econometric skills, a good command of the economic theory, and creativity in developing the right measures of tax avoidance/evasion. An experienced econometrician is needed to handle issues related to statistical issues such as econometric misspecification, low explanatory power and omitted-variable and other biases.

When This Method Should Be Used

The method should be used in countries with high quality data and when experienced researchers with good econometric skills are available to conduct the analysis. This could be a time consuming and expensive method if the data needs to be collected first. Even when the data exists, their preparation for the analysis can take time and effort.

Examples for Econometric Modeling

The method has been used to assess the extent of legal cross-border shopping, direct low-taxed purchases, and illegal bootlegging in the USA and, to a limited extent, for global and regional estimates.

Thursby and Thursby (2000)[64] developed a model of commercial smuggling (bootlegging) to estimate the extent of tax evasion in the US using the state level annual data from 1972–90 excluding states that were hypothesized to be the source of commercial smuggling. Since data on cigarette sales are on tax-paid or legal sales, only a portion of a state's cigarette consumption is

observed when there is commercial smuggling. The tax-paid sales in the state was estimated as a function of retail prices, state taxes, the cost associated with acquiring and camouflaging smuggled cigarettes, as well as enforcement while controlling for time trend, income, and the incentive for tax avoidance. The cost of acquiring and camouflaging smuggled cigarettes was measured by the difference between the state tax rate and the tax in North Carolina, since this tobacco-growing US state was thought to be the primary source of commercially smuggled cigarettes (i.e., tax evasion). The incentive for tax avoidance was captured by the average retail price of cigarettes in adjacent states, by the presence of military bases and Native American reservations in the state[vi], and by the ratio of average tax in adjacent Canadian provinces to neighboring state tax. The enforcement was measured by existence of state penalties for tax evasion, the state membership in a revenue enforcement association, the presence of a discount or rebate for each legal sale for wholesalers and by implementation of the US Contraband Cigarette Act (CCA) in 1978. The time trend was included to account for secular trend in cigarette use. The study found 3–4% of all cigarettes sold in the US evaded taxes during the 1970s, and that the tax evasion increased in 1990 to 7.3%. The authors explained this increase by a change in the balance of enforcement activities between the US state and US federal authorities after passing the CCA, which generated a loophole in the tax audit. The results estimated by the model were compared with the estimate of cigarette sales in excess of consumption in three US states (NC, KY, VA) that were the source of commercial smuggling, and estimates accorded reasonably well.

Merriman et al. (2000)[9] used cigarette tax-paid sales data for 1989–95, cigarette prices and frequency of international travel from 23 European countries to estimate the extent of small-scale smuggling (bootlegging) and cross-border shopping (a combination of tax avoidance and tax evasion). The per capita cigarette sales was modeled as a function of domestic price, income measured by GDP per capita, the incentives for tax avoidance/evasion and other variables, such as the degree of corruption in the country. The incentives for tax avoidance/evasion were modeled as difference in price between the home and destination countries and the total number of cross-border travelers. The model also included a dummy variable for each year and a dummy variable for each country to correct for any factors that are constant over time but vary by country (such as the cultural heritage of the country) or are constant across countries but vary over time (such as the state of knowledge about how smoking affects health). The country dummies also controlled for the average level of corruption in the country that has been associated with the level of large scale organized wholesale smuggling (tax evasion).

The study found that, in a typical European country, the share of cigarettes acquired by bootlegging and/or cross-border shopping accounted for about 3% of domestic consumption.

Yurekli and Sayginsoy (2010)[81] used econometric modeling to study the extent of global large-scale organized smuggling in 1999 using per capita legal sales and trade data from 110 countries in seven regions. They developed a variable that measured incentives for tax evasion as a function of smugglers' expected profit, which is driven by the price differences between legally sold cigarettes and the cigarette world price. The export prices of the US and UK cigarettes to a country and its trading partners were used to proxy the world price. The world price for a pack of US/UK cigarettes calculated by dividing the value of exports by the volume of exports ranged from US$0.15 to US$1.09 per pack, depending on the importing country. In all countries, the world price was lower than the average retail price. This difference and the lack of anti-smuggling law enforcement efforts were assumed to motivate tax evasion. Law enforcement was proxied by the inverse country-specific level of corruption. A static global demand model estimated per capita legal cigarette sales (i.e., a measure of consumption) as a function of the Purchasing Power Parity (PPP), the PPP adjusted average retail price of a cigarette pack, per capita income adjusted for PPP, the smuggling incentives variable, the level of corruption and additional variables capturing demographic and geopolitical characteristics of a country. The model was estimated using OLS (Ordinary Least Square) with White's heteroskedasticity-robust standard errors. The difference between the consumption estimated by the model and the consumption predicted when the smuggling incentive variable value was set to zero provided an estimate of the scope of tax evasion in each country. Aggregating these results showed that 3.4% of global cigarette consumption in 1999 was smuggled, which resulted in a 7.4% loss of tax revenue. The method of Yurekli and Sayginsoy[81] is suitable only when data is available for a large number of countries.

2.5 Other Methods

2.5.1 Comparison of tax paid sales with estimated consumption

This method is a variation of the gap analysis. It compares the change in legal cigarette sales with the predicted change in total cigarette consumption (i.e., legal and illicit) estimated using changes in cigarette

prices, in income, and the price and income elasticities of demand. If the actual change in legal consumption is different than the predicted change, tax avoidance/evasion could be increasing or decreasing depending on the direction of the change. For example, if actual legal cigarette consumption decreases by 5%, and predicted total consumption decreases by only 2%, this would imply that an additional 3% of cigarettes (compared to the previous level of tax avoidance/evasion) are likely to have escaped paying tax. The simulation should be done for multiple years to determine any systematic pattern in the deviation between the predicted and actual sales.

The method is rather simple, intuitive, replicable and relatively inexpensive since it relies on secondary data. However, it requires high-quality time-series data and estimates of country-specific price and income elasticities of cigarette demand, with these estimates taking into account the presence of tax avoidance/evasion. It cannot distinguish between tax avoidance and tax evasion. Similar to the gap analysis, it is primarily used to detect deviations from the trend, not to estimate the scope of tax avoidance/evasion. However, the magnitude of tax avoidance/evasion could be assessed if there was a period with no tax avoidance/evasion, for which data exists.

Example

Walbeek (2014)[82] applied this method in South Africa in order to investigate the industry claim that there has been a sharp increase in the illicit market in recent years. He compared the actual changes in tax-paid cigarette sale with predicted changes in total cigarette consumption for the period 1995 – 2012. The changes in cigarette consumption were predicted using data on cigarette prices, GDP, and previously published price and income elasticity estimates. The upper and lower limits of these elasticities were used to perform a sensitivity analysis. The changes in the gap between the sales and predicted consumption revealed a substantial decrease in tax-paid sales compared to the model prediction in 2000–2002, which would indicate an increase in illicit trade. However, cigarette consumption could have also been influenced by advertising restrictions in 2000-2001 and comprehensive smoke-free legislation in 2001. In 2003 – 2009, there was no evidence that the illicit market has grown. On the contrary, the model predicted that the illicit market declined during this period. There was a spike in the size of the illicit market in 2010 when it grew by about 10.2 percentage points (8.2 points – 12.2 points). However, the spike was not the start of a trend. In 2011 the illicit market increased only marginally, and in 2012 it decreased by 0.6% points (-1.3 % points to 0.0 %

points). The study concluded that the industry claim of a substantial increase in the illicit market in 2011 and 2012 is unfounded.

2.5.2 Comparison of actual and projected tobacco tax revenue

This method is based on a comparison of budgeted and actual excise tax revenue as reported by tax revenue authorities over time. It assumes that if tax avoidance/evasion is structural, tax authorities would have taken it into account when projecting tobacco tax revenue. This would make budgeting more difficult and one would expect to see large deviations between the actual and projected revenue. The ability of a tax authority to accurately budget for tobacco tax revenue is measured by the mean percentage error (MPE) and by the root mean squared percentage error (RMSPE). The MPE indicates whether forecasts/budgets are consistently too high or too low, compared to the actual tax collection. The RMSPE is a measure of dispersion similar to standard deviation. A negative or increasingly negative MPE value is consistent with an increase in tax avoidance/evasion, assuming that the budget was done correctly. RMSPE quantifies the magnitude of the deviation, regardless of whether it is positive or negative.

In order to judge the overall ability of a tax authority to forecast revenue, this methods should be applied to other taxed products whose tax revenue is also budgeted, but subject to no or less tax avoidance/evasion (e.g., alcohol). Comparison of MPE and RMSPE for cigarettes with those of other products can reveal any systematic differences between revenue budgeting for cigarettes and for other products.

For this method to work, the budgeted and actual tax revenue must be available (i.e., reported by the tax authorities) and independent of the producers' pricing decisions. That is, this method can be used only with a specific or quasi-specific tax regime. It requires data for relatively long periods of time (at least five years) and cannot detect large once-off deviations that could be caused by a sudden spike in illicit trade. This method will detect increase/decrease in tax avoidance/evasion, but it cannot estimate its scope and cannot distinguish between tax avoidance and tax evasion.

Example

Walbeek (2014)[82] investigated whether the alleged increases in illicit cigarette trade significantly undermined the South African Treasury's capability to accurately predict excise tax revenue. He studied whether cigarette excise tax revenue had been below

budget in recent years (2000 – 2012), compared to previous decades (1910 – 1999), by calculating MPE and RMSPE for budget revenue deviation for cigarettes, beer, and spirits. Data on budgeted and actual excise revenue for beer, spirits and cigarettes were taken from individual Auditor-General reports and the Treasury's Budget Reviews. The study found that cigarette excise revenues were 0.7% below budget for 2000 – 2012 on average, compared with 3.0% below budget for beer and 4.7% below budget for spirits. Higher predictability of cigarette excise tax revenue indicated little change in illicit tobacco trade during this period, contrary to the alleged increase in illicit cigarette trade. However, the cigarette excise revenue was not as predictable in 2009 – 2012 as in the preceding period 2000–2008. The analysis detected a structural break in 2009 when the actual cigarette excise revenues were below budget in each of the four years between 2009 and 2012, suggesting that over this period the illicit market share has increased. The shortfall of actual tobacco tax revenues (relative to budget) peaked at 11.5% in 2010 but improved in subsequent years. The study concluded that the industry claim of a substantial increase in the illicit market since 2010 is unfounded.

2.5.3 Key Informant Interviews

This method consists of obtaining information from people who likely possess information on the subject matter (key informants). These individuals may work at various government agencies dealing with tax avoidance/evasion (e.g., customs, law enforcement), at academic institutions, private research companies, or as public health advocates and investigative journalists with particular interest in the issue. The information can come directly from those involved in tax avoidance/evasion when these individuals surrender relevant information in the process of legal investigation. In some cases, smugglers offer information voluntarily to journalists, academics or government authorities on the condition of anonymity.

People working in the distribution of tobacco products are another possible source of information. Wholesalers and retailers selling legal products might be aware of their competition selling illicit cigarettes. Even those selling low-taxed products are sometimes willing to talk to researchers as long as they do not fear legal consequences.

Customs and/or police authorities have data on both legal tax avoidance (importing cigarettes within the legal limits) and illicit cigarette seizures that could be used to assess the trend of these activities over time (see also Analysing Seizures method below).

The method can contribute to the understanding of the modus operandi of tax avoidance and tax evasion in a specific country or a region. The key informants who have been dealing with tax avoidance/evasion for a long time usually have a thorough and accurate understanding of the nature and scope of these activities. They are also familiar with changes over time and responses to various measures and public policies.

Key informants should come from a variety of disciplines and settings, which will be helpful in cross verifying and contrasting the estimates. When making the selection, assess the key informants' motivation for over estimating or underestimating the scope of tax avoidance and tax evasion. For example, customs authorities may be motivated to exaggerate the issue in order to get more resources for their activities. On the other hand, those advocating for a tax increase may want to understate the scope of the problem. If possible and safe, also arrange for direct interviews with those directly involved in tax avoidance/evasion. The selection of retailers could be more complicated (and more expensive) if the results are to be representative of a larger retail community, but a statistician can help with a sample selection process and calculating weights assigned to those who were selected.

Ideally, a standard questionnaire is administered to all key informants. The questions must be clear so that the same event/incident is not reported multiple times under a different tax avoidance/evasion category. Geographical areas and time periods must be clearly defined to make sure that different people provide estimates of the same events. The questions should focus on the scope of tax avoidance and tax evasion, but they may also collect information about the modus operandi, knowledge of industry involvement, and law enforcement and other government activities undertaken to deal with the issue. In addition, the information about the interviewees such as their occupation, time on the job, number of people they supervise, age, gender, and race will be useful in developing the weight assigned to information from different experts. For example, you will give more weight to a customs officer who has been in charge of investigating cigarette smuggling for the last 10 years compared to a police officer just assigned to border patrol. The rules for weight assigning need to be clearly documented.

A thorough literature review, on-line searches, and an analyses of newspaper articles and internal industry documents can be important components of this method, particularly when it is difficult to find a variety of key informants on sensitive topics.

The method is relatively simple and requires the least technical and statistical sophistication, except for retailers' interviews that aim at generating statistically representative estimates. The cost of this method is low relative to other methods. Information can be generated relatively quickly and provide valuable background and corroborating information. The method requires good networking and people skills and the ability to conduct a productive interview. An intimate knowledge of local culture is very important when analyzing the information.

The main drawback of the method is the subjectivity of the estimates and their possible bias due to the individual expert's experience, position, interests and exposure to the media. Many experts are familiar with only certain aspects of tax avoidance/evasion and therefore it might be difficult to get the full picture. In addition, those influenced by the tobacco industry have an incentive to report high levels of tax avoidance and evasion in order to prevent tax increases and/or adoption of other tobacco control measures. Law enforcement officers can be motivated to amplify the problem in order to secure more resources. Tobacco control advocates may want to focus on lower estimates of tax avoidance in their efforts to support public policies aimed at reduction of tobacco use, and on the industry role in tax evasion. A comparison of the estimates across countries is problematic due to cultural and political differences.

Given its weaknesses, this method should not be used in isolation and is best accompanied by an alternative methodology in order to cross-validate the results. It is not recommended if tobacco tax avoidance/evasion is a controversial or sensitive topic, because the objectivity of information might be questionable.

Examples

There are no good examples of studies that applied this method. **Joossens and Raw (1998)[43]** used information from experts working in three different organizations (the European Confederation of Cigarette Retailers, Her Majesty's UK Treasury and the Swedish National Police College) to classify 15 countries in the European Union as high-smuggling countries (contraband market share of 10% or more), medium-smuggling countries (contraband market share between 5% and 10%), and low-smuggling countries (contraband market share of less than 5%). However, the authors do not provide more details about how was this information obtained.

Market research companies such as Euromonitor International or ERC Group publish annual country level illicit trade data that rely on information from trade associations, trade press, and trade interviews, but the methodology of data collection is not described.

2.5.4 Monitoring tobacco trade

The method estimates the extent of large-scale tax evasion activities by monitoring the difference between countries' mirror records (pair-wise records of trade partners) on imports and exports. It is based on the hypothesis that the difference between recorded exports of an exporting country and recorded imports of the receiving country is likely to reflect the amount of products diverted to illegal markets while in transit. The destination country of the diverted products will remain unknown.

The method relies on data published either by the United Nations Statistics Division or by the World Trade Organization (WTO) and is very sensitive to data quality. This quality reflects the capacity of national agencies to generate these statistics, and this capacity (and data quality) might be positively related to countries' income level.

Using this method is complicated by the existence of different trade classification systems and their changes over time. Some countries report export/import in monetary values, and others in volumes. Volume data are preferred as they are not subject to changes in currency exchange. Even the volume statistics may pose difficulty if reporting switches from weight (e.g., kg) to the number of cigarette sticks and the weight of one stick is unknown. Furthermore, recorded trade data do not always match correctly within a given month or year. For example, if a cargo is recorded as exports in November or December, it may not be recorded as imports until January or February of the following year.

Given the intrinsic weaknesses of this method, it should not be used for estimating the scope of tax evasion on a country level. It cannot detect small-scale tax evasion, tax avoidance, domestic manufacturing of illegal cigarettes, diversion of cigarettes to a third country, or counterfeit cigarettes. It has been used to generate global estimates of large-scale cigarette smuggling, but studies have pointed out many weaknesses in this method. The method is useful for identifying the source of illicit cigarettes and hubs from which illicit cigarettes are being distributed.

Examples

Merriman et al. (2000)[9] studied the trend in aggregated global cigarette export and import from 1975 till 1996. They found that recorded cigarette exports grew about five-fold while recorded imports grew only slightly more than four-fold during this time. In 1996, recorded exports exceeded recorded imports by about 400 billion cigarettes, suggesting that perhaps one-third of all recorded exports were not recorded as imports by the trade partner. This number of cigarettes represented about 6% of global cigarette consumption. The authors recommended viewing this estimate with caution, since large discrepancies between total reported imports and exports exist for many products, not only for cigarettes.

Yurekli and Sayginsoy (2010)[81] reported that 5383 billion cigarettes were smoked globally and 832 billion cigarettes, or about 15.5% of global consumption, were exported in 1999. Only 661 billion cigarettes (about 79% of global exports) were recorded as imports with no import records for the remaining 171 billion cigarettes. This difference was equal to about 3.2% of global cigarette consumption. As in Merriman et al.[9] (2000), the authors pointed out that such discrepancies exist for many globally traded commodities, and that this difference does not necessarily indicate the level of worldwide smuggling because of different export and import coding systems across countries.

2.5.5 Analyzing Seizures of Illegally Transported Tobacco

This methods measures only tax evasion and it is based on local customs and/or police authorities' reports on illicit cigarette seizures. Globally, the World Custom Organization (WCO) provides annual data on tobacco seizures from its Customs Enforcement Network (CEN). The authorities may know the likelihood that illegal cargo is intercepted and observed changes in the rate of illicit cigarette seizures could indicate changes in the scope of tax evasion, other things being equal. For example, if seizures of illicit cigarettes doubled with little or no change in the level of enforcement, one might conclude that the level of tax evasion also doubled.

However, using seizure data to assess the scope of tax evasion is problematic. First, the information may not be complete or easily available, and it could be difficult to establish its accuracy. For example, the submission of information to the WCO CEN database is not mandatory and the WCO reports warn that the CEN database does not permit the assessment of tax evasion. Second, the large seizures may not be representative

of the illicit market as a whole. Third, the amount of seizure depends heavily on the level of enforcement. If, for example, the budget of law enforcement authorities increases, seizures may increase as well without any change in the scope of tax evasion. Nevertheless, the amount of seized cigarettes provides the lower bound of the scope of tax evasion. Studying the seizures can provide information about the composition of the illicit market by analyzing, for example, the share of counterfeits among all seized cigarettes. It is important that the counterfeit products are determined by an independent expert.

There are no examples of studies published in the peer review literature that applied this method to estimate the scope of tax evasion. In Europe, **Joossens and Raw (2008)**[10] analyzed seizures to study the changes in illicit market. They found that the amount of cigarettes seized in Europe was negatively related to the Memorandum of Understanding between governments and various tobacco companies, to the strength of various anti-smuggling measures, and to legal actions brought against the tobacco industry. They concluded that the size of the illicit market is to large part controlled by the tobacco industry.

2.6 Summary and Recommendations for Estimating the Scope of Tax Avoidance and/or Evasion

Various methods of estimating the scope of tax avoidance/evasion exist. No single methodology will produce a definitive estimate since all of them have advantages and disadvantages. For example, some methods will capture a mix of tax avoidance and tax evasion without being able to distinguish between them, others will not be able to separate the impact that tourism and/or commuting patterns have on the estimates. Since the weakness of a particular approach can be exacerbated by specific market conditions, it is important to use specific local knowledge and creativity when applying these methods.

Given the complexity of tobacco tax avoidance and evasion, the multiple ways to engage in them, and the methods' limitations, it is important to triangulate the estimates of the scope of the problem. Generating multiple estimates using different methods will cross-validate results and minimize methodological objections.

The results obtained from multiple methods should be carefully compared taking into account the fact that different methods could measure different

phenomena. For example, estimates generated by methods that cannot separate tax avoidance from tax evasion should be at least as large as (or larger than) estimates generated by methods that capture only tax avoidance. The difference in estimates between these two methods could indicate the size of tax evasion. It is extremely important to carefully document all steps when conducting research so that studies can be peer-reviewed and their result can be replicated.

Many studies apply the same method over time in order to capture changes in the scope of tax avoidance/evasion rather than generate a point estimate of its scope. Such an approach is useful for evaluating the impact of policies and other factors with a possible impact on tax avoidance/evasion. Measuring the change rather than the scope also addresses some methodological weaknesses of the methods, even though this approach may not generate the estimate of the size of the problem. Repeating the same method over time when no changes relevant for the scope of tax avoidance/evasion occurred can be another useful way to cross validate the results.

This Methodological Guideline presents the most recent, commonly used methods to quantify tax avoidance/evasion, but there might be other methods available and new approaches can be invented taking advantage of new technologies and advanced techniques. Constantly changing market conditions will present opportunities for creative researchers to develop and test new methods. For example, new tracking and tracing systems employing an online coding system will allow researchers to use mobile audit devices to distinguish between products that avoid or evade taxes. Designing studies around the distribution network is another possibility.

Table 2 summarizes all methods measuring the scope of tax avoidance and tax evasion described in this chapter.

Table 2: Overview of Methods that Measure the Scope of Tax Avoidance and Evasion

	PRINCIPLES	ADVANTAGE	DISADVANTAGE	WHEN TO USE	EXAMPLE
Survey of tobacco users	Collecting self-reported data on packs' features and their sources from a statistically representative sample of the population	Direct method of estimating the scope of tax avoidance/evasion and availability of low-tax products	Underestimates tax evasion; problems of validity; potential bias due to social stigma and underreporting	Description of packs features sufficient to determine tax avoidance/ evasion; sufficient budget for a representative sample	Guindon et al. (2014); Stoklosa and Ross, 2014; Nagelhout et al. (2014)
Exam of cigarette packs obtained from smokers	Collecting packs from a statistically representative sample of smokers during an interview or by mail	Direct and objective method of estimating the scope of tax avoidance/evasion	Tax evasion cannot be detected without self-reported info from smokers and/or lab inspection; possible selection bias	Packs features allow to determine tax avoidance/ evasion by visual inspection; sufficient budget for a representative sample	Joossens et al. (2014); Fix et al (2014); Stoklosa and Ross, 2014
Exam of discarded cigarette packs	Collecting a random sample of littered cigarette packs from streets or from garbage	Direct and objective method of estimating the scope of tax evasion; can be less expensive than surveys	Cannot distinguish tax avoidance from tax evasion; estimates relevant only for narrow geographical areas; difficult to account for tourists/commuters	Packs features allow to determine tax avoidance/ evasion by visual inspection	Merriman (2010); Chernick and Merriman (2013)
Exam of cigarette packs obtained from retail	Collecting packs from a random sample of retail outlets	Direct and objective method of estimating the availability of illicit products via legal channels	Cannot estimate the scope of tax evasion; cannot detect tax avoidance; lab inspection needed to detect counterfeits	Packs features allow for determining tax evasion by visual packs' inspection; sufficient budget for a representative sample	Scollo et al. (2014)
Compare sales with consumption (gap analysis)	Subtracting tax-paid sales from consumption estimated from surveys	Transparent, replicable, and relatively low cost method that uses secondary data; estimates can be generated relatively quickly	Lack of reliable survey data; consumer underreporting, tourist purchases and RYO cigarettes can bias the results; better at estimating the change rather than the scope	Reliable and consistently collected tobacco use data exist over long period of time; sales data are available for the same time period	HM Revenue and Customs (2011)
Econometric Modeling	Estimating the demand for tobacco products as a function of incentives for tax avoidance/ evasion using regression analysis	Can detect various types of tax avoidance/ evasion; can model impact of policies	Sensitive to data quality; technically demanding	High quality data and an econometrician are available	Thursby and Thursby (2000); Merriman et al., 2000; Yurekli and Sayginsoy, 2010
Comparison of tax paid sales with estimated consumption	Compares trend in tax paid sales with trend in total consumption predicted using changes in prices, income, and known price/income elasticities of demand	Simple and intuitive method	Cannot distinguish tax avoidance from tax evasion; better at estimating the change rather than the scope	High quality data and an econometrician are available; estimates of price/income elasticities of demand are available	Walbeek (2014)
Comparison of actual and projected tobacco tax revenue	Comparison of budgeted and actual excise tax revenue for a long period of time	Simple and intuitive method; can detect changes in tax avoidance/evasion	Cannot estimate the scope of tax avoidance/evasion; cannot distinguish tax avoidance from tax evasion; cannot detect one time deviation from a trend	Tax revenue prediction and actual revenues for various products is available over time; country uses only a specific tax; authorities consider tax avoidance/ evasion when generating tax revenue estimates	Walbeek (2014)
Key informant interviews	Systematic collection of information from experts	Little technical skills required; low costs; relatively quick assessment of the situation	Subjectivity of the estimates; may generate bias results	Low budget; low technical skills; information needed quickly	Joossens and Raw (1998)
Monitoring tobacco trade	Monitoring the difference between countries' mirror records on imports and exports	Can detect smuggling hubs	Cannot estimate the scope of tax avoidance/evasion for individual countries; captures only large-scale tax evasion	Global estimate of a trend in large-scale tax evasion is needed	Merriman et al. (2000); Yurekli and Sayginsoy (2010)
Analyzing seizures of illegally transported tobacco	Obtaining data on cigarette seizure during certain time period for the whole country	Can generate the minimum scope of tax evasion. Can inform on the composition of the illicit market	Underestimate the scope of tax evasion; sensitive to enforcement effort	Complete data on seizure are publically available	Joossens and Raw (2008)

Assessing the Quality of the Estimates

The agendas of those who fund and/or conduct research on tobacco tax avoidance/evasion may have an influence on the methodology, presentation, and interpretation of the results. The tobacco industry may be interested in exaggerating the extent of tax avoidance/evasion in order to oppose tobacco tax increases and other tobacco control policies such as health warning labels or plain packaging.[83] Law enforcement agencies and policymakers may want to minimize the issue as this may indicate problems of efficiency or corruption. Alternatively, law enforcement agencies, the World Customs Organization, departments responsible for tax collection, and companies selling tracking and tracing technology (e.g., SICPA) could be interested in highlighting the issue in order to secure more resources for their activities. Tobacco control activists may either prefer higher estimates (e.g., to point out the manufacturers' role in tax evasion) or lower estimates (e.g., to minimize concern about the unintended effects of tobacco control measures) depending on the issue at stake.

Given the inherent difficulties estimating the scope of tax avoidance/evasion, and the motivation of various stakeholders to either overestimate or underestimate the size of the problem, it is very important to assess the quality of the estimates in such studies.

This chapter will first lay out criteria for assessing the quality of various studies (Table 3) and then provide examples of studies that in general meet, partially meet, or do not meet those criteria. The criteria do not have equal weight when determining the overall quality of a study, and not all of them are relevant for all methods. We ordered them somewhat arbitrarily, but tried to follow the logical structure of a typical research article. Therefore, the criteria do not need to be applied in the order presented in the table. Using various study examples, we will demonstrate how these criteria can be used to critique and interpret results generated by various research efforts.

The reminder of the section will review eight studies in the light of the criteria described in Table 3.

Table 3
Criteria for Assessing the Quality of Estimates

CRITERIA	CHARACTERISTICS OF STUDIES THAT **MEET THE CRITERIA** FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT **DO NOT MEET THE CRITERIA** FOR GOOD QUALITY
1. Peer reviewed	Published in a peer-reviewed journal; and/or explicitly refers to a peer-review process; and/or it is an official document of a reputable international or government organization.	No reference to a peer-review process; and/or specific terms under which study was prepared are not disclosed; and/or disclaimer about using the results at your own risk.
2. Funding	Funding acknowledged.	Funding not disclosed or acknowledged.
	Funding entity has no potential conflict of interest with respect to the subject of the study.	Funding entity has a potential conflict of interest with respect to the subject of the study.
3. Grounded in theory	Study distinguishes between various types of tax avoidance/evasion, and clarifies which types are the subject of the study.	Study doesn't distinguish between tax avoidance and tax evasion; it is not clear which type of avoidance/evasion is being measured.
	Takes into account any relevant factors that could influence the scope of tax avoidance/ evasion.	Fails to account for factors that could influence the scope of tax avoidance/evasion.
4. Transparency and replicability	Methods and data are adequately described so that the results can be replicated; data is publicly available or can be made available upon request.	Methods and data are not adequately described; the results cannot be replicated using the information provided in the study; data is not publicly available.
	Assumptions are clearly stated.	Assumptions are not stated or not stated clearly.
5. Generalizability of results	Sample size and sampling design are well described and allow for generalization of results to the entire country/region/population.	Sample size and sampling design are not adequately described; sample size is too small to allow for generalization of results.
	The sample is selected objectively.	The sample selection is biased.
	Sample attrition and non-response is described and taken into account; there is an attempt to establish the representativeness of the sample.	Sample suffers from large attrition and/ or high non-response rate and there is no attempt to correct for this or to establish the representativeness of the sample.
6. Objective criteria preferred over subjective criteria	Low-tax purchases are identified based on a set of objective criteria such as place of purchase, product price, etc.	Low-tax purchases are identified by respondents' self- report.
	Self-reported low-tax purchases are cross-verified using objective criteria.	There is no attempt to cross-verify the self-reported information using objective criteria.
7. Measurements are defined correctly	Survey questionnaire distinguishes between different tax avoidance/evasion categories.	Survey questionnaire doesn't clearly distinguish between different tax avoidance/evasion categories; categories may overlap and the same event might be counted multiple times.
	Conversion of cigarette sticks to/from weight measure is transparent and based on a well-established conversion factor.	Conversion of cigarette sticks to/from weight measure is not transparent or is not justified.
8. Identification of counterfeit products	Identification of counterfeit products is performed by an independent researcher or lab.	Identification of counterfeit products is performed by a party with a vested interest in in the results.
9. Presentation of results	Estimates are presented as a range or with confidence intervals that account for the statistical properties of the sample and/or various assumptions used in generating the estimate.	Results are not presented as a range or with confidence intervals. Results are not robust with respect to assumptions made.
	The size of the illicit market is expressed as a share of the total market.	The size of the illicit market is expressed as a share of the licit market. This makes the problem look bigger.
10. Cross-validates a point estimate using multiple methods or measures change over time using the same method	Uses multiple methods and/or corroborating information to cross-verify the estimates.	Estimates the scope of tax avoidance/evasion at one point in time without using multiple methods to cross-verify the results.
	Estimates changes in tax avoidance/evasion over time using the same method.	Corroborating evidence used to cross-verify results cannot be trusted based on criteria presented in this table.
11. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the applied methodology/data and assesses the implication of these shortcomings for the estimates.	Weakness of the applied methodology/data are not acknowledged/discussed.

Example 1

The first study is from France where **Lakhdar (2008)**[84] applied three approaches to assess the size of legal cross border shopping (tax avoidance) and illegal cigarette smuggling (tax evasion) after a series of tobacco tax increases that led to a 44.7% increase in cigarette prices from 2002 to 2004. First, he used a simulation model to predict cigarette sales in France over time (1999 – 2006) as if all regions experienced the same decline in consumption as reported by the region with the lowest decline in cigarette sales. The assumption was that the region with the lowest decline has not been affected by smuggling or cross-border shopping, because it experience such a small drop in sales. The predicted sales were then compared with the actual sale and the gap was attributed to tax avoidance/evasion. Sales data came from the tobacco industry because it possesses regional sales data. Second, he employed gap analysis and compared the official sale of manufactured and hand-rolled cigarettes with the estimates derived from national surveys that captured the consumption of the same products in one year (2005). The comparison was done on a regional level in order to assess the impact of the proximity to a border with a country with lower priced cigarettes. Third, the study collected all cigarette packs properly disposed of and processed in one waste management plant in a Paris suburb at two different points in time in order to identify the countries of origin of foreign tobacco entering France based on the brand, the language, the heath warning messages (if any), or other features. The author pointed out the lack of representativeness of this sample and considered this part of the study to be exploratory.

The first method estimated that cigarettes equivalent to 14 – 17% of legal sales in the period of 2004 – 2006 did not pay taxes in France, while the second method estimated that cigarettes equivalent to 20% of legal sale were not paying taxes in France in 2005. The collection of cigarette packs at a waste collection centre showed that foreign cigarettes accounted for 18.6% of the sample in 2005 and 15.5% in 2006. All three methods resulted in a very similar estimate of the size of the illicit market.

Based on the first method, the study concluded that the substantial tobacco tax increases in 2003 and 2004 led to an increase in cross-border shopping (tax avoidance) and cigarette smuggling (tax evasion), but the study could not distinguish between them. Since the majority of tax avoidance/evasion occurred near the borders, the study speculated that the problem is primarily related to cross-border purchases (which can be both legal and illegal). The study discussed alternative approaches to measuring tax avoidance/evasion and their implication for the estimates. The authors admitted that they did not consider distance to the low-price border as a factor motivating cross-border shopping and acknowledged the weakness of the survey-based consumption estimate that most likely suffered from underreporting. The estimates were presented as a range and the study was peer reviewed with no competing interests declared.

Table 4 summarizes how **Lakhdar (2008)**[84] fits the criteria for assessing the quality of the estimates. The main strength is the use of multiple methods to assess the scope of tax avoidance/evasion. The study has some weaknesses, but most of them are acknowledged. Therefore, the study can be categorized as well-executed, and its results can be trusted with the caveats highlighted by the author and in Table 4.

Example 1. Table 4
Assessing Lakhdar (2008)[84]

Criteria	Characteristics of studies that MEET THE CRITERIA for good quality	Characteristics of studies that DO NOT MEET THE CRITERIA for good quality
1. Peer reviewed	Published in a peer-reviewed journal.	
2. Funding	No competing interests were declared; The author's institution has no potential conflict of interest with respect to the subject of the study.	No funding acknowledged in the Acknowledgement, but most likely funded by the author's institution.
3. Grounded in theory	Study acknowledges that it measures a combination of tax avoidance (cross-border shopping) and tax evasion (illegal smuggling).	The distance to the state border is not taken into account, but this weakness is acknowledged. The impact of only one factor (tax increase) is considered.
4. Transparency and replicability	Methods and data are adequately described; some data is publically available; results could be replicated. Assumptions are clearly stated.	It is not clear if the industry data is publically available.
5. Generalizability of results	Two of the three methods allow for generalization of results to the entire country. The sample for two of the three methods is the entire country.	Sample size/sampling design of the trash method does not allow for generalization of results, but this is acknowledged. The sample selection of the trash method is biased, but this is acknowledged.
6. Measurements are defined correctly	The manufactured and hand-rolled cigarettes consumption is compared to the manufactured and hand-rolled cigarettes sale.	Packs' characteristics do not distinguish between tax avoidance/evasion but this is acknowledged.
7. Presentation of results	Estimates are presented as a range.	The size of illicit market is expressed as a share of licit market.
8. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Uses multiple methods and/or corroborating information to cross-verify the estimates.	
9. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the applied methodology/data and assesses the implication of these shortcomings for the estimates.	

Example 2

Another study that used different multiple methods to cross-validate the results was **Stoklosa and Ross (2014)**.[72] In 2011, they conducted a household survey and collected discarded packs to estimate the size of the illicit cigarette market in Warsaw, Poland. The goal was to identify packs that were not destined for the Polish market by inspecting excise tax stamps and health warnings.

The household survey used a quota sampling method taking into account the size, the gender and age composition of Warsaw's population. During the survey 400 smokers were asked to show all open cigarette packs in their possession. This was different from some previous surveys that only asked for an open pack. The interviewers found that in some cases, a smoker would have two packs open at the same time: one low-tax pack for their own use, and one full-tax pack if a visitor stopped by. The pack data obtained during the survey were weighted by the self-reported amount of monthly cigarette consumption.

The collection of discarded packs followed the methodology developed by Merriman[73] by randomly selecting 30 out of 783 voting districts in Warsaw to systematically collect 754 discarded cigarette packs.

All observed tax stamps were compared with official tax stamps provided by the Ministry of Finance. Packs with a tax stamp issued by another country or without the Polish health warning were classified as packs not taxed in Poland. To account for the possibility that the tax stamp was removed in the process of opening the pack, packs with a missing or damaged tax stamp, but with a health warning in Polish, were counted as full-tax cigarettes. This could underestimate the share of illicit cigarettes if some of the packs with Polish health warnings were not taxed. The data from packs collected on streets could not distinguish between tax avoidance and tax evasion. The packs observed during the household survey could have been supplemented by self-reporting data on the packs' provenance (e.g., brought to Poland legally by

travellers), which would allow estimation of the scope of tax avoidance and tax evasion separately, but this analysis was not performed.

The study found that 14.6% and 15.6% of cigarette packs were not intended for the Polish market, using the survey and the discarded pack method, respectively. The test of independence comparing the results based on the two methods determined that they are not statistically different. Since the two different methods agreed on the share of non-domestic cigarettes on the market, it seems unlikely that the study's disclosed weakness related to its relatively small sample size would have biased the results.

Table 5 demonstrates how various criteria for assessing the quality of the estimates were applied to Stoklosa and Ross[72] (2014). The main strength of the study is the use of multiple methods to cross-validate the results. The main weaknesses is the small sample size and the failure to separate tax avoidance from tax evasion using the self-reported survey data. The small sample size is acknowledged as a study weakness. Overall, the study can be categorized as well-executed and its results can be trusted, given that two different methods resulted in the same estimate.

Example 2. Table 5
Assessing Stoklosa and Ross (2014)[72]

CRITERIA	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed	Published in a peer-reviewed journal.	
2. Funding	Funding acknowledged. Funding entity has no potential conflict of interest with respect to the subject of the study.	
3. Grounded in theory	Study acknowledges that it measures a combination of tax avoidance (cross-border shopping) and tax evasion (illegal smuggling). The impact of other factors is controlled by the limited time span of the study period.	Study failed to separate tax avoidance (cross-border shopping) from tax evasion (illegal smuggling) using the survey data.
4. Transparency and replicability	Methods and data are adequately described so that the results can be replicated; data is publically available or can be made available upon request. Assumptions are clearly stated.	
5. Generalizability of results	Sample size and sampling design is well-described. The sample is selected objectively using a quota sampling method. Quotas for each district reflected the size of the district's population, and the gender and age distribution of the Polish population were taken into account.	Sample size is too small to allow for generalization of results, but this shortcoming is acknowledged. The limitation of the quota sampling methods is not acknowledged.
6. Objective criteria preferred over subjective criteria	Low-tax purchases are identified based on a set of objective criteria: the presence of a tax stamp or an appropriate health warning.	
7. Measurements are defined correctly	Survey questionnaire distinguishes between different tax avoidance/evasion categories.	The information that would allow the distinction between tax avoidance and tax evasion is not used.
8. Identification of counterfeit products		The identification of counterfeit cigarettes is not performed due to budget constraints.
9. Presentation of results	Estimates are presented with confidence intervals. The size of illicit market is expressed as a share of total market.	
10. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Uses multiple methods to cross-verify the estimates.	
11. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the applied methodology/data and assesses the implication of these shortcomings for the estimates.	

Example 3

Blecher E (2010)[85] employed gap analysis to estimate the size of the illicit cigarette market in South Africa between 1997 and 2007. First, he calculated the tax-paid sales by dividing the total excise tax revenue by the specific excise tax. Then, he estimated the cigarette consumption using adult smoking prevalence (from a national representative survey), official population estimates and average smoking intensity. Since the national survey did not collect data on smoking intensity for the period of 1997 – 2001, the author calculated it using non-linear decay function and the assumption that the illicit market did not exist in 1997 (i.e., dividing the tax-paid sales by number of smokers in 1997). The assumption of 0%, 5% and 10% smoking intensity underreporting allowed the author to test the sensitivity of the estimates. The study found that the size of the illicit market grew from 1997 until 2000 when it reached 9.4% – 11.5% of the total market. Between 2000 and 2007, the share of the illicit market was stable. In 2007, the share of illicit cigarettes was 7.0% – 11.2% of the total market.

As suggested by Table 6, Blecher E (2010)[85] meets most of the criteria for high quality estimates. The most valuable features of the study are the focus on the changes in tax avoidance/evasion over time using the same established methodology, and finding a solution for missing smoking intensity data. The study did not distinguish between various types of tax avoidance/evasion, which is typical for a macro-level analysis, and did not take into account the smaller size of the market when calculating the revenue loss. Both of these shortcomings are acknowledged.

Example 3. Table 6
Assessing Blecher E (2010)[85]

CRITERIA	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed	Published in a peer-reviewed journal.	
2. Funding	The author's institution has no potential conflict of interest with respect to the subject of the study.	No funding acknowledged in the Acknowledgement, but most likely funded by the author's institution.
3. Grounded in theory	Discusses factors that could have influenced the scope of tax avoidance/evasion.	Study doesn't distinguish between tax avoidance and tax evasion due to data limitations and due to the specific nature of the illicit cigarette market supply in South Africa.
4. Transparency and replicability	Methods and data are adequately described so that the results can be replicated; data is publically available or can be made available upon request. Assumptions are clearly stated.	
5. Generalizability of results	The use of macro-level data and nationally representative surveys allow for generalization of results to the entire country.	
6. Measurements are defined correctly	Measures of tax-paid sales and cigarette consumption are clearly defined.	
7. Presentation of results	Estimates are presented as a range or with confidence intervals that account for various assumptions used in generating the estimate. The size of the illicit market is expressed as a share of total market.	
8. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Estimates changes in tax avoidance/evasion over time using the same method.	
9. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the applied methodology/data and assesses the implication of these shortcomings for the estimates.	

Example 4

Data quality is a primary concern in low- and middle-income countries. Some of this quality deficiency can be overcome by applying appropriate and/or innovative methods.

Pavananunt (2011)[86] used two methods to estimate the size of the illicit cigarette market in Thailand for six selected years from 1991 to 2006. The first was the gap method that compared estimates of consumption with official sales. Cigarettes sales were estimated using tax data and 1% of the estimated amount was subtracted to account for damage or product loss. There is no information regarding the source of the tax data and no justification is provided for the 1% adjustment. Consumption of cigarettes was estimated by combining data from three different surveys (two different surveys for prevalence and one additional survey for average number of cigarettes consumed by a smoker). Even though it was not discussed in the paper, there is a high probability that each survey used a different sampling frame and/or different questions to collect data. This makes it difficult to compare trends over time. The author subtracted an estimate of consumption of hand-rolled cigarettes from total cigarette consumption since hand–rolled cigarettes were not included in the calculation of the sales data. However, the estimation of hand-rolled cigarette consumption required making numerous assumptions, which introduced additional noise into the time series data. The impact of these assumptions on the estimates are not discussed. The author also did not clarify whether the estimates of hand-rolled cigarettes shares came from the same surveys that were used to estimate cigarette consumption. The estimated consumption was considerably lower than legal cigarette sales, fluctuating from 29% to 54% of legal sales depending on the year of the survey. Such results would suggest illegal export of cigarettes taxed in Thailand to other countries. This is highly unlikely given that cigarette prices in Thailand are higher compared to its neighboring countries. The author attributed the gap between the tax-paid sales and consumption to possible under-reporting of cigarette use in the surveys and to the surveys' designs that did not capture consumption of migrant workers and visitors to Thailand. The author concluded that comparing sales with consumption is not a feasible approach to estimate the scope of tax avoidance/evasion in Thailand due to the shortcomings of the survey data. Therefore, the author focused on the second method that was based on discrepancies between export volume from countries exporting cigarettes to Thailand (UN Comtrade) and official data on imports from the same countries (Customs Department of Thailand) during 1991-2006.

On the country level, this method is primarily useful for identifying the source of illicit cigarettes, not for estimating the scope of tax evasion. In addition, using the trade discrepancy method is complicated by many factors, including the differences in trade classification systems and their changes over time. In this case, using trade data from two different sources introduced additional noise into the data and increased the likelihood that the discrepancy between recorded exports and imports does not accurately reflect the level of illicit trade. Nevertheless, the author adjusted these discrepancies using a three-year moving average to account for different time lags in data recording across countries, but no explanation was given for why three years was considered the most appropriate adjustment period. The results revealed huge differences between Thailand and their trade partners' records, ranging from 83% to 15% of the partner's export to Thailand. The missing import volume was assumed to be all consumed in Thailand even though there is no evidence to support this assumption. Based on this calculation, the author reported that the level of smuggling in Thailand rose from 3% in the early 1990s to a peak of 17% in 1998, then declined to 7% by 2004 and rose to 10% in 2005. The study further attempted to compare the trend in illicit cigarette trade obtained from trade discrepancies with excise tax rates over time. Even though it states that there was an increase in both the excise tax rate and illicit trade during the study period, the study concludes that there was no relationship between the size of the illicit cigarette market and the excise tax rate.

Table 7 summarizes the strengths and the weaknesses of Pavananunt (2011)[86] and shows that this study only partially meets the criteria of a well-executed study. The main contribution of the study was that it was the first systematic attempt to measure the size of the illicit market in Thailand. However, the study struggled with data quality and selection of the appropriate method. It acknowledged its shortcomings and called for more research to quantify the scope of tax avoidance/evasion in Thailand.

Example 4. Table 7
Assessing Pavananunt (2011)[86]

Criteria	Characteristics of studies that **MEET THE CRITERIA** for good quality	Characteristics of studies that **DO NOT MEET THE CRITERIA** for good quality
1. Peer reviewed	Published in a peer-reviewed journal.	
2. Funding	Funding acknowledged.	
	Funding entity has no potential conflict of interest with respect to the subject of the study.	
3. Grounded in theory	Takes into account relevant factors that could influence the scope of tax avoidance/evasion.	Study doesn't distinguish between tax avoidance and tax evasion and confuses legal tax avoidance with illegal tax evasion.
4. Transparency and replicability	Data is publically available or can be made available upon request.	The methodology and data are not fully described.
	Assumptions are clearly stated.	Some assumptions are not justified.
5. Generalizability of results	The use of macro-level data and nationally representative surveys allow for generalization of results to the entire country.	
6. Measurements are defined correctly	Measures of tax-paid sales and cigarette consumption are clearly defined.	
7. Presentation of results	The size of the illicit market is expressed as a share of total market.	Results are not presented as a range or with confidence intervals. Results are not robust with respect to assumptions made.
8. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Estimates changes in tax avoidance/evasion over time using the same method.	No cross-validation of results since one method is deemed unreliable.
9. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the applied methodology/data.	The impact of weaknesses on the estimates is not assessed.

Example 5

In Australia, three major tobacco companies commissioned a series of reports on the illicit tobacco market in Australia from major global consulting groups.[87-92] All these reports suffered from a lack of transparency and academic rigor[93-96] while relying survey data collected by Roy Morgan Research (RMR) and on empty pack surveys conducted by Klynveld Peat Marwick Goerdeler (KPMG). The survey methodologies employed by RMR and by KPMG were not adequately described and their data conflicted with the results of much larger nationally representative surveys. The major problem with the RMR survey was that it asked respondents if they purchased any contraband or any counterfeit cigarettes. People may not be always aware of the fact that they have purchased an illegal product unless these products can be clearly identified, which is not always the case. It is likely that the RMR questionnaire recorded the same purchase multiple times due to overlapping questions (e.g., counterfeited cigarettes were reported both as contraband cigarettes and also separately as counterfeited cigarettes), which could have resulted in double or triple counting of illicit purchases. Based on the average amount of illicit tobacco purchased, those who admitted purchasing illicit tobacco would have to use it almost exclusively. This conflicted with the results of a national survey that showed that the vast majority of smokers who used illicit tobacco products use them only occasionally. The Deloitte studies assumed that an illicit cigarette stick weighed 1.0 gram, but the assumption applied for the licit cigarettes was not disclosed. Most studies assume that the weight of a cigarette stick is 0.7 gram, the Australian government uses 0.8 gram for the weight of a legal stick, and the follow up study produced by KPMG[91] assumed that between 0.6 and 0.75 grams of RYO tobacco is used in each cigarette. If there was a different weight applied for licit and illicit cigarettes, and this difference was not justified, the scope of the illicit tobacco market could have been overestimated. The 2011 report claimed that illicit tobacco products represented 15.9% of the licit market in 2010, instead of reporting the estimate as a share of the total market, which would have been 13.7%. Reporting the estimate as a share of the licit market generates a larger, more dramatic figure. In that year, a tobacco control NGO, Quit Victoria, provided an alternative estimate based on publically available data: about 2–3% of the total market was estimated to be illicit.[93] The subsequent reports[89-91] provided estimates of a trend. The estimated share of illicit cigarettes in the legal market dropped from 15.9% in 2010 to 13.4% in 2011, to 10.5% in 2012, and increased to 14.2% in 2013. This would have been a drop from 13.7% in 2010 to 9.5% in 2012, and an increase to 12.4% in 2013 if the estimates were expressed in term of the share of the total market. Even though these estimates may have suffered from the same weaknesses, to the extent that the same methodology was used, the estimate of a trend should be valid. This means that the share of the illicit market

declined between 2010 and 2013, a result that was not highlighted in any of these studies. Aware of the criticism of the methodologically weak RMR survey, KPMG (2013b)[91] added a discarded pack collection survey.

However, the representativeness of their samples is questionable, and the number of legal non-domestic cigarettes was underestimated, thus overestimating the size of illicit cigarette market.[95] Even though the KPMG (2013b)[91] report tried to cross-verify the estimates of unbranded illegal tobacco use by estimating the sale of rolling paper, the result of this exercise was highly sensitive to assumptions about the amount of RYO tobacco used in each cigarette. The report assumed that each RYO cigarette uses between 0.6 and 0.75 grams per cigarette, while another study suggested that that amount is close to 0.45 grams.[95] Using higher amount of tobacco

per tube generated an upward bias in the estimates of use of unbranded tobacco.

Table 8 assess the quality of the reports on the scope of the illicit cigarette market in Australia. These studies clearly do not meet the good quality criteria. The only positive feature is the assessment of the trend, but given the lack of transparency, the consistent application of the same method cannot be guaranteed. KPMG (2014)[92] tried to address some weaknesses of the earlier reports (e.g., it stop relying on the methodologically weak RMR survey and accounting for legal consumption of foreign packs), but the lack of transparency about the methods and about contractual agreements with the tobacco companies who have a vested interest in the results put these estimates into the unreliable category.

Example 5. Table 8
Assessing the Industry-Funded Estimates in Australia

Criteria	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed		No reference to a peer-review process; terms under which study was prepared and reviewed are not disclosed; disclaimer about using the results at your own risk.
2. Funding	Funding by the tobacco industry acknowledged.	Funding entity has a potential conflict of interest with respect to the subject of the study.
3. Grounded in theory	Study distinguishes between various types of tax avoidance/evasion, and clarify which types are subject of the study. Takes into account some factors that could influence the scope of tax avoidance/evasion.	Fails to account for the presence of tourist and foreign students that could influence the scope of tax avoidance/evasion.
4. Transparency and replicability		Methods and data are not adequately described; the results cannot be replicated using the information provided in the study; data is not publically available. Assumptions are not stated or stated clearly.
5. Generalizability of results		Sampling design is not adequately described. Survey sample suffers from high non-response rate and there is no attempt to correct for this or to establish the representativeness of the sample.
6. Objective criteria preferred over subjective criteria		Low-tax purchases are identified by respondents' self- report, and there is no attempt to cross-verify the information using objective criteria.
7. Measurements are defined correctly		Survey questionnaire doesn't clearly distinguish between different tax avoidance/evasion categories; categories may overlap and the same purchase might be counted multiple times. Conversion of cigarette sticks to/from weight measure is not transparent or is not justified.
8. Identification of counterfeit products		Identification of counterfeit products is performed by a party with a vested interest in in the results.
9. Presentation of results	The size of the illicit market is expressed as a share of the total market (KPMG and PwC reports).	Results are not presented as a range or with confidence intervals. Results are not robust with respect to assumptions made. The size of the illicit market is expressed as a share of the licit market (Deloitte reports).
10. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Changes in tax avoidance/evasion over time are presented in later reports.	Earlier reports present a point estimate of the scope of tax avoidance/evasion. Corroborating evidence used to cross-verify results cannot be trusted based on criteria presented in this table.
11. Acknowledgement of methodological weaknesses		Weaknesses of the applied methodology/data are not acknowledged/discussed.

Example 6

In Europe, Project Star conducted by KPMG has provided an annual estimate of illicit tobacco market volume and market share at both national and EU levels since 2006, even though the first report that became publically available is from 2011 and provided estimates for 2010.[77] The project is the result of an agreement between Philip Morris International (PMI), the European Commission, OLAF (the European Anti-Fraud Office) and the EU Member States. The data comes from statistics on legal cigarette sales, discarded packs surveys, and from consumer surveys. The sale data are in most cases provided by PMI, and corroborated by prevalence data, also obtained from PMI despite the fact that official WHO prevalence data are publically available. Since the scope of tax avoidance/evasion depends to some extent on prevalence estimates, and the PMI and WHO data on prevalence differ, the results may be suspect on this ground alone. The discarded pack collection at a country level is conducted by various commercial entities under contracts with the main tobacco manufacturers. In each country, a sample of littered cigarette packs is periodically collected in several medium and large cities in order to determine the prevalence of non-domestic and counterfeit products, while also studying the non-domestic (i.e., both legal via the import allowance and illegal via smuggling) cigarette market shares of four main manufacturers. However, the methodology of empty pack surveys and the model used to generate estimates are not sufficiently described to judge the quality of the estimates, but there is evidence that the tobacco industry used selective sampling in order to systematically misrepresent the size of the illicit cigarette market.[66] Specifically, the sampling method in Germany overrepresented geographic regions along the country's eastern border and around U.S. military bases, where evidence of more tax avoidance/evasion can be expected. In some cases, the sample sizes of the empty pack survey vary substantially from its original targets without any explanation. For example, the target sample size for Poland in 2011 was 34,000 packs, but the final sample consisted of 694,547 discarded cigarette packs.[72] All data are collected in cities, thus underrepresenting the rural population. The estimates of non-domestic packs rely heavily on expertise and data provided by the tobacco industry, which has an obvious conflict of interest. For example, the manufacturers determine if a discarded pack is genuine or counterfeit while knowing that there are penalties if the genuine pack share rises to a certain level.[18] A close examination of the 2010 results revealed that almost a quarter of the EU illicit cigarette market consisted of PMI's own brands, while counterfeited PMI brands represented just 5% of this market — a finding obscured by PMI's public presentation of the data.[18] The consumer survey data are used to estimate the scope of legal non-domestic consumption, but this method fails to account for legal cross-border purchases by migrant workers, foreign students, and those living in the border areas, thus overestimating the size of illicit cigarette market. Project Star estimated that 9.9% of the total EU market consisted of illicit cigarettes in 2010.[56] An independent study estimating the scope of illicit cigarette consumption in 16 EU countries found that only 6.5% of the total market consisted of illicit cigarettes. This is 33% lower compared to the 9.7% Project Star estimate for similar countries. The 2012 Project Star estimates stated that that 65.5 bn cigarettes, or 11.1% of total EU consumption, is illegal.[98]

In Asia, Philip Morris International (PMI) funded the Asia-11 and Asia-14 illicit trade studies, which relied on a methodological approach similar to the KPMG Project Star and were executed by the International Tax and Investment Center (ITIC) and Oxford Economics.[99,100] The International Tax and Investment Center (ITIC) claims to be an independent non-profit research and education foundation that serves as a clearinghouse for information on best practices in taxation and investment policy. However, it is funded by the major transnational tobacco companies (Philip Morris International, British American Tobacco, and JT International), which calls into question ITIC's independence.[101] Oxford Economics is a commercial consulting group. The Asia-11 and Asia-14 reports, like the KPMG reports for the EU, lacks specifics about its methodology, sampling design, and data sources.[102-104] The data analysis often relies on industry-provided data and on methodologically weak estimates, while the description of the surveys makes it difficult to assess the extent to which they provide representative and meaningful data. Surveys conducted via telephone interviews are particularly problematic since many households in lower income countries may not have telephones. The scope of the empty pack surveys is not well described. If these surveys were conducted in popular public places in urban areas and/or during peak tourist times, or were conducted in a nonrandomized unscientific manner (e.g., selecting known hotspots for illicit consumption), such surveys will overestimate the extent of illicit cigarette trade. In addition, the report does not provide a clear rationale for selecting countries for this report.[102] Both the Asia-11 and the Asia-14 reports as well as the Project Star reports ignore the possibility that the tobacco industry could be a source of illicit products and that the legal supply chain is not secure.

The Project Star and Asia-11 reports are assessed against the quality criteria in Table 9. Each study clearly failed to meet the majority of the criteria and, as advised by the studies themselves, the public should rely on these estimates at their own risk.

Example 16. Table 9

Assessing Project Star[105,98] and Oxford Economics (2012)[99]

CRITERIA	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed		No reference to a peer-review process; specific terms under which study was prepared are not disclosed; disclaimer about using the results at your own risk.
2. Funding	Funding by tobacco company acknowledged.	Funding entity has conflict of interest with respect to the subject of the study.
3. Grounded in theory	Distinguishes between various types of tax avoidance/evasion. Takes into account only some factors that could influence the scope of tax avoidance/evasion.	Fails to account for some cross-border shopping and purchases by migrant workers and foreign students, which could overestimate the scope of tax evasion.
4. Transparency and replicability		Methods and data are not adequately described; the results cannot be replicated using the information provided in the study; data is not publically available. Assumptions are not stated or stated clearly.
5. Generalizability of results		Sample size and sampling design is not adequately described; sample size is too small in some countries to allow for generalization of results. The sample selection for discarded packs is biased – urban areas only; biased prevalence estimates. Sample suffers from high non-response rate and there is no attempt to correct for this or to establish the representativeness of the sample.
6. Objective criteria preferred over subjective criteria	Low-tax products are identified based on a set of objective criteria.	The identification criteria are defined by a stakeholder with a vested interest in the results.
7. Measurements are defined correctly		The method cannot distinguish between various types of tax avoidance and tax evasion categories. Questionnaire does not distinguish between different types of tax avoidance/evasion (Asia study).
8. Identification of counterfeit products		Identification of counterfeit products is performed by a party with a vested interest in in the results.
9. Presentation of results	The size of the illicit market is expressed as a share of total market.	Results are not presented as a range or with confidence intervals.
10. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Estimates changes in tax avoidance/evasion over time using the same method in Europe. Multiple approaches are used, but they are complementary and cannot be relied upon in isolation.	Only point estimate presented in the Asia report. Corroborating evidence used to cross-verify results cannot be trusted based on criteria presented in this table.
11. Acknowledgement of methodological weaknesses		Weaknesses of the applied methodology/data are not acknowledged/discussed.

Example 7

A study from Italy **Calderoni (2014)**[97] claimed to use a new method to estimate the volume of the illicit cigarette market and the associated revenue loss for a four year period (2009–2012) at the regional level. The study relied on data collected for the industry-sponsored Project Star (KPMG, 2013a)[98] and on data directly provided by Philip Morris International. Even the author himself expressed concerns about data quality,

but he used them anyway to generate regional estimates by simply weighting the national estimates by the regional estimate of smokers' share in the population and 'non-domestic' packs in the empty pack surveys. The author recognized that the non-domestic packs share was a poor proxy for illicit trade share, because empty pack collection cannot distinguish between tax avoidance and tax evasion. The study reported that the revenue loss due to tax avoidance/evasion increased from €0.5 bn in

2009 to €1.2 bn in 2012, and suggested that the share of illicit cigarettes on the market is driven by proximity to countries with cheaper cigarettes. The author failed to mention that proximity can also motivate legal cross-border shopping.

The author of the study, Professor Calderoni, is a researcher at Transcrime, a research center associated with the Università Cattolica del Sacro Cuore in Milan and funded by Philip Morris International. Although Transcrime researchers claim to have full control over their research results, their reports closely reflect tobacco industry views on public policies. In addition, tobacco companies often present Transcrime's work

in policy debates without mentioning their industry funding, creating the impression of a broad independent constituency in favor of the industry's arguments against tobacco control policies.[63]

Table 10 summarizes the critique of Calderoni (2014). Despite the study being published in a peer-reviewed journal and meeting some criteria of a well-executed study, it suffers from a major weakness of relying on poor quality data. In addition, the author works for an institution funded by the tobacco industry. These two features call the results of Calderoni (2014) into question.

Example 7. Table 10
Assessing Calderoni (2014)[97] Estimates

CRITERIA	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed	Published in a peer-reviewed journal.	
2. Funding		Funding from tobacco industry not disclosed/acknowledged. Funding entity has a potential conflict of interest with respect to the subject of the study.
3. Grounded in theory	Study describes various types of tax avoidance/evasion. Takes into account various factors that could influence the scope of tax avoidance/evasion.	Uses results of a study that cannot distinguish between tax avoidance/evasion.
4. Transparency and replicability	Methods and data are adequately described so that the results can be replicated. Assumptions are clearly stated.	Data is not publically available.
5. Generalizability of results		Sample size and sampling design are not adequately described; sample size might be too small to permit regional level estimates. The sample selection is biased toward urban areas. There is no attempt to establish the representativeness of the sample.
6. Objective criteria preferred over subjective criteria	Low-tax products are identified based on a set of objective criteria.	The identification criteria are defined by a stakeholder with a vested interest in the results.
7. Measurements are defined correctly		The method cannot distinguish between various types of tax avoidance and tax evasion categories.
8. Identification of counterfeit products		Identification of counterfeit products is performed by a party with a vested interest in the results.
9. Presentation of results	Estimates are presented in a range that accounts for various assumptions used in generating the estimate. There are some indications that the size of revenue loss due to illicit market is expressed as a share of potential revenue.	It is not clear that the size of revenue loss is expressed correctly, and it is not clear how it was calculated.
10. Measures change over time using the same method or cross-validates a point estimate using multiple methods	Estimates changes in tax avoidance/evasion over time using the same method.	No cross-validation of results.
11. Acknowledgement of methodological weaknesses	Points to possible weaknesses of the data.	

Example 8

In the USA, LaFaive and colleagues from the Mackinac Center for Public Policy generated estimates of tax avoidance and tax evasion for 47 US states from 1990 to 2006 using econometric analysis and taking advantage of cross-state and cross-time variation in state excise taxes and smoking prevalence.[106] Their model consisted of two parts. The first part estimated state per capita tax paid sales as a function of state-level smoking prevalence and a time trend. The time trend was supposed to represent smoking intensity and consumption underreporting, assuming that smoking intensity and consumption underreporting are similar across states and exhibit similar trend, while there was no underreporting of smoking prevalence. However, this assumption is not realistic since there are differences in smoking intensity across states[26], smoking prevalence is being underreported[69], and social norms that influence underreporting can have different trends across states given their diverse approaches to tobacco control.[22]

The second part of the model estimated the gap between actual sales and sales predicted by the first part of the model as a function of average tax differential with neighbouring states weighted by the population living near the border, the population living on both sides of the border as the share of the state population, the state tax differential with the state of North Carolina (North Carolina was not included in the model), and a state tax for states with Native American reservations and/or states with Mexican or Canadian borders. The population variable is problematic since only the border population in a particular state is motivated to either cross-border shop or not, and this motivation is unaffected by the population size on the other size of the border. The mean of the population variable is 1.305, meaning that on average 130.5% of state population would be potentially motivated by the tax differentials. The model treated the presence of a Canadian and Mexican border the same way as it treated the presence of Native American reservations, assuming that the motivation to shop there was to avoid state taxes without considering the prices of cigarettes in those two countries. In addition, the model assumed that North Carolina is the only source of all illegal bootlegging, given its no-tax-stamps requirement and relatively low tax. This is not a realistic assumption given the empirical evidence that other states are also the source of cigarette bootlegging.[64]

Given the problematic assumptions and definitions of some variables as well as issues with the model specification, the results should be interpreted with caution. The tax differential with a neighbouring state, which was supposed to estimate the extent of cross-border shopping, was statistically significant, but had the wrong sign, meaning that higher tax in a state would motivate people from a lower-tax state to cross the border and buy cigarettes with higher taxes. The authors dealt with this unexpected result by including an interactive term between tax difference and the percentage of population living near the border. However, this variable is problematic, as indicated above. The state tax differential with the state of North Carolina had the correct sign, and the authors concluded that this differential causes commercial smuggling. However, the model could not capture large scale tax evasion by diversion, which involves the manipulation of accounting records, reporting only a portion of their sales, or importing illegal cigarettes from overseas. The country-level Michigan model evaluating the impact of tax increases in neighbouring states also generated mixed results, with several coefficients having a wrong sign. The results that had the wrong signs were ignored by the authors.

Table 11 outlines the shortcoming of LaFaive et al,2008 The study meets some criteria of a well-executed study, but suffers from major limitations such as incorrect model specification and ignoring the results that do not fit the study's hypothesis. These issues might have been addressed if the study had been peer reviewed. In addition, the Mackinac Center for Public Policy has been criticized by leading academics for the low quality of its research.[28] Therefore, these results should be treated with considerable skepticism.

Example 8. Table 11
Assessing LaFaive et al (2008)[106]

CRITERIA	CHARACTERISTICS OF STUDIES THAT MEET THE CRITERIA FOR GOOD QUALITY	CHARACTERISTICS OF STUDIES THAT DO NOT MEET THE CRITERIA FOR GOOD QUALITY
1. Peer reviewed		No reference to a peer-review process.
2. Funding	Funding acknowledged.	Funding entities may have a potential conflict of interest with respect to the subject of the study.
3. Grounded in theory	Study distinguishes between various types of tax avoidance/evasion, and clarifies which types are subject of the study.	The model estimating tax avoidance/evasion is not correctly specified. Fails to account for some factors that could influence the scope of tax avoidance/evasion (e.g. regulation of cigarette Internet sales).
4. Transparency and replicability	Methods and data are adequately described; data is publically available or can be made available upon request. Assumptions are clearly stated.	
5. Generalizability of results	Sample size and sampling design is well described and allow for generalization of results to the entire country/region/population. The sample is selected objectively.	
6. Measurements are defined correctly		The motivation for tax avoidance/evasion is not correctly defined.
7. Presentation of results	The size of illicit market is expressed as a share of total market.	Results are not presented as a range or with confidence intervals. Results are not robust with respect to assumptions made.
8. Measures change over time using the same method or cross-validates a point estimate using multiple methods		Estimates the scope of tax avoidance/evasion during one period of time without using multiple methods to cross-verify the results. Another method is used to establish relationship between tax and tax avoidance/ evasion, but the results are not consistent with the study's hypothesis.
9. Acknowledgement of methodological weaknesses	Points to possible weaknesses.	The impact of the weaknesses on the estimates is not discussed; unexpected results are ignored.

Summary of examples

Even though assessing the quality of studies of tax avoidance/evasion may requires technical skills and experience, this chapter provides a set of simple indicators that allow even a lay person to form an initial opinion about a study. A study that does not meet one or more of the quality criteria should be subject to scrutiny by experienced and independent researchers.

The studies subject to such scrutiny in this chapter are summarized in Table 12.

The summary in Table 12 clearly demonstrates that studies supported by the tobacco industry cannot be trusted due to lack of transparency and the use of potentially contaminated data. The estimates presented in these studies are consistently and substantially higher compared to those produced by independent researchers.[72,93]

Table 12
Summary of Studies Subject to the Quality Criteria

STUDY	NUMBER OF CRITERIA FOR HIGH QUALITY STUDY MET	NUMBER OF CRITERIA FOR LOW QUALITY STUDY MET	RESULTS CAN BE TRUSTED	MAIN REASON FOR TRUSTING/ NOT TRUSTING THE RESULTS
Lakhdar (2008)	12	8	Yes	Estimates cross-validated using multiple methods; weaknesses are acknowledged.
Stoklosa and Ross (2014)	15	5	Yes	Estimates cross-validated using multiple methods; weaknesses are acknowledged.
Blecher E (2010)	12	3	Yes	Focuses on the changes in tax avoidance/evasion over time; weaknesses are acknowledged.
Pavananunt (2011)	12	7	No	Struggles with data quality and appropriate methods; most weaknesses are acknowledged.
Industry Funded Estimates in Australia	5	18	No	Lacks transparency; data potentially biased; funder with a conflict of interest.
Project Star (KPMG 2011; KPMG 2013a) and Oxford Economics (2012)	7	17	No	Lacks transparency; data potentially biased; funder with a conflict of interest.
Calderoni (2014)	11	13	No	Relies on poor quality data; institute's funder has a conflict of interest.
LaFaive et al (2008)	9	10	No	Model not specified correctly; selective interpretation of the results.

Conclusions and Summary

This Methodological Guide updates the previous set of recommendations on how to estimate the scope of tax avoidance and tax evasion. We draw on the results of numerous empirical studies that tested the applicability of five methods described by the World Bank Toolkit #7 in a variety of settings. Over time, some of those methods have been refined, and some revealed new weaknesses, while new methods evolved as a response to the evolving nature of illicit tobacco trade, the policy debates surrounding the issue, and the development of new technologies.

Our Methodological Guide expanded the original five approaches into eleven distinct methods by adding five new methods and by separating one method (observing smokers) into two (survey of tobacco users and examination of cigarette packs obtained from smokers) due to their distinct features. Unlike the previous Toolkit, we summarize the principles of sound research at the beginning of the core section "How to Measure the Scope of Tax Avoidance and Evasion" and do not repeat it with each method. This allows us to focus on the distinct features of each methodology. Another new feature of this Guide is a critical assessment of the existing estimates of tax avoidance and evasion. The goal is to provide guidance on how to assess the quality of existing estimates and help various stakeholders, including the research community and policymakers, to navigate through studies that are presented to them. Since the sole focus of the Guide was to provide an estimate of the scope of tax avoidance and tax evasion, it does not describe methods to eliminate the problem. The WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products[3] provides a comprehensive overview on that subject.

Based on the assessment of the methods presented in this Methodological Guide, we recommend to use multiple methods that suffer from the minimum weaknesses, execute them according to the principles of the rigorous research and triangulate the results in order to cross-validate the estimates and minimize methodological limitation of individual methods. Such an approach will result in methodologically sound and objective quantitative estimates of tobacco tax avoidance and tax evasion.

It is hoped that this Methodological Guide will inspire the research community to study the scope of tax avoidance and tax evasion, apply the described methods, and build upon them in order to develop new ones. This will improve our understanding of the scope of the problem and allow for the development of tailor-made solutions to minimize it.

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