

5.1 Measures to assess the effectiveness of tobacco taxation

Introduction

Significant increases in cigarette and other tobacco product taxes are widely considered to be a highly effective mechanism to reduce tobacco use and, as a result, the death, disease, and economic and social costs caused by tobacco use (Jha & Chaloupka, 1999; Jha *et al.*, 2006). These tax increases are effective in inducing current tobacco users to quit, preventing youth from becoming regular users, keeping former users from restarting, and reducing the amount consumed by continuing users (Chaloupka *et al.*, 2000a). When the revenues from these taxes are used to support other tobacco control efforts (e.g.

enforcement of tobacco control policies, mass media information campaigns, and increased awareness of and access to cessation services and products), the impact is increased. Given this evidence, Article 6 (Figure 5.1) of the WHO FCTC, calls for Parties to the treaty to use tax and price policies to reduce tobacco use, while Article 15 (Figure 5.2) calls for the adoption and implementation of measures aimed at eliminating the illicit trade in tobacco products that can undermine the effectiveness of increased tobacco taxes.

This section focuses on measures to evaluate the effectiveness of tobacco taxation. Historically (and still the case in many countries), the

primary purpose of tobacco taxation was the efficient generation of revenue for use in financing government spending. As evidence about the impact of higher taxes on tobacco use has accumulated, an increasing number of governments, particularly in high resource countries, have used higher tobacco product taxes as a tool for reducing tobacco use and its consequences (Jha & Chaloupka, 1999). Similarly, these taxes can be used to correct for the externalities caused by tobacco use, such as the health consequences of exposure to environmental tobacco smoke among non-smokers, or the financial costs of publicly financed healthcare services in treating

1. The Parties recognize that price and tax measures are an effective and important means of reducing tobacco consumption by various segments of the population, in particular young persons.
2. Without prejudice to the sovereign right of the Parties to determine and establish their taxation policies, each Party should take account of its national health objectives concerning tobacco control and adopt or maintain, as appropriate, measures which may include:
 - a. Implementing tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption; and
 - b. Prohibiting or restricting, as appropriate, sales to and/or importations by international travelers of tax- and duty-free tobacco products
3. The Parties shall provide rates of taxation for tobacco products and trends in tobacco consumption in their periodic reports to the Conference of the Parties in accordance with Article 21.

WHO (2003)

Figure 5.1 WHO FCTC Article 6: *Price and Tax Measures to Reduce the Demand for Tobacco*

1. The Parties recognize that the elimination of all forms of illicit trade in tobacco products, including smuggling, illicit manufacturing and counterfeiting, and the development and implementation of related national law, in addition to subregional, regional and global agreements, are essential components of tobacco control.
2. Each Party shall adopt and implement effective legislative, executive, administrative or other measures to ensure that all unit packets and packages of tobacco products and any outside packaging of such products are marked to assist Parties in determining the origin of tobacco products, and in accordance with national law and relevant bilateral or multilateral agreements, assist Parties in determining the point of diversion and monitor, document, and control the movement of tobacco products and their legal status. In addition, each Party shall:
 - a. require that unit packets and packages of tobacco products for retail and wholesale use that are sold on its domestic market carry the statement: “Sales only allowed in (insert name of the country, subnational, regional, or federal unit)” or carry other effective marking indicating the final destination or which would assist authorities in determining whether the product is legally for sale in the domestic market; and
 - b. consider, as appropriate, developing a practical tracking and tracing regime that would further secure the distribution system and assist in the investigation of illicit trade.
3. Each Party shall require that the packaging information or marking specified in paragraph 2 of this Article shall be presented in legible form and/or appear in its principal language or languages.
4. With a view to eliminating illicit trade in tobacco products, each Party shall:
 - a. Monitor and collect data on cross-border trade in tobacco products, including illicit trade, and exchange information among customs, tax and other authorities, as appropriate, and in accordance with national law and relevant applicable bilateral or multilateral agreements;
 - b. enact or strengthen legislation, with appropriate penalties and remedies, against illicit trade in tobacco products, including counterfeit and contraband cigarettes;
 - c. take appropriate steps to ensure that all confiscated manufacturing equipment, counterfeit and contraband cigarettes and other tobacco products are destroyed, using environmentally-friendly methods where feasible, or disposed of in accordance with national law;
 - d. adopt and implement measures to monitor, document and control the storage and distribution of tobacco products held or moving under suspension of taxes or duties within its jurisdiction; and
 - e. adopt measures as appropriate to enable the confiscation of proceeds derived from the illicit trade in tobacco products.
5. Information collected pursuant to subparagraphs 4(a) and 4(d) of this Article shall, as appropriate, be provided in aggregate form by the Parties in their periodic reports to the Conference of the Parties in accordance with Article 21.

WHO (2003)

Figure 5.2 WHO FCTC Article 15: *Illicit Trade in Tobacco Products*

diseases caused by tobacco. However, a number of arguments have been raised in opposition to increased tobacco taxes, including that higher taxes will promote extensive tax avoidance among continuing users, result in increased smuggling of tobacco products, unfairly burden low-

income populations, and cause significant job losses. The alternative goals and potential consequences of increased tobacco taxation suggest the need to measure several outcomes resulting from a change in tobacco taxation. A simple conceptual framework for these outcomes is

contained in Figure 5.3 (the bold variables are covered in the text here; the other measures are discussed elsewhere in this Handbook and will not be described in detail in this section).

There are other outcomes that can be affected by tobacco taxation, as well as by other

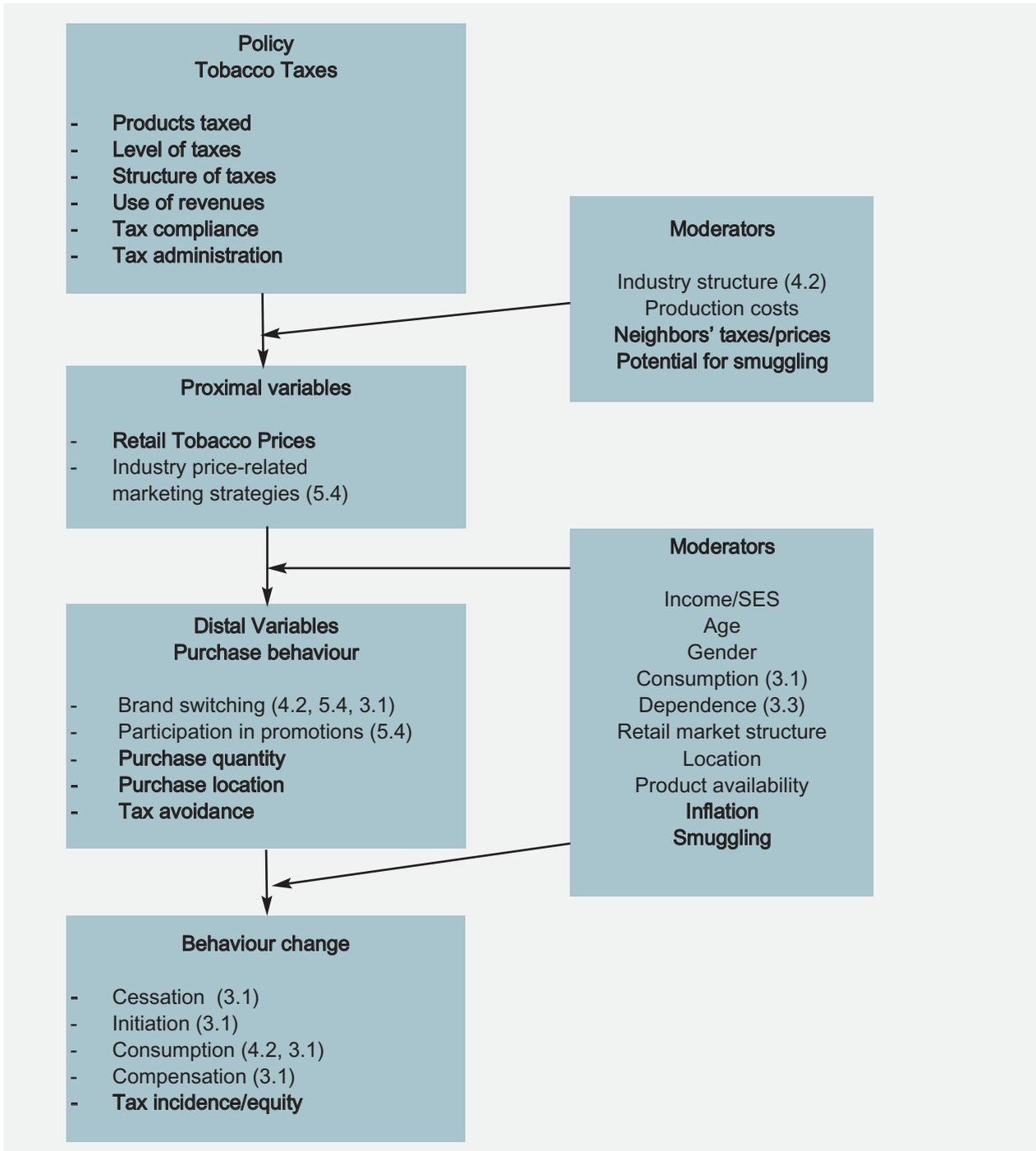


Figure 5.3 Conceptual framework for the evaluation of tobacco tax policies

Numbers in parentheses refer to sections in the Handbook covering those topics

In bold, variables covered in the main text

tobacco control policies and programmes. These include the effects of the reductions in tobacco use that result from tax increases, and other factors, on outcomes such as overall economic activity, as reflected by employment, national income, and development. Opponents of tobacco tax increases, for example, argue that higher taxes will have a negative impact as jobs in tobacco growing, manufacturing, and related activities are lost when tobacco use declines. These outcomes are beyond the scope of this Handbook; approaches to assessing these are described elsewhere (see, for example, Tool 5 of the World Bank's Economics of Tobacco Toolkit (<http://www.worldbank.org/tobacco>) on measuring the employment impact of tobacco control policies (Zhang, 2002)). This section will focus primarily on measuring tobacco product taxes and prices, the purchase behaviour of users, the extent of individual tax avoidance, larger scale tobacco product smuggling, and, briefly, the incidence of tobacco taxation.

Motives for tobacco taxation

It is important to understand the underlying motivation for tobacco tax increases in order to assess their effectiveness. Historically, the primary motivation for tobacco taxation was the efficient generation of government revenue, with nearly all countries having taxed tobacco products for many decades or, in some cases, centuries. Even in countries where

other motives have become more important, revenue generation remains a significant factor. The less than proportionate response of tobacco product consumption to changes in tobacco product prices (relatively "inelastic demand" in the language of economists), the small number of producers, significant consumption, and lack of good substitutes make tobacco products particularly attractive targets for excise and other taxation. As Adam Smith describes in *The Wealth of Nations*, "Sugar, rum, and tobacco, are commodities which are no where necessaries of life, which have become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation." (Smith, 1776). With few exceptions, tobacco product taxes have been relatively easy to administer and collect, have provided limited opportunities for tax avoidance and evasion, and have generated significant revenues (Sunley *et al.*, 2000; Yurekli, 2002).

In recent decades, as evidence on the health consequences of tobacco use has accumulated, additional motives for tobacco taxation have emerged. Of particular importance is the use of tobacco taxation as a tool for improving public health. This motive has gained prominence as economic evidence emerged on the effectiveness of increased tobacco product taxes and prices in reducing tobacco use, particularly among children and less educated, lower-income populations (Chaloupka *et al.*, 2000a).

Not that long ago, the conventional wisdom was that the addictive nature of tobacco use implied that increases in prices would have little or no effect on use. However, considerable economic research over the past three decades has clearly demonstrated that increases in tobacco taxes and prices are effective in reducing tobacco use. Well over one hundred studies from high-income countries consistently find that a 10% increase in cigarette prices will lead to relatively immediate reductions in overall tobacco use of between 2.5% and 5% (Chaloupka *et al.*, 2000a). About half of the impact on aggregate consumption results from reductions in the prevalence of smoking and half from reductions in cigarette consumption among continuing smokers (Chaloupka *et al.*, 2000a). Growing evidence from low- and middle-income countries suggests that the same price increase reduces overall smoking by up to twice as much (Jha & Chaloupka, 1999; Ross & Chaloupka, 2006). Given the addictive nature of tobacco use, the impact of a permanent price increase will take several years to fully appear, as addicted users respond to the increase in price. Estimates from the USA suggest that the long-run reductions in use resulting from a permanent price increase are about double the short-run effects (Chaloupka *et al.*, 2000b).

The reductions in prevalence caused by tax and price increases are largely the result of increased cessation among current tobacco users. Higher taxes and prices lead

numerous users to try to quit; while many eventually relapse, a significant number are successful in the long-term (Tauras & Chalouka, 2001; Tauras, 2004). In addition, key populations, such as youth and those on low incomes, are particularly sensitive to price. Growing evidence indicates that higher taxes and prices are particularly effective in reducing the number of youth who initiate regular smoking (Tauras *et al.*, 2001; Chaloupka, *in press*). Similarly, as implied by economic theory, tax and price increases lead to greater reductions in tobacco use among low-income, less educated populations than among higher-income, more educated persons (Townsend *et al.* 1994; Farrelly *et al.*, 2001). Given current smoking trends, tax and price levels, and evidence on the effects of price on smoking by different age and income groups, estimates indicate that tens of millions of premature deaths, that would have otherwise been caused by tobacco use over the next 50 years globally, could be averted by relatively modest increases in tobacco product prices (Jha *et al.*, 2006).

A final, related motive for tobacco taxation is that the tax can be used to correct for the external costs resulting from tobacco use. These include the healthcare costs from treating diseases among nonsmokers, as well as their lost productivity, that are caused by exposure to tobacco smoke, along with the publicly financed healthcare costs to treat tobacco-attributable diseases among tobacco users.

While there has been extensive research on the impact of tobacco taxation on tobacco use behaviours, country-specific evidence is lacking in most countries. In many countries where evidence is available on aggregate relationships, little is known about the impact of taxes and prices on tobacco use among key subpopulations (e.g. youth, low-income persons). Even in countries where substantial research has been done on these issues, questions remain (e.g. on nonlinearities on the impact of tax and price on tobacco: whether large tax increases have disproportionately larger or smaller effects than smaller tax increases).

As illustrated in Figure 5.3, the effectiveness of tobacco taxation in reducing tobacco use behaviour and concomitant harm, generating revenues, and covering the costs of tobacco use depends on:

- the degree to which increased taxes raise the prices of tobacco products, including the extent to which tobacco product manufacturers, distributors, and retailers pass along the tax increase, and/or engage in price-related marketing efforts that offset at least some of the amount of the tax increase, as well as the extent to which large-scale smuggling of tobacco products emerges/grows in response to the tax increases;
- the behavioural response of tobacco users to the increased taxes and prices, including not just changes in their tobacco use (e.g. cessation attempts,

reductions in tobacco product consumption, compensation), but also changes in their purchasing behaviour (including, for example, switching to cheaper brands, using price reducing promotions, and engaging in efforts to avoid the tax increases);

- the use of the revenues generated from the tax increase to support additional tobacco control activities, such as support for and promotion of cessation interventions (see Section 5.7), and mass media and other public education campaigns (see Section 5.6).

Measuring tobacco tax policy

The first step in assessing the impact of tobacco taxation is developing good measures of the structure of tobacco taxes. There are a variety of taxes that can be imposed on tobacco products. Generally, these include the following types (Table 5.1): customs (import/export) duties, excise taxes, sales taxes, and value-added taxes (VAT).

These taxes can be imposed at different levels and the base for one tax may include the other taxes. In the USA, for example, national excise taxes are collected from tobacco product manufacturers, while state and local excise taxes are collected from distributors. Sales taxes are imposed at the retail level by many states and localities, with most including excise taxes in the base for computing the sales tax. Similarly, the base for the VAT

Types of taxes	Definition
Customs duty	A tax on imports and/or exports, typically applied on a wide range of products, but may include additional levies on particular products.
Excise tax	A tax on selected goods produced for sale within a country or imported and sold in that country; can be specific (based on quantity or weight, independent of price) or <i>ad valorem</i> (assessed as a percentage of price).
Sales tax	A tax on a broad range of goods and services sold within a country, generally assessed at the point of sale to consumers and as a percentage of the retail price.
Value-added tax (VAT)	A general, indirect tax on consumption that is applied at each stage of production and distribution based on the value added to the product at that stage.

Sources: Yurekli (2002); Sunley *et al.*(2000)

Table 5.1 Types of Taxes Applied to Tobacco Products

used in many countries includes all excise taxes that have been collected, typically from tobacco product manufacturers.

Tobacco product excises are the most important of these, given that the others are typically applied to a wide range of goods and services, including tobacco products, while excises are applied to a few specific products (e.g. alcohol and gasoline). There are two basic types of tobacco excise taxes: specific taxes and *ad valorem* taxes (Table 5.2). Specific excise taxes are based on some measure of quantity, such as per stick taxes on manufactured cigarettes or weight-based taxes on roll-your-own tobacco. *Ad valorem* taxes are based on a measure of value and are typically applied as a percentage of the price (e.g. 50% of the manufacturer's price). When measuring *ad valorem* taxes, it is

helpful to include measures of the monetary value of the tax in addition to the percentage rate that is applied. Most countries apply some mix of specific and *ad valorem* taxes to tobacco products. Finally, for purposes of comparing tobacco taxes across countries, it is useful to express these taxes as a percentage of retail price including, when relevant, as a percentage of price for different categories within a product type (e.g. for locally produced and international brands of cigarettes).

Each form of the excise tax has advantages and disadvantages in achieving the goals discussed above (Sunley *et al.*, 2000; Yurekli, 2002). The revenues generated from specific excise taxes tend to be more stable than those generated from *ad valorem* excise taxes, given that revenues from the latter vary more with

industry pricing strategies (e.g. industry price cuts are effectively subsidized by the government when *ad valorem* taxes are applied). In the presence of high inflation, however, the inflation-adjusted value of the revenues from specific excises will fall over time, unless the tax is increased regularly, in contrast to the revenues from *ad valorem* taxes (assuming that industry prices are keeping pace with inflation). Specific excise taxes will generally result in a greater variety of products than will *ad valorem* taxes, since the price difference between higher quality and lower quality products will be smaller with specific taxes, creating a greater incentive to produce higher quality products. In general, if the primary motive for tobacco taxation is to reduce tobacco consumption, imposing specific tobacco excise taxes would be

Construct	Tobacco Product Taxes
Measures	Specific and <i>ad valorem</i> excise taxes applied to tobacco products.
Sources	Ministry of Finance, others (e.g. International Monetary Fund, WHO)
Validity	“Gold standard”
Variation	Different types of excise taxes and/or different tax rates are likely to be applied to different types of tobacco products; in some countries, sub-national tobacco excises are important to measure.
Comments	Useful to obtain other measures of tobacco tax administration, such as whether or not tax stamps are required, as well as excise taxes in other nearby jurisdictions. Also useful to estimate tax as a percentage of retail price for comparisons across countries and for assessing impact of tax on price in response to tax increases.

Table 5.2 Measures of Tobacco Product Taxes

preferred, particularly when inflation is relatively low (Sunley *et al.*, 2000).

In evaluating the impact of increases in tobacco product taxes on key outcomes, the size and timing of the increase will be important. For example, large tax increases can be implemented all at once or phased in through a series of more incremental increases over time. Existing estimates suggest a relatively linear relationship between the size of a tax increase and its impact on tobacco use behaviours; more research is needed to assess potential non-linearities in this relationship, differences in the effects of one-time large increases versus a series of smaller increases that add up to an equivalent increase over time, and related issues.

Given that excise taxes are typically included in the base for sales taxes and VAT, it is important to understand how

these taxes are applied to tobacco products in order to assess the impact of a tobacco tax increase on the prices users pay for tobacco products. Similarly, other aspects of tax administration will be integral to understanding the impact of these taxes on tax avoidance and smuggling, including: whether or not tax stamps are required and, if so, the design of the stamp and how it is applied; at what stage in the manufacturing and distribution process the taxes are collected; regulation and licensing of those involved in the distribution of tobacco products; the treatment of existing stocks of tobacco products when taxes are increased (e.g. whether or not “floor” taxes are applied); and more (Sunley *et al.*, 2000; Yurekli, 2002). In addition, there are other policies that focus on improving tax compliance, such as policies that target direct sales of tobacco products (e.g. Internet, mail, and phone sales), and that limit or ban duty

free purchases. Finally, some policies address the ultimate impact of tax increases on retail prices for tobacco products, such as policies that specify minimum prices for these products or that ban price reducing promotions for them.

In monitoring tobacco taxes and prices over time, it will be important to account for the effects of increases in the prices of other goods and services consumed (inflation). Taxes that are infrequently increased, or that increase slowly relative to the prices of other goods and services, will lose their value over time, potentially resulting in decreases in the inflation adjusted value of tobacco product prices (as, for example, occurred in the USA through much of the 1970s and early 1980s (Chaloupka, *in press*)). Declines in the relative (inflation adjusted) prices of tobacco products, all else constant, will lead to increases in the use of these products.

Proximal variables: measuring tobacco product prices

Understanding how tobacco tax increases affect the prices users pay for tobacco products is critical in measuring the effectiveness of tobacco taxation in both reducing tobacco use and in generating revenues; that is, price is the key mediator for tax. Increases in tobacco taxes are expected to result in increases in the prices of tobacco products. The extent to which tax increases are passed on to tobacco users will be moderated by number of factors, including the structure of the tobacco product market, tobacco industry pricing strategies, the costs of producing tobacco products, the potential for tax avoidance and smuggling, and the extent to which tobacco use responds to changes in prices (Chaloupka *et al.*, 2000a). In countries where the tobacco product markets are dominated by one firm and/or where costs of producing rise rapidly with output, it is likely that an increase in tobacco product taxes will result in less than comparable increases in tobacco product prices, particularly when tobacco use is relatively responsive to changes in price. In contrast, in countries where the tobacco product markets are highly competitive and where per unit production costs are independent of output, increases in tobacco taxes are likely to result in comparable increases in the prices of tobacco products. Existing empirical evidence, largely from the USA, indicates

that increases in tobacco taxes result in increases in tobacco product prices that will match or exceed the increase in taxes (Chaloupka *et al.*, 2000a).

A variety of approaches have been used to measure retail cigarette and other tobacco product prices at different levels of aggregation. These approaches differ widely in their cost and coverage. Retail price data can be collected from individuals, households, and retail outlets, and can be aggregated to the market, sub-national (e.g. state or province), or national levels. Some price data may be available from government sources, while others will be available from commercial or other private sources. Costs of obtaining or developing alternative price databases will vary considerably based on source and/or level of detail. Different types of price data are needed to answer different questions. For example, a composite measure of prices is sufficient for analyses that look at the impact of price on aggregate consumption, while brand specific prices will be important for analyzing the effect of relative prices on brand choice. As noted above for tax, it is important to account for the effects of inflation when evaluating the impact of tobacco taxes on tobacco product prices, and of taxes/prices on tobacco use and related outcomes.

For purposes of comparison, alternative retail price collection strategies will be grouped into three categories, based on the form of data collection: technology-based, observational, and

survey (Table 5.3). In places where multiple methods have been used to measure price, the measures produced are generally highly correlated with one another and follow consistent trends.

Technology-based systems for measuring prices:

Some measures of prices based on technology-based data collection systems take advantage of sophisticated technologies employed by a growing number of tobacco product retailers in at least some countries. Most prevalent are the “scanner-based” data collection systems that utilise the universal product codes (UPCs) included on most product packaging. These systems are most widely used in high-income countries, but are spreading to many low- and middle-income countries. Other technologies that go beyond those based on UPCs, such as radio frequency identification (RFID) tags, are starting to emerge, but have not yet been widely implemented. Companies such as A.C. Nielsen (<http://www.acnielsen.com>) and Information Resources International (IRI) (<http://www.infores.com>) collect and sell these data in a growing number of countries.

These high-tech data collection systems have the advantage of collecting more comprehensive and more detailed data than can be collected using other approaches. They essentially provide a census of the prices paid for every sale, by UPC, in the outlets that employ the relevant

Method	Description
Technology-Based	Uses of Universal Product Code (UPC) and scanner technology (or others) to collect detailed information on the sale of every tobacco product, including information on price, quantity, and use of promotion at detailed product/brand-level; limited to sample of participating vendors with relevant technology. Also used at the household level to collect detailed information on all household purchases of tobacco products and other consumer goods.
Observation	Use of trained observers to collect information (price, price promotions, packaging information, etc.) on selected tobacco products from a sample of tobacco product vendors.
Survey	Use of mail or telephone questionnaires of tobacco product vendors to collect information on prices and price promotions for selected products, or surveys of tobacco product users to collect information on prices and use of promotions for the products respondent consumes.

Table 5.3 Methods for Collecting Tobacco Product Prices

technology. Brand and package-specific information can be extracted from these data, as well as information on a variety of price-related promotions at the retail level. For example, prices for single pack, carton, and any multi-pack specials will appear separately for every brand in these data; to the extent that there are other in-store promotions, such as on-package coupons or other retail value added promotions (e.g. a free gift with cigarette purchase), these will be separately available as well. This type of data was used, for example, to document the associations between retail promotions for cigarettes and the Master Settlement Agreement, state cigarette excise taxes, and state tobacco control programmes in the USA (Loomis, *et al.*, 2006). In addition to the price data, these systems produce good measures of market share and the share of

sales that reflect at least some tobacco company promotional efforts in the sample of participating tobacco product outlets. These data were also used to examine how prices of and promotions for premium, discount, and deep discount cigarettes in the USA affected the share of the cigarette market accounted for by each category (Tauras *et al.*, 2006).

Comparable systems use UPCs and in-home scanners to collect data on prices and purchases at the household level from nationally representative samples. In the USA, for example, A.C. Nielsen maintains its HomeScan sample; IRI's comparable sample is the Combined Outlet Consumer Panel. Both are panels of tens of thousands of households that include information on the outlets from which household members purchase various products and the

quantities that are purchased; prices are input for purchases from outlets that do not participate in the store level, scanner-based database. Both companies maintain similar databases in other countries, as does Sofres, Taylor and Nelson, Inc. (<http://www.tns-global.com>).

The major limitation of these systems is their coverage. Given the manner in which data are collected, stores that do not employ the relevant technologies will be excluded. While these technologies are relatively widely used in high-income countries, there are many retailers that do not yet employ them; most likely in many low- and middle-income countries. In addition, at least some large retailers in some countries (e.g. Wal-Mart in the USA) do not participate in the systems. To the extent that prices, promotional activities, and sales patterns differ among included

and excluded outlets, the data produced by these systems may not be representative. The home-based data collections partially fill this gap, but generally do not include representative samples of households at sub-national levels. In addition, these systems do not provide complete geographic coverage, but instead tend to focus their data collection efforts on larger metropolitan areas. Again, to the extent that there are differences in prices, promotional efforts, and sales between more urban and more rural markets, the data produced by these systems may not be representative. In addition, these data are relatively expensive, particularly as the desired information is more disaggregated. Finally, given that these data are provided by commercial vendors, there will likely be some constraints imposed on how the data can be shared and/or published.

Observational approaches to measuring prices:

A second approach to collecting tobacco product price data is the use of observational data collection methods. This approach involves trained observers visiting tobacco product vendors and collecting information on the prices of various tobacco products, as well as measures of promotions that affect the price that consumers pay for these products (e.g. on pack coupons, multi-pack promotions). This approach is generally employed in collecting the tobacco product price data that are

included in consumer price indices in many countries. Similarly, the Economist Intelligence Unit (EIU; <http://www.eiu.com>) uses this approach to collect tobacco product prices (cigarettes and pipe tobacco) in 129 cities around the world. In the USA, ACCRA (formerly the American Chamber of Commerce Researchers' Association) used to collect cigarette prices for 250-300 metropolitan areas each quarter (<http://www.coli.org>). In addition, some market research companies (e.g. A.C. Nielsen) conduct store observations that collect detailed data on pricing, product placement, in-store advertising and promotion, and other marketing activities.

In these systems, cigarette and other tobacco product prices are typically one component of a larger price data collection effort. The EIU, for example, collects prices on over 160 products. These systems have usually been developed to measure changes in the cost-of-living over time and/or to compare the cost-of-living across locations. The EIU data were used, for example, to compare the affordability of cigarettes among low-, middle-, and high-income countries, and to assess the impact of affordability on cigarette consumption in these countries (Blecher & van Walbeek, 2004). Some of the more proprietary databases are used by companies to track their own pricing and marketing strategies, as well as to obtain information on the strategies employed by their competitors.

Tobacco policy researchers have also employed observational data collection methods to measure cigarette and other tobacco product prices and price-related promotions. For example, the ImpacTeen project employed these methods to collect price and other data from almost 17,500 retail outlets in nearly 1000 US communities from 1999 through 2003 (<http://www.impactteen.org>). These data were used, for example, to examine the impact of cigarette prices and point-of-sale cigarette marketing on youth smoking uptake (Slater *et al.*, 2007). Similarly, the Rockefeller Foundation's Trading Tobacco for Health Initiative (TTHI) developed and pilot tested methods for collecting these data in several Southeast Asian countries, as well as in selected other countries (<http://www.tobaccoevidence.net>).

There are a number of challenges to employing these methods to develop good measures of tobacco product prices. Perhaps the most significant is the development of the appropriate sample frame for use in selecting a representative sample of tobacco product retailers. Alternative approaches include using business list data (available at some cost from commercial vendors) to identify potential tobacco product vendors, sampling geographic areas and thoroughly canvassing them to identify these vendors, or using convenience samples of vendors that are readily identifiable and easily observed. ACCRA, for example, requires that observers

visit a minimum of five stores, but recommends more (particularly when there is substantial variation in price), but provides limited additional guidance (for details, see the ACCRA manual at <http://www.coli.org/surveyforms/colimannual.pdf>). In contrast, the ImpacTeen project used business list data to develop a sample of all retailers that might sell tobacco products (based on self-reported Standard Industrial Classification (SIC) codes), then conducted a short telephone screening call with each to determine whether or not they did sell tobacco products, and drew their sample from those that did sell. The TTHI, in contrast, employed a grid search method to canvass given geographic locations to identify tobacco product vendors. To the extent that there are a large number of more informal tobacco product vendors (e.g. street vendors, kiosks, etc. that might not appear in commercial business lists), the latter approach seems most appropriate.

A second challenge relates to the geographic area to be covered by the observational data collection methods. Producing nationally representative price measures in large countries would require multiple teams of observers throughout the country and would involve considerable expense. Alternatively, the approaches used by the EIU and ACCRA that limit data collection to cities or metropolitan areas and that employ convenience samples, will be significantly less costly. However, to the extent that there are significant geographic

differences in pricing and price-related promotional efforts, these differences will not be reflected in measures based on data from a limited number of locations.

A third challenge is determining the set of tobacco products for which price and other price-related data will be collected. In contrast to the high-tech methods described above that produce very detailed data at the UPC level, it is not feasible to try and collect data for more than a small fraction of available products. The EIU, for example, collects data on three products: one pack of Marlboro (or another international brand if not available), one pack of a popular local brand, and 50 grams of MacBaren pipe tobacco; similarly, ACCRA used to collect prices for a single product: a carton of Winston king-sized cigarettes. Research-based observational data collection efforts have typically selected a subset of products that includes the most widely consumed products/brands. When there are different price or other categories for some products (e.g. premium and discount cigarettes, or international and domestic cigarettes), then popular products/brands within each category are collected. To the extent that there is limited variation within a given product category (e.g. premium brand cigarettes), measures of price based on observational data collection for a small number of products will be a good reflection of overall prices.

A fourth challenge to developing good measures of tobacco product prices, based on the observational data collection

methods, relates to the aggregation of the brand specific data from multiple outlets into a composite price measure. Ideally, this measure would be an average price measure weighted so as to reflect the shares of sales of the different brands that it includes, as well as the sales in different types of outlets (to the extent that there are differences in prices across outlets). Brand share data may be available nationally, but are less likely to be available locally. Similarly, data on the share of sales accounted for by sales in different types of outlets are unlikely to be readily available in many countries.

Survey approaches for measuring prices:

A third approach to collecting data on tobacco product prices and price-related promotions is the use of survey methods. These include mail and telephone surveys of tobacco product vendors and population surveys (including surveys of tobacco users only).

The cigarette price data that have been most widely used in economic studies of the impact of cigarette taxes and prices on smoking behaviour are the price data reported for the USA in the *Tax Burden on Tobacco* (TBOT) (Orzechowski & Walker, 2007). Annual, state level average cigarette prices have been collected and reported for over five decades in the TBOT, with reported prices reflecting weighted averages of prices for single packs, cartons, and vending ma-

chine sales (where weights are based on national shares); since the growth of discount brands in the late 1980s, alternative price series, one including discount brands and one excluding these brands, have been produced. Researchers have used these price data to examine the impact of prices on tax paid cigarette sales (Farrelly *et al.*, 2003a), adult smoking prevalence (Farrelly *et al.*, 2001), smoking cessation (Tauras & Chaloupka, 2001; Tauras, 2004), and youth smoking initiation (Tauras *et al.*, 2001). Reported prices are supposed to reflect the normal retail prices, exclusive of any price-related promotions. The price data are collected through a mail survey of cigarette retailers across the USA. Limited information about the survey itself, sampling frame, response rates, and underlying data is available from internal Tobacco Institute documents (Tobacco Institute, 1991).

In exploratory work on data collection methods done as part of the ImpacTeen project, researchers also conducted a mail and telephone survey of representative samples of tobacco product retailers in three US states, along with observational data collection in representative subsamples in each state. Prices were collected for ten brands of cigarettes in three price categories (premium, discount, and deep discount), as well as for a few other widely consumed tobacco products. In addition to price data, information on various price-related promotions was also collected. As was expected, response rates to

the mail survey were very low (less than 10%); response rates to the telephone survey were also low, albeit higher than to the mail survey. However, despite the relatively low response rates, the measures of price produced from the three methods were generally consistent with one another; though there was somewhat greater variance in the measures of the extent of promotional activity.

Similar efforts have been undertaken in other countries. For example, data were used on cigarette prices collected from a commune level survey to estimate the impact of price on the initiation and cessation of tobacco use in Vietnam (Laxminarayan & Deolalikar, 2004). Likewise, cigarette price data were collected from market level surveys in China and Russia to estimate the impact of price on smoking in these countries (Lance *et al.*, 2004).

The use of telephone or mail surveys of tobacco product vendors to collect data on tobacco product prices and price-related promotions faces several of the same challenges as described above for systematic observational data collection. Of particular note are the difficulties in developing an adequate sampling frame (particularly in countries/markets where more informal vendors are important), the feasibility of collecting detailed data for many products, and the challenges in aggregating the data in order to produce representative price measures.

Alternatively, price and price-related promotions data can be

collected through population surveys. A number of cross-sectional and longitudinal surveys have collected information on cigarette prices from respondents. These include population surveys, such as the Global Youth Tobacco Survey (GYTS), which has included questions on price in many of the countries in which the survey has been implemented, and the planned Global Adult Tobacco Survey (GATS) (these surveys are described in Section 4.3). Similarly, the International Tobacco Control Policy Evaluation Study's (ITC) longitudinal surveys of adult smokers, that are being conducted in a growing number of countries, asks smokers how much they pay for cigarettes. Most surveys that inquire about price only ask the relevant questions of current users; some, however, have asked all respondents, while others have asked current and former users.

The price data collected from these surveys are useful in developing aggregate measures of price (e.g. at the national and/or sub-national level, depending on the nature of the sample). However, the use of the individual's self-reported price in analyses that look at the impact of price on respondents' smoking behaviour is problematic given the likely reverse causality between smoking behaviour and price. That is, heavier smokers, all else the same, are more likely to choose less expensive brands, purchase in greater quantities, seek out less costly vendors, engage in tax avoidance, and take

advantage of price-reducing promotions. Given this, treating the self-reported price as an exogenous determinant of individuals' smoking behaviour will lead to an overestimate of the effects of price. Appropriately aggregated measures of price based on individual level self-reported prices can be used to overcome this problem.

In addition to using the surveys to collect prices, it is important to also collect information on the brand that the individual purchased including information on various characteristics of the product (e.g. for cigarettes, length, filter or no filter, and others), and the quantity purchased (e.g. number of cigarettes, grams of smokeless tobacco, etc.); these measures are discussed in detail in Section 3.1. Some surveys use questions that rely on respondents' ability to perform mathematical computations (e.g. on average, how much did you pay for each pack of cigarettes you bought last time?). For respondents that buy by the pack, this is straightforward; it is somewhat more difficult for those who buy by the carton and even more difficult for those who take advantage of multi-pack specials (e.g. buy-three-get-two-free). Alternatively, one could ask how much the respondent paid for their purchase and what quantity was purchased (e.g. for cigarettes, in packs, cartons, single cigarettes, other combinations). For example, the first draft of the GATS questionnaire includes the following questions:

The last time you bought cigarettes for yourself, how many cigarettes did you buy?

INTERVIEWER: RECORD NUMBER AND UNIT BELOW

1. Cigarettes
2. Packs
→ How many cigarettes were in each pack? _____
3. Cartons
→ How many cigarettes were in each carton? _____
4. Other: Specify: _____

How many cigarettes were in each [FILL]? ____

How much money did you pay for this purchase?

_____ [FILL COUNTRY CURRENCY]

Ideally, the price questions would be asked so as to capture the use of any additional price-reducing promotions (e.g. coupons) at this purchase; the collection of data on use of promotions is described in more detail in Section 5.4. One example of these types of price questions, from the US Current Population Survey's Tobacco Use Supplement (where the majority of purchases are by the pack or carton), is:

What price did you pay for the LAST pack of cigarettes you bought? Please report the cost after using discounts or coupons.

\$____.____

What price did you pay for the LAST carton of cigarettes you

bought? Please report the cost after using discounts or coupons.

\$____.____

When asking questions about price and purchase-related information, some surveys focus on the most recent purchase (as in the examples above), so as to minimize recall error and get a consistent measure of current prices. Other surveys focus on the "usual" price paid, brand consumed, and other purchase-related information. An example of this is the series of price questions from the US Adult Tobacco Survey:

How much do you usually pay for a pack of cigarettes?

\$____.____

How much do you usually pay for a carton of cigarettes?

\$____.____

This approach has the advantage of capturing consumers' typical behaviour, but will not pick up any changes in behaviour that may be particularly relevant for measuring price (e.g. a smoker taking advantage of a buy-one-get-one-free promotion for a brand other than the usual brand on their last purchase). Some ask questions on both usual and most recent purchase (e.g. some versions of the ITC surveys include variants of both types of questions).

In addition to, or as a substitute for, asking respondents for some of the detailed information on the products they consume, some

surveys have asked respondents to report the UPC on the pack of cigarettes that they are currently consuming (which can be used to determine brand, filter, flavor, length, etc.); the same could be done for other manufactured tobacco products. Likewise, in some face-to-face surveys (e.g. the version of the ITC survey conducted recently in Poland), respondents are asked to show the interviewer the pack that they are currently consuming; the trained interviewers can then record this information, along with other relevant information that can be helpful in assessing the extent of tax avoidance and smuggling (as discussed below). In many countries, price is recorded on the pack; to the extent that this is the case, respondents (or the interviewer) asked to examine the pack can report the listed price.

Some efforts to measure tobacco product prices rely on consumer or household expenditure surveys. These surveys typically collect information on expenditures on a wide variety of goods and services, including tobacco products, consumed by the individual/household over some specified period of time (e.g. previous week, previous month). Some of these surveys also include questions on tobacco product consumption and, in household surveys, who in the household consumed these products. Responses to these questions can be used to estimate price (by dividing total expenditures on tobacco products by total consumption of these

products). This type of derived measure of price should be used with more caution than the more direct measures described above given the potential compounding of errors across the various questions. This is of particular concern in household expenditure surveys where one family member reports on overall household expenditures and consumption, and/or in surveys where broad measures of tobacco expenditures and use are reported, rather than measure of product-specific expenditures and consumption.

Researchers have used either self-reported prices or price measures based on self-reported expenditures in a variety of studies. For example, one analysis of the demand for cigarettes in Bulgaria used self-reported cigarette prices (Sayginsoy *et al.*, 2002), while another used a measure of price derived from self-reported expenditures to estimate the demand for tobacco in Myanmar (Kyaing *et al.*, 2005).

As discussed above, the ability to use these data to assess how changes in tobacco product taxation affect the price consumers pay for these products will depend on the collection of other key variables. Example questions addressing other issues relevant to price are contained in other sections of this Handbook (e.g. brand choice in Section 3.1, use of promotions in Section 5.4).

Finally, some surveys collect a variety of other information related to tobacco taxation and tobacco product prices. For tobacco tax increases to have a meaningful

impact on tobacco use behaviours (e.g. promote efforts to quit or prevent youth from starting to consume regularly), the price increases need to be noticed and of sufficient magnitude to raise concerns in the user. How large the increase needs to be for this to happen, however, is moderated by the user's (or potential user's) characteristics, including their tobacco use. For example, economic theory predicts that low-income persons will generally be more responsive to changes in prices of the goods and services they consume than will high-income persons, given that consumption of each accounts for a greater share of the individual's budget. Empirical evidence confirms that this is the case for tobacco products (Townsend *et al.* 1994; Farrelly *et al.*, 2001).

Developing good measures of this awareness and concern is more challenging than measuring observable variables like tax and price. Nevertheless, a number of population surveys have attempted to address this by collecting data on the role of tax and price changes in an individual's smoking decisions, concerns about tax and price increases, perceptions of responses to increases in prices, responses to specific recent tax/price changes, perceptions about the effectiveness of price increases in reducing smoking (particularly among youth), support for tobacco tax increases, and other related attitudes and beliefs. Little research exists on the relationships of tax and price increases to

these questions and there is little evidence on their validity. A few examples of these types of questions include:

- In the last 6 months, have you spent money on cigarettes that you knew would be better spent on household essentials like food? (ITC)
- In the last month, how often, if at all, did you think about the cost of smoking? (ITC)
- If the price of cigarette rose today by \$___ per pack, how many cigarettes do you think you would smoke per week? (with comparable questions about switching to a cheaper brand, trying to quit, buying by the carton instead of the pack, etc.) (variations in ITC)
- Did the price of cigarettes affect your decision to stop smoking? (with comparable questions about starting, daily versus occasional smoking, and quantity smoked) (Ontario Tobacco Research Unit Canadian tobacco survey database (OTRU))
- Now thinking about your own patterns of smoking, how much effect on your smoking do you think each of the following would have in reducing your smoking...(a) if the price of cigarettes doubled, would this have a... (OTRU)
- The price of cigarettes has a big influence on keeping people your age from smoking (agreement/disagreement scale) (1999 Florida Anti-Tobacco Advertising/Media Evaluation - State Survey (US-FATMESS))
- Have you talked with friends

about the rising price of cigarettes? (US-FATMESS)

- Do you like raising the price of cigarettes to keep people from smoking? (US-FATMESS)
- How much additional tax on a pack of cigarettes would you be willing to support if some or all the money raised was used to support tobacco control programmes? (US Adult Tobacco Survey (US ATS))

These questions can provide data that may be useful for other purposes, but are not of primary importance for evaluating the impact of tobacco taxation (except, perhaps, in some limited circumstances). Questions about support for tobacco tax increases can be helpful in demonstrating public support for these increases, and those that tie support to funding of tobacco prevention/cessation programmes can similarly demonstrate support for these programmes; there are risks to furthering tobacco control, however, if responses indicate a lack of support. Questions on expected responses to tax and price increases can be used to estimate the potential revenue and public health impact of proposed tax increases; these types of questions are common in market research studies, but their predictive validity for tobacco research has not been assessed. Questions about responses to recent tax increases (or decreases, as was the case in Canada in the mid-1990s) can be useful in assessing the impact of these changes, particularly in the

absence of comparable baseline data or when attempting to disentangle the effects of tax changes from other policy changes around the same time.

Summary:

Three alternative methods can be used to measure tobacco product prices for use in assessing the impact of tobacco taxation on price and, ultimately, on tobacco behaviours. These methods have different strengths and weaknesses and the cost of implementing each can vary considerably. To the extent that a national measure of price is of most interest and a regularly repeated population survey of tobacco use is in place, including questions on price in such a survey would be the most efficient approach to collecting this measure. Table 5.4 briefly summarizes each.

Distal variables: measuring tobacco product purchase behaviour

To some extent, the impact of tobacco taxation on tobacco use behaviour will depend on opportunities for tobacco users (and potential users) to minimize the effects of the tax increase on the prices they pay for tobacco products. These opportunities will vary from location to location and will depend on factors such as:

- the variety of tobacco products available and the relative prices of these products, given

Construct	Prices of Tobacco Products
Measure 1	Technology-based systems for measuring prices, e.g. “scanner-based” retail sales data, radio frequency identification tags, in-home scanners.
Sources	A. C. Nielsen (http://www.acnielsen.com), Information Resources International (IRI; http://www.infores.com), Sofres, Taylor and Nelson, Inc. (http://www.tns-global.com)
Validity	Clearly validated
Variation	Comprehensiveness of sample varies over time within countries, and will vary considerably across countries as technologies diffuse. Validity will depend on the comprehensiveness of the system.
Comments	More comprehensive data than other approaches (e.g. brand and package-specific information, census of prices paid for every sale, price-related promotion). Limitations include incomplete participation of tobacco product vendors (particularly where there is a large informal sector), limited use of technology in many low- and middle-income countries, incomplete geographic coverage, and relatively high cost of the data.
Measure 2	Observational approaches, e.g. trained observers visit tobacco product vendors and collect price information.
Sources	Economist Intelligence Unit (EIU; http://www.eiu.com), ACCRA (http://www.coli.org), research-based efforts (e.g. ImpacTeen – http://www.impacteen.org), consumer price index, tobacco products component
Validity	Clearly validated
Variation	Existing international systems (EIU) provide limited product, outlet, and geographic coverage. More comprehensive systems could be developed at the country level for expanded set of products, more systematic sampling of vendors, and more representative geographic coverage. Validity will depend on the extent of implementation (e.g. products included, sample of vendors, and geographic coverage).
Comments	There are challenges in getting a comprehensive sample within and among geographic regions. It is also a challenge to determine which prices to assess and how to aggregate across brands. Costs of implementing a comprehensive system are likely to be high in most countries.

Table 5.4 Measure of Tobacco Product Prices

Measure 3	Survey approaches: mail and telephone surveys; population surveys.
Sources	U.S. Tax Burden on Tobacco (TBOT), Global Youth Tobacco Survey (GYTS), Global Adult Tobacco Survey (GATS), The ITC Project
Validity	Clearly validated
Variation	For vendor surveys: inclusion or exclusion of price-related promotions in prices; mix of products on which price/promotion data are collected; sample of vendors included; mail versus telephone survey. Validity will depend on comprehensiveness of survey, sample of vendors, and response rates. For population surveys: focus on last purchase versus usual purchase, quantity purchased, inclusion of price promotions. Validity will depend on the quality of the price questions.
Comments	For vendor surveys: response rates are low; difficult to develop an adequate sampling frame and collect detailed data on many products. For population surveys: self-reported price at the individual level should not be used to study the impact of price on individual level tobacco use behaviours; subnational aggregation of price can be problematic.
ACCRA: Formerly, American Chamber of Commerce Researchers' Association	

Table 5.4 Measure of Tobacco Product Prices

- the opportunities for substitution from one type of tobacco product to another in response to changes in relative prices that result from changes in taxes (e.g. switching to roll-your-own tobacco in response to an increase in taxes/prices on manufactured cigarettes)
- the variety of brands for a given type of product, particularly brands in different price categories, that allow for switching to less expensive brands in response to increases in taxes and prices (e.g. difference in prices among premium, discount, and deep discount brands; differences in prices between international brands and locally produced brands)
 - the availability of “discounts” based on the quantity purchased (e.g. prices for cigarettes that are lower per pack/per stick when purchased by the carton rather than by the pack)
 - the availability and extent of industry promotions that reduce the price or provide added value for at least some purchases including: on-pack money off coupons; multi-pack promotions (a different form of quantity discount, such as buy-one-get-one-free promotions); special price reductions at the point of sale; distribution of free cigarettes at sponsored and other events; and value added promotions, such as gifts with purchases (e.g. a “free” cigarette lighter with the purchase of a pack of cigarettes). Some of these will be available at the point of sale, while others may come through other channels (e.g. coupons in print advertising and direct mail promotions) (see Section 5.4)
 - differences in prices among local tobacco vendors (e.g. differences in prices between “convenience” stores where a premium is paid for the “convenience”) and less convenient, bulk purchase stores where quantity discounts are extensive
 - the extent of an “informal” market in tobacco products (e.g. street vendors with no fixed location), particularly as it allows for distribution of smuggled and/or counterfeit tobacco products
 - access to lower tax/price jurisdictions and/or distribution channels (e.g. other countries,

tax-exempt jurisdictions, such as Native American reservations in the USA, the Internet, and other direct tobacco product vendors), and ready access to these jurisdictions/channels that allow relatively easy, low cost opportunities to purchase from/through them.

As described in some detail above for measuring price, there are multiple methods for collection of and/or multiple sources for these data. The technology-based systems can provide comprehensive information on the range of products and brands that are sold in different types of outlets and on the relative prices across products/brands, many of the types of industry promotions for them, and/or the quantity discounts that are available on each. However, as discussed above, these databases are limited in several ways, particularly in capturing the full range of tobacco product vendors (most notably those in the informal sector, the Internet, and other direct vendors), and their utility for assessing the tax avoidance that can emerge in response to tax and price increases.

Observational methods can produce similar information on some of these measures. While not providing the extensive detail on product, brand, relative prices, promotions, and sales that is available in the technology-based systems, observational methods can provide at least some measures of the range of tobacco products and brands available and

the types of promotions on at least a selected set of these products. On the other hand, they can be applied to many different types of tobacco product vendors (including direct vendors, those in the informal sector, and others that allow for tax avoidance in nearby jurisdictions).

Similarly, information on all of these measures can be collected through surveys of tobacco users. As discussed in Section 3.1, surveys can provide good measures of the types of tobacco products consumed, as well as on brand choice, while the aggregate data described in Section 4.2 can be used to look at the market share for different types of products and/or brands. Section 5.4 describes the use of surveys to measure awareness of and participation in a variety of tobacco industry promotional efforts, including those that impact on the price tobacco users pay for the products they consume.

Purchase quantity:

Buying in greater quantity (e.g. by the carton instead of the pack) can reduce the per unit cost of tobacco products. Many surveys have assessed purchase quantity; some examples of these questions include:

- The last time you bought cigarettes for yourself, did you buy them by the carton, the pack, or as single cigarettes? (ITC)
- Do you usually buy cigarettes by the pack or the carton? (US ATS)

The GATS questions on price above provide a more flexible way of obtaining quantity purchased that can be applied in a wider range of settings than either of these questions. Similar questions can be developed for other tobacco products. As evidenced by these questions, timing of purchase can vary, with questions focusing on most recent purchase, regular/usual purchases, any purchase, and purchases over some specified period (last week, last month); the same will be true for other questions on purchase behaviour (Table 5.5).

Purchase location:

Many recent surveys have included a question or series of questions on purchase location, including type of vendor purchased from and efforts to avoid taxes by purchasing from different jurisdictions (Table 5.6). Given the extensive variation across countries, the response categories for these types of questions will need to be tailored to a given country so as to include responses that capture the full range of vendors and locations available to tobacco users. For example, the following question has been asked of cigarette smokers in recent waves of the ITC survey in Poland (for both last purchase and usual purchase):

Where did you buy your last pack of (or do you usually buy) cigarettes? (Gas station, Hypermarket, Grocery store/deli, Tobacco Shop, News stand/Kiosk, Marketplace (stationary stand/

Construct	Purchase Behaviour - Purchase Quantity
Measure	<p>“The last time you bought cigarettes for yourself, how many cigarettes did you buy?” RECORD NUMBER AND UNIT BELOW</p> <ol style="list-style-type: none"> 1. Cigarettes 2. Packs → How many cigarettes were in each pack? _____ 3. Cartons → How many cigarettes were in each carton? _____ 4. Other - Specify: _____ → How many cigarettes were in each [FILL]?
Source	GATS (draft questionnaire)
Validity	Evidence of utility, but with limitations.
Variation	Can be developed for other tobacco products; can be simplified where product packaging is standardised; can ask about last purchase or usual purchase quantity. Accuracy of self-report unclear, particularly from questions that limit responses to packs and cartons.
Comments	Important for assessing efforts to minimize price in response to tax increase by buying larger quantities which often reduce the per unit price.
GATS: Global Adult Tobacco Survey	

Table 5.5 Measures to Assess Purchase Quantity

fixed seller), Street seller (mobile seller), Over the Internet, Wholesaler, “Black Market,” Other)

Versions of the ITC surveys in other countries exclude some of these responses, but include others; for example, the French version asks about purchases outside France, but within the EU, as well as purchases outside the EU. US and Canadian surveys ask about purchases in other states and provinces, respectively, as well as in other countries and on Native American reservations (which are exempt from state/provincial taxes). Most versions of the ITC survey include duty-free shops as an option, and separate convenience stores from other

types of stores. The draft GATS questionnaire includes military stores (which are often tax exempt) and vending machines as options, while noting that the list needs to be adjusted to fit the local environment.

Tax avoidance:

Data from the questions on purchase quantity and location, coupled with the price, product, brand, and promotion questions discussed above and elsewhere in this Handbook, are helpful for assessing users’ efforts to minimize prices by changing various aspects of their tobacco product purchase behaviour. They

are also of some use in measuring the extent of tobacco users tax avoidance (i.e. their efforts to avoid taxes by purchasing their tobacco products in tax exempt locations, such as Native American reservation stores or from direct sales vendors located on reservations, duty free shops, military stores), or from vendors based in lower tax jurisdictions (e.g. in neighboring or nearby countries or sub-national jurisdictions, the Internet, and other direct vendors based in low tax/price jurisdictions) (Table 5.7). Finally, they have some utility in assessing the extent of more organised smuggling (the illegal transportation, distribution, and/or

Construct	Purchase Behaviour - Purchase Location
Measure	<p>“Where did you buy your last pack of cigarettes?”</p> <p>Responses tailored to local environment, can include: gas station, hypermarket, supermarket, grocery store/deli, convenience store, large discount store, tobacco shop, news stand/kiosk, marketplace (stationary stand/fixed seller), street seller (mobile seller), Native American reservation, military store, over the Internet, by mail, by telephone, wholesaler, another jurisdiction (e.g. country, state, province), “black market”, others</p>
Sources	The ITC Project, GATS, and other surveys
Validity	Evidence of utility, but with limitations.
Variation	Response categories need to be tailored to the specific country; can ask about last purchase versus usual purchase. Where used, the distribution of responses and trends over time have expected associations with other factors.
Comments	Important for assessing efforts to minimize price in response to tax/price increase by purchasing from lower price vendor.

The ITC Project: The International Tobacco Control Policy Evaluation Study
GATS: Global Adult Tobacco Survey

Table 5.6 Measures to Assess Purchase Location

sale or resale of tobacco products, generally in an effort to avoid all taxes), and/or counterfeiting (production and sale of cigarettes using brand names and packaging of popular brands sold by leading tobacco companies, typically without paying taxes), to the extent that some of the potential vendors will largely be selling smuggled or counterfeit cigarettes (e.g. mobile street vendors selling from backpacks or those in the “black market”). When assessing tax avoidance and smuggling is of particular interest, asking these questions for last purchase, usual purchase, and any purchase over a specified time period (e.g. three or six months), particularly when

coupled with information on quantity purchased, can be useful in producing upper and lower bound estimates for the extent of these problems. They can also be useful in assessing the impact of some of the policies designed to increase tax compliance that were mentioned above (e.g. policies targeting the Internet and other direct sales).

Measuring tobacco product smuggling

Given the illegal nature of tobacco product smuggling, measuring its extent for use in assessing the impact of tobacco taxation (both as an outcome and as a factor

which may moderate the impact of tobacco tax increases on price and tobacco use behaviour) is more difficult than measuring the constructs described above. While tobacco tax and price levels can help to explain the extent of smuggling, other factors can be as or more important in doing so; these include the degree of corruption in a country and the nature of tobacco product distribution (Jha & Chaloupka, 1999; Merriman *et al.*, 2000; Merriman, 2001). Moreover, improvements in technology, adoption of new policies, and strengthening of enforcement efforts and penalties appear effective in reducing the amount of

Construct	Purchase Behaviour - Tax Avoidance
Measure	Questions on purchase location, quantity, and price described in previous tables
Sources	The ITC Project, GATS, and other surveys
Validity	Evidence of utility, but with limitations.
Variation	Purchase locations relevant for assessing tax avoidance will vary from country to country. Purchasing from other jurisdictions, duty free shops, street sellers, and direct vendors (e.g. on the Internet) will typically reflect efforts to avoid local taxes; some locations will be relevant to assessing smuggling. Where used, associations between these measures and other factors (e.g. local taxes, proximity to lower tax or tax-exempt jurisdictions) are expected.
Comments	Information on differences in prices across vendors can help identify those that may be relevant for tax avoidance, coupled with information on quantity purchased (both last purchase and usual purchase) can provide a range for estimates of the extent of tax avoidance. Will be useful in addressing concerns about loss of tax revenues to tax avoidance in response to tax increases.
The ITC Project: The International Tobacco Control Policy Evaluation Study GATS: Global Adult Tobacco Survey	

Table 5.7 Measures to Assess Tax Avoidance

tobacco product smuggling (Chaloupka *et al.*, 2008). Despite this, concerns about smuggling often emerge as significant barriers to increased tobacco taxation. Developing good estimates of the extent of smuggling can be helpful in addressing these concerns. It is worth noting that counterfeit cigarettes are emerging as a significant component of illicit markets in tobacco products. Some of the methods and measures described in this section will be applicable to assessing the degree of counterfeit as well; for ease of exposition, however, the discussion here will focus on smuggling.

Five alternative approaches to measuring tobacco product smuggling are described in Tool 7

“Understand, Measure, and Combat Tobacco Smuggling” of the World Bank’s Economics of Tobacco Toolkit (<http://www.worldbank.org/tobacco>) (Merriman, 2001). These will be briefly described here (Table 5.8); those interested in applying these approaches should refer to the tool for more details. Some of these have been applied relatively widely, while others have yet to be systematically applied (or even pilot tested).

The first approach is to conduct key informant interviews with relevant industry representatives, law enforcement agents, government officials, and researchers working on these issues to get their estimates of the extent of the tobacco product

market accounted for by smuggling. Market research firms have used this approach and published estimates of the share of the market accounted for by smuggled cigarettes (e.g. Market Research International has published these in the *World Tobacco File*). Researchers have linked these data to potential determinants of smuggling (e.g. tax or price levels, corruption (Merriman *et al.*, 2000)), and the resulting estimates suggest that the measure produced from the key informant interviews are useful in comparing across countries. When aggregated, estimates of global smuggling produced from these data are consistent with those produced from other methods described below, sug-

Construct	Tobacco Product Smuggling
Measure 1: Key Informant Survey- based Estimates	Surveys of industry representatives, law enforcement agents, government officials, and researchers to obtain their estimates of the extent of tobacco product consumption accounted for by smuggled products.
Measure 2: International Trade Data-based Estimates	Comparison of import and export statistics to determine extent to which exported products do not appear as imports in the countries they were shipped to; utility at the country level is unclear.
Measure 3: Estimates Based on Comparison of Tax Paid Sales Data and Self- report Survey Data	Difference between estimated total consumption from self-report survey data and tax paid sales data can provide estimate of combined tax avoidance and smuggling; accuracy will depend on biases in both and on changes in biases over time.
Measure 4: Estimates Based on Econometric Modeling of Demand for Tobacco products	Use of tax paid sales data to estimate demand for tobacco products, controlling for key Econometric Modeling of determinants (e.g. price, income, policies) and including measures of potential for tax avoidance and smuggling. Accuracy of estimate will depend on quality of data, ability to control for key determinants of demand, and the ability to measure potential determinants of tax avoidance and smuggling.
Measure 5: Estimates from population Surveys	Surveys to identify users' tax avoidance efforts through questions on purchase location and price, can also include efforts to have survey respondents and/or interviewers report on aspects of packaging including tax stamps, warning labels, and other labeling/markings on pack.
Measure 6: Estimates Based on Observation of Tobacco Product Vendors	Observation of tobacco product vendors to look for tax stamps, warning labels, and other labeling/markings on pack in effort to identify smuggled products.
Source	Most methods are described in World Bank's Economics of Tobacco Toolkit: Tool 7 "Understand, Measure and Combat Tobacco Smuggling" (Merriman, 2001).
Validity	Evidence of utility, but with limitations.
Variation	Alternative methods likely to produce different estimates of the extent of tobacco product consumption accounted for by smuggling. Where multiple methods have been used, resulting measures are generally correlated with one another and have the expected associations with other factors (e.g. corruption).
Comments	Most methods have not been applied widely and more research is needed to determine the validity of the estimates they produce. A combination of methods is likely to be needed to obtain good estimates of the extent of consumption accounted for by smuggling. Good estimates will be important in addressing concerns over the extent to which smuggling will emerge/grow in response to tobacco tax increases.

Table 5.8 Measures for Assessing Tobacco Product Smuggling

gesting that they are valid at some level. Whether or not they provide accurate country level estimates has yet to be fully assessed.

A second approach described in the World Bank's smuggling tool, as well as discussed in Section 4.2 of this Handbook, is the use of international trade data to track smuggling. This approach looks at differences between a country's reported tobacco exports to other countries and those countries reported imports. This approach is useful in assessing the extent of smuggling globally, but is of limited utility for gauging the extent of tobacco product consumption accounted for by smuggled products at the country level, given that one can not identify where the products that "disappear" in transit end up being consumed. Some have assumed that they end up in the country that they were destined for based on reported exports, but this is a tenuous assumption at best. At the global level, estimates produced by this approach are comparable to those produced from the key informant approach.

A third approach is the comparison of data on tax paid tobacco product sales and national estimates of tobacco product consumption based on self-reported survey data. To the extent that there are no reporting biases in either, differences between tax paid sales and reported consumption will reflect the combination of organised smuggling and individual tax avoidance. As described in other sections of this Handbook, there

may be systematic biases in both the tax paid sales data (Section 4.2) and the survey data (Section 3.1) that can limit the utility of this approach. However, as discussed in the World Bank tool, to the extent that these biases are constant over time, changes in the difference between the two measures can be assumed to reflect changes in tax avoidance and smuggling. However, to the extent that the biases in the two measures change over time and to differing degrees, this approach will be less useful in measuring trends in tax avoidance/ smuggling.

A fourth approach is to use the tax paid sales data to model the demand for tobacco products, controlling for key determinants of sales (e.g. prices, incomes, other tobacco control policies) and including variables that measure the opportunities for tax avoidance and smuggling. These variables would reflect the extent and ease of access to lower tax/price jurisdictions (e.g. extent of Internet access, price differences between neighboring countries, distribution of population near borders, extent of travel between countries), corruption, and other variables associated with tax avoidance and smuggling. Estimates from these models can be used to produce estimates of the extent of tax avoidance and smuggling by predicting what tax paid sales would be if these variables were set to zero. Several studies in the USA, for example, include measures that reflect the differences in taxes or prices between USA

states, weighted by state populations and distances from state borders (Farrelly *et al.*, 2003a). Others have looked at this issue across countries (Merriman *et al.*, 2000). The World Bank's smuggling tool provides a detailed step-by-step explanation for using this approach.

The final approach described in the World Bank smuggling tool is to use population surveys to try and identify the extent of use of smuggled tobacco products. The question(s) on location of purchase described above provide some information that can be useful in assessing the extent of consumption accounted for by smuggled products (e.g. based on purchases in the "black market" or purchases from vendors more likely to sell smuggled products, such as mobile street vendors).

Some surveys have gone further in trying to identify consumption of smuggled products. As briefly noted above, this is done by asking survey respondents or, in face-to-face surveys, interviewers to examine the package from which the user is currently consuming for specific features that can indicate whether or not local taxes were paid on the product. Information on the presence or absence of a tax stamp, presence or absence of local warning labels, and other package labeling (e.g. that indicates where the product was intended for sale or that reports tar, nicotine, and carbon monoxide) can be collected. This approach, in part, depends on whether or not tax stamps,

warning labels, and/or other markings are required on tobacco product packaging and on one's ability to link these to specific countries; something that seems reliably done by trained interviewers rather than by survey respondents. For example, in recent waves of the ITC Poland survey, interviewers have been trained to recognize Polish tax stamps, warning labels, and tar/nicotine/carbon monoxide content labels, as well as those from the Ukraine, Belarus, and Russia; if observed stamps/labels are from another country, this is recorded and the country identified, if possible. This approach depends on users' willingness to produce the package from which they are currently consuming and on the respondent's or interviewer's ability to report this information. In the ITC Poland survey, the vast majority of smokers have produced the pack from which they are consuming and interviewers appear to be successfully recording relevant information.

A related approach that is not discussed in the World Bank's smuggling tool, but that has been pilot tested in limited settings, builds on the observational data collection methods discussed above. Observers can be trained to recognize local and foreign tax stamps, warning labels, and other package labels/markings, and can collect this information on packages available for sale in the outlets observed when collecting price, promotion, and other data. This approach has been used to

identify smuggled cigarettes in a small convenience sample in Vietnam (Joossens, 2003) and in a pilot study in Poland (http://www.tobaccoevidence.net/activities_workshop.html), but has not been systematically applied at the national level in any country.

As the discussion illustrates, each of these approaches has limitations and none will provide "the" definitive measure of smuggling. Each approach needs to be validated and refined; however, together they are likely to produce a good measure of the extent of tobacco product smuggling (Table 5.8).

Incidental effects: fairness of tobacco taxes

The burden of tobacco taxation on the poor (regressivity of the tax) is often raised as a concern in debates over tobacco tax increases. Evaluating the impact of tobacco taxation and increases in tobacco taxes on equity can be helpful in addressing this concern. Equity (or fairness) is a key consideration in the development of any tax policy, including tobacco tax policy. Economists generally consider both "horizontal equity" and "vertical equity" when looking at tax policy. Horizontal equity implies that individuals with the same income should pay the same tax, while vertical equity suggests that those with the greatest ability to pay (those with higher incomes) should pay more in taxes than those with lesser ability to pay. Tobacco taxes in all

or nearly all countries are likely to violate the principle of vertical equity, implying that these taxes are regressive (account for a higher proportion of total income for low-income persons). This results, in part, from the greater concentration of tobacco use among less educated, lower-income persons in most countries. Even in countries where tobacco use increases with income, the increase is unlikely to be proportional to income, implying that the share of income accounted for by tobacco taxes falls as income rises. However, several observers have noted that while tobacco taxes may be regressive, tobacco tax increases can be "progressive" given that tobacco use among the poor falls more sharply when taxes and prices are increased than it does among those on higher incomes, so that a greater share of the increase is paid by higher-income consumers (Chaloupka *et al.*, 2000a). Moreover, the equity implications of tobacco taxes should not be considered in isolation, but rather as part of the overall fairness of a country's fiscal system, which will depend on the distributional effects of other taxes as well as of government spending. For example, to the extent that the new revenues generated by tobacco tax increases are used to fund tobacco cessation programmes targeting the poor (e.g. subsidizing treatment and counseling for low-income users) and to support other progressive programmes, concerns about the

burden of the tax increase on the poor are at least somewhat alleviated. This approach was used in the USA for example, where revenues generated from cigarette tax increases have been used to support the expansion of the state Children's Health Insurance Programme, which provides health insurance for low-income children.

Evaluating the equity implications of tobacco taxes and tax increases is typically a complicated exercise. Those interested in assessing the equity implication of tobacco taxation are encouraged to see Tool 6 "Equity Issues, Tobacco, and the Poor" of the World Bank's Economics of Tobacco Toolkit, which provides detailed, step-by-step methods for doing this (Peck, 2002).

Summary and recommendations

This section focused on the measures that are needed for evaluating the impact of tobacco

taxation, a highly effective tool for reducing tobacco use. The impact of tobacco taxes on tobacco use behaviours (see Sections 4.2 and 3.1) is mediated by tobacco product prices, tobacco company price-related marketing efforts (see Section 5.4), tobacco users' purchase behaviour, tax avoidance, and smuggling.

Measuring tobacco product taxes is straightforward (see Table 5.2), with information on the level and structure of these taxes readily available from the Ministry of Finance and other sources (e.g. the International Monetary Fund, the WHO's *Global Tobacco Control Report*). In some countries, it will also be important to measure subnational taxes. Three methods for measuring tobacco product prices were discussed in this section: technology-based, observational, and survey-based. These methods have differing strengths and weaknesses and their costs will vary considerably (see Table 5.4). To the extent that a national measure of price is of

most interest and a regularly repeated population survey of tobacco use is in place, including questions on price in such a survey would be most efficient. Measuring tobacco product purchase behaviour can be easily done through the addition of a limited set of questions to this survey (see Tables 5.5 and 5.6 for recommended measures). Developing accurate measures of tax avoidance and tobacco product smuggling is more challenging and the validity of these measures is unclear and needs further research. Some of the questions on purchase behaviour in population surveys can be used to provide a range for the extent of tax avoidance (see Table 5.7). Multiple methods, most of which have not been widely applied and which need further research, can be used to assess the extent of tobacco product smuggling (see Table 5.8).