Handbook of Tobacco Taxation: Theory and Practice

by Arthur B. Laffer, Ph.D.

Revenues $

Normal Range | Prohibitive Range

0%   Tax Rates   100%

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THE
LAFFER
CENTER
at the Pacific Research Institute

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Acknowledgments

I had loads of help in bringing this book to fruition. And for this help I am truly grateful, for the project would neither have been undertaken nor completed on my own.

First and foremost, Philip Morris International (PMI) deserves credit for their efforts globally to ensure that tobacco taxation is applied responsibly in reaching the public health and public finance goals of each country. I personally am no longer a smoker and actually am now quite hostile toward cigarettes, but I am also a realist and acknowledge that people are going to continue to smoke. Accordingly, the industry should be taxed and regulated based upon sound economic theory.

How to achieve public policy goals via taxation is what this book is all about, and that desire on the part of PMI to work with governments toward reaching these goals is admirable and should not go unnoticed. They sponsored this effort and for that I am grateful. In particular, I would like to thank Huub Savelkouls and Declan Coyne for the countless hours they spent with us providing ample practical examples of the theoretical points made.

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Foreword

As a non-smoker whose mother died of cancer after smoking her whole life, I might not seem to be a natural supporter of smokers. Indeed, I am actually hostile towards cigarettes and the act of smoking. But my personal feelings do not suspend the laws of economics.

Many people believe that policy toward objectionable products like guns, alcohol and tobacco should be made on purely moral grounds, without consideration of economics. On the contrary, however, there is a rich history in economics of how to address non-economic objectives in the most efficient way possible. It is from the latter vantage that any policymaker should approach the tax and regulatory process surrounding tobacco, and that is precisely the approach taken in this book.

The aim of this book is to serve as a handbook or reference guide for everyone interested in or involved in setting tobacco taxation policy. The topic is very relevant and timely from a domestic standpoint and international standpoint. Tobacco taxes represent an essential source of tax revenue for most countries across the globe, and the public health goals of reducing smoking incidence cannot be understated. However, certain actors are seeking to curtail the policy process at the national level and instead create an overarching tobacco tax structure and level for every country across the globe. Such an effort is detrimental to the goals of tobacco taxation.

Tobacco regulation and taxation are complex matters that require consideration of a number of political, economic, and demographic factors prior to deciding on a tobacco tax structure and level. Amongst these factors are: elasticity of demand, affordability, regressivity of the tax, the tax multiplier of *ad valorem* taxes, unintended consequences such as illegal trade, smuggling, and decreased revenues.

Before even beginning to delve into these considerations, however, the first and foremost task in order to enact any agenda vis-à-vis tobacco is to have politicians across the globe understand that tobacco companies are not their enemy. If anything, tobacco companies should be partners and instruments of public policy. As much as possible, tobacco sales should go through legitimate tobacco companies and government should have constructive relations with tobacco companies. In other words, you don't want to tax cigarettes to the point that consumers are no longer purchasing cigarettes from tobacco companies and instead are smuggling, dealing in illicit trade, etc. Instead, you want to work with tobacco companies to make the market operate above ground.

That having been said, the next question is how do we go about designing an objective function for government to operate with the tobacco companies? In my view, the government/tobacco industry dialogue and partnership: 1) needs to focus on minimizing the illicit, non-regulated market. In other words, high quality tobacco products must be readily available at a reasonable price to attract consumers to purchase tobacco from tobacco companies rather than from smugglers or other illegal dealers. 2) recognizing the partnership model and understanding the negative consequences of tobacco use, focus on how we can reduce smoking prevalence. 3) positive incentives (carrots) need to be used as well as negative incentives (sticks) to bring about the desired policy goals.

Quite simply we have a consumption problem with respect to tobacco. Growing tobacco doesn't hurt anyone, nor does

buying and selling tobacco. Even international trade in tobacco is little different than international trade in anything else. But consuming tobacco is where the harm occurs. So, the issues surrounding tobacco are not a matter of production or trade; they are exclusively a matter of consumption.

Direct cures for direct problems are the answer: A consumption solution for a consumption problem. What you want to make sure you do is allow all tobacco to legally cross national boundaries as long as there is a consumption cure to the consumption problem—that could entail taxing consumption, subsidizing non-tobacco consumption, or using government spending in some way to reduce tobacco consumption. Governments should look at the cost/benefit differences in those potential programs.

This book focuses most prominently on using taxation as the solution to the tobacco consumption problem, as that is the current *modus operandi* of most governments around the world. We walk through a host of considerations that any government should consider in setting tobacco tax policy and do so in a way that I believe is clear, helpful, enlightening, and always follows sound economics. Along the way, we reaffirm a number of the common conclusions about tobacco tax policy, but also provide both new ideas and critiques of some existing orthodoxy.

Executive Summary

Excise taxes are consumption taxes applied to a specific good, such as alcohol, gasoline, or tobacco, for example. Such taxes may be a mechanism to generate revenues for the overall government budget, be intended to curb consumption (e.g., "sin" taxes on alcohol and tobacco), act as an "earmarked tax" to fund a public good (e.g., gasoline taxes often fund road maintenance and repair), or correct for a negative externality of consumption (e.g., fat taxes on fatty foods)—or any combination of the four.

Adam Smith laid the groundwork for taxing consumable goods, with an excise tax on such goods seen as the most market-neutral tax—guaranteeing government revenue without increasing the natural wage rate of laborers. The premise of this assertion is that if goods like tobacco, rum, or sugar become too expensive, then consumers can simply cut them out of their budget, as they are not necessities.

Over the subsequent centuries, a number of economists have expanded upon Smith's theories. The additional research, along with years of practical experience, has cemented tobacco as one of the most frequent targets of tax increases, on both public health and public finance grounds. While the levying of excise taxes is theoretically substantiated for generating government tax revenues with minimum market distortions, as well as correcting for externalities, there are numerous theoretical and practical issues to consider when introducing or increasing excise taxes.

In addition to the traditional theoretical considerations for excise taxation, there is also a growing political push for international tobacco taxation (i.e., additional tobacco taxes administered globally by an international body), as well as international tobacco tax harmonization (i.e., international guidelines for structuring tobacco taxation). While there may be mounting pressure for international taxation or harmonization, at present there is scant theoretical rationale for either. As the theory and practical experiences make clear, countries need to retain control of their own fiscal policy because one size does not fit all. There are vast differences in policy objectives and priorities, social and economic circumstances, and existing industry and excise tax structures across the globe. Because there are upper limits to the size of tax increases and how high the tax levels on tobacco products can be at the national level, countries need to retain their fiscal sovereignty to determine the optimal excise tax structure and level on tobacco products to meet their national government objectives.

Given recent discussions on international tobacco taxation, it remains of interest to find a way to objectively compare tax levels across countries. Broadly three approaches exist: comparing tax incidence, expressing taxes as a percentage of the retail consumer price; comparing monetary tax levels, in a common currency per pack of cigarettes; or comparing tax levels taking into account domestic income levels. Our study shows that this last approach, which takes into account the domestic affordability of tobacco products, is the most sensible for public policy benchmarking purposes.

In general, governments levy excise taxes on tobacco to achieve fiscal and public health objectives. In order to evaluate both objectives, it is first necessary to review the elasticity of tobacco demand. From there, fiscal revenue and public health goals will be discussed in context of the Laffer Curve (fiscal) and the Bhagwati Theorems (public health). Other theoretical concerns, such as affordability, regressivity, illicit trade, and the excise tax structure are also considered in this book. Of course, no analysis would be complete without an overview of the practical aspects of excise taxation—each of these topics are highlighted below.

I. ELASTICITY OF DEMAND

In order for policymakers to assess the impact of tax policy on various government objectives—raising tax revenues, public health, employment, and so on—it is critical to have a working understanding of several relevant micro-economic concepts, such as price elasticity of demand, cross-price elasticity of demand, and income elasticity of demand. Each form of elasticity plays a crucial role for identifying the demand characteristics of tobacco consumption, which in turn will help policymakers to formulate the best system of taxation on tobacco products.

Many publications on tobacco taxes are based on the conventional wisdom that the price elasticity of tobacco products is between -0.3 and -0.5, which implies that tax increases can generate the double dividend of increasing tax revenues and reducing smoking incidence at the same time. Although this appears to be a correct assessment in many cases, there are also increasingly examples of much higher price elasticities, indicating that tax policies may need to be adjusted to achieve the desired policy outcome.

For these reasons, it is vital for policymakers to understand how demand is measured in order to interpret the precise meaning of the price elasticity. First, governments need to properly measure the number of smokers and the amount that those smokers smoke. Next, four separate price elasticity measurements should be estimated: the elasticity of aggregate tax-paid demand (to assess the impact of tax and price changes on tax revenues), the elasticity of aggregate consumption (to assess the impact on illicit trade and cross-border sales), and the elasticity of both smoking prevalence and smoking intensity (to understand the impact of tax and price changes on individual smoking behavior). Based on our research, in general, countries don't have in place a systematic survey to measure all relevant elasticities and how they evolve over time, even though these are fundamental parameters to establish a well-founded tax policy for public health and tax revenue purposes.

II. LAFFER CURVE

The Laffer Curve illustrates the relationship between tax rates and government tax revenues, and provides an explanation for why this relationship is not always positive. Broadly speaking, changes in tax rates have two effects on revenues: arithmetic and economic. Arithmetically, if tax rates increase, tax revenues per dollar of tax base will similarly increase. Economically, however, higher tax rates will discourage consumption and encourage switching to lower taxed substitute products or illicit tobacco products—thereby *decreasing* the tax base. The arithmetic effect and economic effect are opposing forces—therefore, when the two are combined, the consequences of the change in tax rates on total tax revenues are no longer quite so obvious.

The price elasticity of tobacco demand will impact the shape of the Laffer Curve and the revenue maximizing tax rate: the more elastic, the lower the revenue maximizing tax rate will be, as consumers will be more sensitive to price increases. Most of the time, when tobacco tax rates are increased, government tax revenues increase, as well. However, there are increasingly examples of countries whose tax rates have entered the so-called "prohibitive range" of the Laffer Curve. Within the EU Cyprus, Denmark, Germany, Greece, Ireland, Latvia, Portugal, Sweden and the United Kingdom have experienced multiple yearly declines in tobacco tax revenue over the decade to 2012, while Malaysia, Norway and Singapore have reached the upper limits on tobacco tax increases. A number of states within the United States have at times found themselves in or bumping up against the prohibitive range of the Laffer Curve, meaning tax revenue would only fall with further tax increases and tax revenues could actually increase by lowering tax rates.

Additionally, it is important to bear in mind that the tax rate at which government revenues are *maximized* (the highest point on the Laffer Curve) is not automatically the point at which tax policy is *optimized*. If for instance the illicit tobacco trade and its impact on crime, or the regressive impact of excise taxes on lower income individuals are serious concerns, these may be reasons to enact tax rates below the revenue-maximizing level. Conversely, if the objective of reducing tobacco consumption for public health reasons is seen as

the primary objective, tax rates may correspondingly need to be above the revenue-maximizing point (constrained by the illicit trade potential). The optimal tax rate from a revenue perspective is thus not automatically equal to the optimal tax rate from a broader policy perspective.

III. UNINTENDED CONSEQUENCES OF TOBACCO TAXATION—BHAGWATI THEOREMS

In many instances, governments use economic policies in order to achieve non-economic outcomes that are welfare improving rather than technically efficient. The taxation of tobacco is an example of this—governments typically intervene in the Pareto-optimal free market in order to pursue their non-economic objective of reducing tobacco consumption.

Jagdish Bhagwati is a world-renowned international trade theorist whose work on the optimization of economic policy while accounting for non-economic objectives, such as reducing consumption of certain products (e.g., for health reasons), is particularly relevant to tobacco taxation. Bhagwati addresses three potential policies in order to constrain consumption levels—a production or factor tax-cum-subsidy, a tariff, or a consumption tax-cum-subsidy. Although policy interventions are rarely economically efficient, when the policymaker has non-economic objectives, the Bhagwati Theorems can be used to analyze and rank different policy decisions in order to minimize the cost to the overall economy and reduce the distortionary impacts on the market.

The consequences of choosing a sub-optimal policy can be dire—Bhagwati notes that pursuing the wrong economic policy can result in a peculiar situation where economic growth can potentially lead to a country being worse off than it was prior to growth, a situation he coined as "immiserizing growth". Therefore, if the economic target is to constrain consumption, then the available policy options are to: a) tax the targeted behavior, b) subsidize desirable behavior, or c) spend money to reduce the targeted behavior in some way. Any other policy response has the potential

of creating unintended consequences far worse than the problem that needs to be solved.

Bhagwati concludes that the optimal government intervention policy in order to curb consumption of a particular good is a tax policy, as consumption taxes directly impact consumption levels, which is the non-economic objective. Accordingly tobacco taxation is, in principle, a good policy instrument to reduce tobacco consumption, but it has to be managed and structured carefully.

IV. TAX AND INCOME DISTRIBUTION

As one of Adam Smith's four maxims of taxation, equity continues to be a crucial consideration for policymakers to ensure that tobacco taxes are not regressive—that is that the tax burden does not disproportionately fall onto individuals in lower income brackets. For tobacco excise tax policy, this especially becomes a concern if the prevalence of smoking is higher for lower income individuals and if the price elasticity of tobacco demand is less elastic for lower income individuals. Such a case is particularly problematic since increases in excise taxes can further diminish the standards of living for individuals in lower income brackets—the choice may come down to forgoing proper nutrition in order to maintain current tobacco consumption.

For a comprehensive evaluation of taxes on income distribution, one should look at the overall impact of all taxes and subsidies on individual consumers. Domestic structures of direct and indirect taxes, as well as social security systems, are further examples of unique, country specific characteristics, as a result of which tobacco tax policy will need to be tailored to individual country circumstances. An internationally harmonized tax approach is likely to exacerbate issues of equity and regressivity in individual countries.

V. EXCISE TAX AND ILLICIT TRADE IN TOBACCO PRODUCTS

When a good becomes too expensive, consumers may discontinue or reduce its consumption, reduce the consumption of other goods in order to continue consuming the highly taxed product, or turn to illicit tobacco products. Taxes thus create a financial opportunity for illicit trade, but this is not a sufficient condition in and of itself. The potential profits for smugglers (and savings for consumers) from illicit trade must be weighed against other factors. Consequently, it isn't just high tax rates that indicate whether illicit trade activity will be a problem, but rather high tax rates coupled with other factors such as affordability, level of corruption, effectiveness of enforcement, and cultural and societal reasons.

VI. TAX STRUCTURE

Excise taxes come in two main forms—specific and *ad valorem*. A specific excise tax is a fixed monetary amount per unit of tobacco product (e.g. pack, weight, carton, piece), whereas an *ad valorem* excise tax is a percentage tax on the price of each unit. In both instances, however, there is a wedge created between the amount paid by consumers and received by producers. The consumer will face prices that are higher than what the producer will receive for the good, and the government collects this difference as tax revenue.

Around the world, there is a remarkable variation of excise tax structures in place for cigarettes and other tobacco products. Governments tailor these systems to meet certain domestic policy objectives, but clearly some of these objectives evolve over time, and will be different from country to country. Many countries design their excise structure to primarily reduce smoking prevalence, and implement a fully specific structure that does not encourage consumers to shift consumption to lower taxed products, thus maximizing the impact of tax increases on the average consumer price. Other countries want to balance their objectives, and also give priority to protecting employment, for instance, by applying lower taxes to hand-made tobacco products to promote this goal. Still other nations are concerned about the regressive impact of tobacco taxes on low income

smokers and therefore see a policy need for lower taxed fine-cut tobacco. These are just some of the examples of how domestic policy considerations translate into a certain type of excise tax structure.

On the more general discussion of specific versus *ad valorem* taxes, there is a global trend towards more specific systems, as tax revenue and public health objectives have started to dominate other public policy considerations (e.g., income distribution, employment, protecting domestic producers). From a public finance and public health perspective, specific taxes are clearly preferred over *ad valorem* taxes. Specific taxes offer a more stable and controllable source of tax revenue, for instance because government income does not depend on consumer brand choice trends. If public health is an important objective for policymakers, then a specific excise is also highly encouraged since it is based on the number of units sold, which implies that the tax burden is equal per unit (i.e., if all cigarettes are equally bad, tax them all the same). Given that a specific excise tax equalizes the tax burden across all cigarettes, it is more likely that the consumption of cigarettes will fall following a tax increase because consumers will not be able to offset a tax increase by down-trading to lower taxed cigarettes.

VII. TOBACCO TAX SYSTEM: PRACTICALITIES

At the individual country level, there are four key elements that must be correctly in place for an efficient and effective tobacco excise tax system. Firstly, clear and precise tobacco product category definitions are required, in particular if countries wish to apply different tax levels to different tobacco products. Without proper product definitions government tax revenue will be lost as "loophole products" are likely to be launched—products that technically fall in a lower-taxed category, but are seen by consumers as adequate substitutes of a higher-taxed category. Moreover, these product definitions need be amended and updated over time in response to new product developments.

Secondly, correct excise tax structures are required to ensure that similar tobacco products are treated on an equal basis. From a government tax revenue standpoint, the excise tax structure should sup-

port stable and predictable collections and ensure, as much as realistically possible, that excise tax increases translate into government tax revenue increases. While there are a vast array of tax structures applied across the globe, from a pure tax revenue point of view, specific tax structures ensure that all similar tobacco products will pay the same amount of excise tax, while at the same time specific taxes reduce the incentive for consumers to down trade to lower taxed products—as well as reduce the tax revenue losses if they do trade down.

Thirdly, the correct excise tax level must be applied to each tobacco category. While on average the price elasticities for cigarettes and other tobacco products are low, this can change over time, particularly in response to relatively large tax increases or changes in macroeconomic factors. As many countries have experienced, the Laffer Curve also applies to tobacco taxation. When tax levels become too high, consumers will reduce consumption, down-trade to lower-taxed products, and switch to non-taxed, illicit tobacco products. Accordingly, after a certain point, further tax increases will not result in commensurate increases in government tax revenues. Governments must also keep in mind that the tax bearing capacity of tobacco products will vary from one tobacco category to the next, for instance because of production cost differences, and the tax levels applied on each category need to be calibrated accordingly.

Finally, the excise tax system needs to be supported by good tax administration and collection systems. The tax administration and collection systems should facilitate the efficient collection of the excise tax revenue by the customs and excise officials and should not be unnecessarily burdensome on the manufacturers or importers. A proper legal framework that provides a balance between the rights of taxpayers and the powers of the tax agency should be in place. Overall, the tax administration system should be as simple as possible to expedite efficient payment of tobacco taxes by all manufacturers and importers.

PART I
General Principles of
Excise Taxation

General Principles of Excise Taxation

I.   ECONOMIC THEORY OF TAXATION

Excise taxation is the practice of applying a unique tax to a specific good or service, such as alcohol, gasoline, airline tickets, or tobacco, for example. Such taxes may be a mechanism to generate revenues for the overall government budget, be intended to curb consumption (e.g., "sin" taxes on alcohol and tobacco), act as an "earmarked tax" to fund a public good (gasoline taxes often fund road maintenance and repair), or correct for a negative externality of consumption (e.g., carbon taxes on air transportation)—or any combination of the four. Excise taxes may either distort or correct consumer preferences, and are a uniquely targeted tool by which consumption may be affected.

A.   Review of the History of Excise Taxation

Prior to discussing the structure, design, and administration of excise taxes, this book will first examine the origins of excise taxation, as well as the relevant underlying economic principles.

The practice of excise taxation to collect government tax revenue can be traced as far back as the Han dynasty in China and to the Mauryan period in India,[1] but it was Adam Smith's *Wealth of Nations*[2] that laid the groundwork for taxing consumable goods. Excise taxes were seen as the most market-neutral taxes, guaranteeing government revenue without increasing the natural wage rate of

laborers.[3] The premise of this assertion is that if goods like tobacco, rum, or sugar become too expensive, then consumers will simply cut it out of their budget, as it is not a necessity.

Smith's opinion was that taxes should not be higher than necessary and should not reach a point of encouraging evasion.[4] The government should neutrally collect the minimum required revenues needed to sustain itself—this is the central premise of Smith's efficiency maxim on taxation. Smith also addressed three other maxims with respect to taxation—equality, transparency, and convenience. Equality, as Smith defined it, is the notion that each individual "ought to contribute towards the support of the government…in proportion to the revenue which they respectively enjoy under the protection of the state". Smith noted the importance of taxes being both transparent and convenient in order to minimize uncertainty, because uncertainty "encourages the insolence and favours the corruption of an order of men who are naturally unpopular". Taxes should be convenient in that the consumer pays them "by little and little, as he has occasion to buy the goods".

In the early 19th century, English political economist David Ricardo expanded on Smith's theories to account for substitution effects; during the same period, French economist Jules Dupuit developed the notion that there is a break point in taxation or a point where taxation becomes excessive in his 1844 essay "On the Measurement of Utility from Public Works."[5] While the argument was not entirely new, Dupuit was the first to distinctly identify two ranges in a certain tax rate that were divided by an optimal tax level. Dupuit noted that, "If a tax is gradually increased from zero up to the point where it becomes prohibitive, its yield is at first nil, then increases by small stages until it reaches a maximum, after which point it gradually declines until it becomes zero again."[6] This idea of taxes being raised to the point of diminishing revenues was previously alluded to in Smith's *Wealth of Nations*[7] and in Alexander Hamilton's *The Federalist Papers.*[8]

In the early 20th century, Frank Ramsey proposed in his article, "A Contribution to the Theory of Taxation" (1927)[9] that taxes on consumption products should be formulated in a way that minimizes any reduction of utility. In his analysis, he finds that consumption

taxes should be inversely related to the price elasticity of demand for the underlying product.[10]

In other words, if a good is inelastic, i.e., not very sensitive to price change, Ramsey would argue that it is a prime candidate for higher taxation, as increasing the price of that good will fail to reduce demand by a proportional amount. Ramsey theorized that by taxing inelastic or low price elasticity goods at a higher rate, distortion to consumer choice is minimized—that is, the distribution of expenditure over different goods is closest to the original market equilibrium prior to imposing the tax. This book will further discuss the Ramsey Rule, including its shortcomings, in a later section.

The theory of optimal taxation was later expanded into the realm of macroeconomics via the Laffer Curve.[11] The Laffer Curve illustrates the point at which taxes become so high that tax revenue begins to decline: otherwise known as the Prohibitive Range of the curve. The Laffer Curve was employed in discussion of income tax rates, but the idea is also broadly applicable to discussions on excise taxation.

The basic idea behind the relationship between tax rates and tax revenues is that, broadly speaking, changes in tax rates have two effects on revenues: arithmetic and economic. Arithmetically, if tax rates decline, tax revenues per dollar of tax base will similarly decrease. Economically, however, lower tax rates further incentivize labor, output, consumption, and employment—thereby increasing the tax base. (Raising tax rates has the opposite economic effect by penalizing participation in the taxed activities.) The arithmetic effect and economic effect are opposing forces and, therefore, when the two are combined, the consequences of the change in tax rates on total tax revenues are no longer quite so obvious. For example, if the government increases the excise tax rate by 10 percent, this does not imply that government tax revenue will also increase by 10 percent. If excise tax rates are already high, the additional 10 percent might discourage taxed consumption enough that tax revenues would not increase by 10 percent since some consumers may choose to purchase less as a result.

Tax revenue responses to a tax rate change will depend upon many factors: the tax system in place, the time period being considered, the ease of moving into underground or untaxed activities, the level of tax rates already in place, how long these tax structures and tax rates have been in place, the prevalence of legal and accounting-driven tax loopholes, the characteristics of the supply factors, and the interaction between supply and demand. If the existing tax rate is too high—in the "Prohibitive Range" shown below in Figure 1—then a tax-rate cut would result in increased tax revenues. In this particular case, the positive economic effect of the tax cut would outweigh the arithmetic effect of the tax cut.[12]

Figure 1

The Laffer Curve
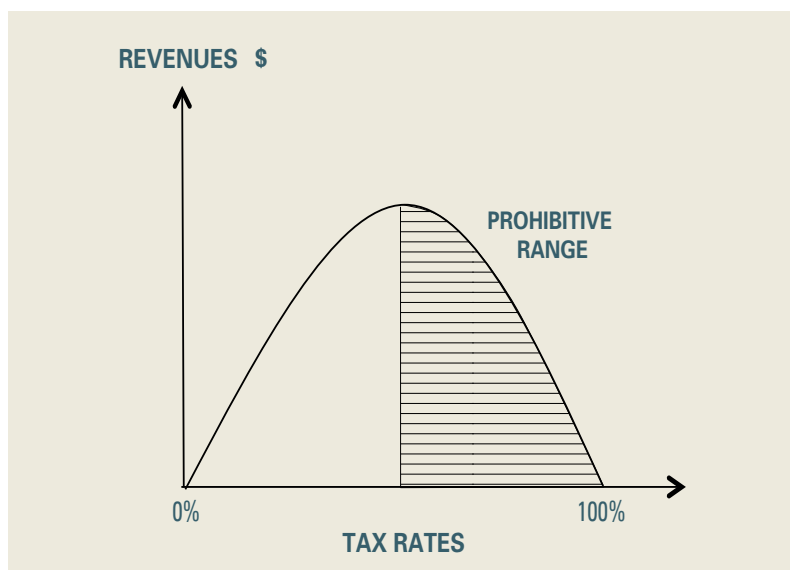
Our discussion so far was limited to introducing taxes to generate government revenue. However, other policy objectives have also been proposed, such as correcting for externalities, which was originally put forth by Arthur Pigou.[13] Externalities are the costs imposed upon or benefits conferred to others, which should be taken into account by the consumer of a particular good. Optimally, according to Pigou, activities with negative externalities (e.g. causing health

care costs or environmental damage) should be taxed in order to more accurately represent the true costs of such an activity—and to discourage its prevalence.

Conversely, activities that produce positive externalities can be seen as valuable to society and as such, should be rewarded with subsidies—such as vaccines, or flu shots. Not only do these lower an individual's chances of becoming ill, they also provide a degree of "herd immunity": because if one is unlikely to contract measles (due to having received a vaccine), then others are less likely to contract measles as well, even if someone hasn't been vaccinated. These taxes are called "Pigouvian taxes", and are typically set equal to the marginal social damage (or benefit) of the underlying action.[14] Unfortunately, while the optimal level of a Pigouvian tax does exist in theory, it's nearly impossible to determine this in practice— as it requires an exact calculation for the marginal social cost of the negative externality.

The Pigouvian tradition was widely accepted until 1960, when Ronald Coase demonstrated that the optimal solution is to allow the individuals generating externalities to bargain with the individuals who are impacted by the externality.[15] This eventually led to Buchanan and Stubblebine demonstrating that voluntary negotiation between the relevant parties yields a Pareto optimum solution (one in which no one can be made better off without making someone else worse off), whereas the Pigouvian tax does not.[16] Furthermore, the effectiveness of a Pigouvian tax can also be impacted by the market structure, as Pigou's original results rely on a perfectly competitive market framework. Specifically, Pigouvian taxes lead to market distortions in the presence of both oligopoly[17] and monopoly structures,[18] as these make it nearly impossible to estimate ideal tax levels.

Recent Developments in Excise Taxation

Modern advances in economics have led to the development of more sophisticated models, which are better able to analyze the effects of excise tax increases on consumption. Without going into too much detail, such models include the following:

- The log-log model (where both dependent and independent variables are expressed in logarithmic terms), which directly estimates (constant) price and income elasticities of demand. However, the problem of implying constant elasticities is that it is generally inappropriate,[19] as will be further discussed in Section II;

- The "myopic addiction" model, a dynamic demand-based model describing short-sighted addictive behavior (used to describe consumers who completely ignore the future while making current consumption decisions);

- The "rational addiction" model, where consumption of an addictive good increases both the future utility of consuming that same good (due to addiction), as well as the costs of discontinuing use.[20]

Importantly, the rational addiction model predicts that the current consumption of addictive goods will respond to future prices—that is, if future tax increases are expected on addictive goods, then consumers will reduce their consumption of such products, as higher prices imply higher lifetime costs associated with consumption. An important theoretical implication of this model is that long run price elasticity of demand exceeds short run price elasticity of demand—in other words, the model theorizes that a price increase will have a bigger impact on consumption in the long run compared to the short term impact.

More recently, Gruber and Koszegi have expanded the rational addiction approach by allowing for consumers' time inconsistent preferences,[21] a term that describes consumers' behavior when their consumption preference changes over time. Consider, for example, New Years' resolutions: I resolve to exercise every day, but I have discontinued this resolution by March. Because what I expected to prefer in March (i.e., exercising) differed from what I actually preferred (i.e., not exercising), I can be said to have time inconsistent preferences.

Applying their model to tobacco taxation, Gruber and Koszegi find that the optimal tax per pack of cigarettes in the U.S. ranges from $0.40 to $14.66, depending on the value of several parameters which

model the time inconsistency of consumers (parameters that they do not measure, but assume).[22] To compare, the average combined federal and state excise tax per pack on cigarettes in the U.S. was $2.22 in 2012. The large estimated range for the optimal tax per pack of cigarettes calculated by Gruber and Koszegi is due to the absence of reliable estimates for inputs such as the long-run discount factor, the hyperbolic short-run discount factor, and the relationship between current demand for cigarettes and past smoking. This wide range is very unpractical for policymakers—in fact, this range covers the full variation of tax rates implemented in the USA from Missouri, with the lowest total tax rate of $1.18 ($1.01 federal taxes, $0.17 state taxes), to New York City, which has the highest combined federal, state and local tax rate, at $6.86 per pack of cigarettes as of 2012.[23]

While Gruber and Koszegi's models make an interesting academic exercise, the wide range of potential optimal tax levels mean they are not particularly useful for policymakers, due to the intrinsic uncertainty in the model's parameters.

In conclusion, while the levying of excise taxes is theoretically substantiated for generating government tax revenues with minimum market distortions, as well as correcting for externalities, merely establishing the theoretically optimal tax level isn't sufficient, as there are a plethora of practical issues with its implementation.

B. The Economic Principles of Taxation

The standard theory of public finance contends that taxation is necessary in order to finance public expenditures since the market fails to provide certain public goods. To determine whether the appropriate tax system is being administered,[24] the following five criteria are used to evaluate excise taxes: (1) economic efficiency, (2) administrative costs, (3) flexibility, (4) political responsibility or accountability and (5) equity.[25] The fifth criterion, equity, requires its own section in order to fully discuss the consequences that tobacco excise taxes have on issues surrounding equity. The material on equity is presented in Section V.

1. ECONOMIC EFFICIENCY

The concept of an economically efficient tax system can be described as a tax system that disturbs the least the efficient allocation of resources. Since individuals optimize their utility based on their preferences and on the real cost of goods and services, introducing a tax will always, to some extent, distort consumer choice in that it changes their bundle of goods and services, which affects the overall allocation of resources.

i. *Deadweight Loss*

Deadweight loss is the term given to a loss of economic efficiency when the equilibrium for a good or service is not Pareto optimal—that is, due to the presence of market distortions, some mutually beneficial transactions are not occurring (resulting in a net loss of welfare). Deadweight loss may also be referred to as "excess burden" or "allocative inefficiency".

Consider a hypothetical example, where there is a market for bicycles: consumers are given the option to purchase a bicycle at the market price of $100. If bicycles are taxed by 20 percent (raising the price from $100 to $120), some consumers who would have purchased a bicycle at $100 will choose not to do so at a price of $120—their net loss of utility would be considered a deadweight loss. Conversely, if bicycles are instead *subsidized* by 20 percent (decreasing the price from $100 to $80), some consumers will purchase a bicycle, even though their benefit is less than the true cost of $100 per bicycle. This unnecessary expense results in similar deadweight loss, as resources are not being allocated efficiently.

Furthermore, consider a slightly different scenario, where a consumer has the option to consume either wine or beer, with the consumer preferring beer over wine. If the two goods are priced equally, the consumer will choose that which he prefers—however, if an additional tax is levied on beer, the consumer may choose to drink wine instead. In this scenario, the net loss of utility (from consuming the less-preferred good) would also be considered deadweight loss.

Deadweight loss is one of the primary criteria for evaluating taxation efficiency—if the benefits generated from public expenditure

programs (funded by the excise tax revenues) are greater than the combined costs associated with the deadweight loss and the administration of the excise tax, then the excise tax system is said to be efficient.

Of course, there are degrees of "efficiency"—tax systems that reduce the deadweight loss or the administrative costs are considered more efficient because fewer distortionary effects are created. Therefore, the criterion to be used to measure efficiency is whether the deadweight loss is as small as possible for the required revenues to be generated. In order to measure the deadweight loss from an excise tax, it is first necessary to estimate the shift in consumption resulting from a shift in price—otherwise known as price elasticity of demand.[26] The less responsive consumption is to changes in price (i.e., the more inelastic the good), the smaller the deadweight loss—as the percentage change in the quantity demanded will be less than the percentage change in the price increase. However, this approach neglects to account for the fact that consumers will have to decrease their consumption of other goods and services to stay within their budget, which also reduces their overall utility. Furthermore, long run estimates of the price elasticity of demand tend to be more elastic than short run estimates, which will result in higher deadweight loss over time.

It is also important to note that an excise tax in general is less efficient than a broad-based tax on all consumption goods—broad-based taxes do not discern between goods, thus making substitution between goods impossible as a means of avoiding taxation. That is, the most efficient tax system is the lowest possible tax rate on the broadest possible tax base. Excise taxes, however, target particular goods (and thus have a smaller tax base), making it possible for consumers to substitute the taxed good for the untaxed good—reducing government tax revenues. Therefore, excise taxes will be less efficient and will have a larger deadweight loss relative to broad-based taxes. Although broad consumption taxes (such as sales tax or VAT) are preferred over excise taxes, if excise taxes are used, then taxing all tobacco products (and close substitutes) at the same rate will help restore some efficiency that would be lost under a differential tax system, where some tobacco products are taxed higher than others.

When assessing whether tobacco excise tax increases would be efficient, the policymaker must be aware of the following: (1) the effects of increasing tobacco excise taxes with respect to other goods and services (i.e., distorting the quantity demanded), (2) the long run price elasticity of tobacco demand, and, (3) the size of the illicit market. Given that the long run price elasticity of tobacco demand is estimated to be more elastic[27] and that the illicit market for tobacco products is a concern in many countries,[28] increasing tobacco taxes may well reduce efficiency due to higher deadweight loss and relatively small increases in tobacco excise tax revenue. In fact, additional increases may push tobacco excises into the "Prohibitive Range" on the curve, which would very clearly indicate that the tax system is inefficient.[29]

ii. Are Tobacco Taxes Effective at Meeting Public Health Goals?

The fact that tobacco products have a negative price elasticity, which means that tax and price increases are expected to reduce the quantity consumed, is not sufficient to conclude that tax and price measures are necessarily effective as a public health tool.

First, there is the topic of illicit trade. Price increases will reduce the demand for tax-paid product (i.e., there is a negative price elasticity of demand), but consumers may instead buy illicit products, as a result of which overall tobacco consumption may remain stable or decline less compared to tax-paid product (i.e. price elasticity of consumption may be closer to zero compared to price elasticity of demand).

Second, many studies focus on predicting an overall reduction in the cigarette market as a result of tax and price increases. However, from a public health perspective it may make a difference whether this reduction in market size is achieved as a result of a decline in smoking prevalence (percentage of people smoking), a reduction in smoking rate (daily number of cigarettes per smoker), or a combination of these two factors.

Third, cigarettes are far from homogenous since they differ in quality, size, and tar and nicotine levels. In fact, results from Evans and Farrelly (1998)[30] and by Farrelly et al (2004)[31] find that following a

tax increase, smokers will adapt their consumption by switching to cigarettes yielding more tar and nicotine. These results, in part, are built on the theoretical foundation laid out by Harris (1980),[32] who established a theoretical framework to account for smokers' change in behavior under higher excise taxes.

In other words, the conclusion that tax and price increases reduce overall tobacco consumption may be correct (provided illicit trade plays no role), but this does not necessarily imply a reduction in the harm caused by smoking to the individual or population.

2. ADMINISTRATIVE COSTS

Although excise taxation usually provides a steady stream of tax revenue to the government, policymakers must weigh those revenue funds against the costs of administering the tax. There are direct costs associated with administering excise taxes, which are mainly the government's costs of collecting and enforcing the tax system, such as infrastructure (buildings), labor, computers, etc. Furthermore, there are indirect costs, which are borne by tax payers; these include the compliance costs of time (i.e., filling out forms, record keeping) and of additional labor (i.e., hiring accountants and tax lawyers). Additionally, complex tax systems are more costly than simpler systems, usually due to special provisions. For instance, in the case of tobacco, complexity can arise when governments apply different systems of excise taxes based on certain characteristics (i.e., roll-your-own versus cigarettes, weight or length differentiation, *ad valorem* versus specific tax system, etc.).

Although measuring the cost of administering tobacco excise taxes would be useful, there is a lack of data on the topic. However, given the growing presence of the illicit trade of tobacco, it is likely that the administrative costs associated with enforcement and compliance are increasing. For instance, the UK government reported £69 million in expenditure on tackling tobacco smuggling in 2011/2012.[33]

3. FLEXIBILITY

Ideally, the tax system, whether the tax is on consumption or income, should be flexible (although rarely is in practice)—it accommodates changes in economic circumstances by automatically adjusting with the business cycle, such that lower rates are used during recessions to offset the decline in consumer income.[34] Furthermore, the appropriate tax system should allow for swift changes in the tax rate. If a tax change comes too late, it may exacerbate, rather than ameliorate, existing economic conditions; by the time the change takes effect, the economic climate may have already shifted, making the new tax rate inefficient and detrimental to further economic growth.

Excise taxes (and indirect taxes in general) are not particularly flexible with respect to business cycles, since excise tax rates do not fluctuate with the cycle.[35] Australia has now started to link tobacco tax increases to wage growth (average weekly earnings)[36]—thus linking tobacco taxes to the business cycle to some extent, although only in one direction: up. When wages decline, for instance during a recession, the law in place will not reduce the excise tax level accordingly. Compared to other taxes, such as income or corporate taxes, excise taxes tend to be relatively easy to adjust, and many countries use excise taxes as a convenient last minute fiscal tool to finalize the government budget. This "flexibility" may mean that excise taxes are "overused" and set at very high levels compared to other tax categories simply because they are the most easy to adjust and often most acceptable, politically, to increase. But this flexibility tends to go only one way—rare are the examples where government reduces excise taxes.

Recent trends in tobacco excise taxation have focused on establishing internationally agreed upon guidelines for the taxation of tobacco products, which would greatly reduce the flexibility to adjust tax rates from a domestic perspective. Furthermore, an international excise tax level or rate could be detrimental to many economies given that each country faces its own set of economic and political issues and characteristics.

4. POLITICAL RESPONSIBILITY OR ACCOUNTABILITY

The political responsibility or accountability criterion relates to the notion that tax systems should be designed such that there is transparency with respect to who bears the tax burden and to the uses of the tax funds—taxpayers should be made aware of the tax and what it is funding. Many indirect taxes fail to meet these requirements since, more often than not, taxpayers are unaware of where the true tax burden lies and the amount of tax revenue that is allocated toward the general revenue fund versus the amount that is directed toward specific aims or the cost of administering the tax.[37]

To illustrate this lack of consumer awareness, Table 1 shows the results of a recent survey asking 1,023 Argentinean adults what percentage of the retail selling price of a pack of cigarettes do they think goes to the government as tax.[38] As Table 1 demonstrates, neither the general public, nor adult smokers themselves, are very much aware of the current excise tax level, as the average tax incidence in Argentina is 69 percent. The average response among smokers was 43 percent for the average tax incidence on a pack of cigarettes, while 78 percent of all smokers believe the average tax incidence is below the 60 percent mark.

Table 1

	TOTAL / N=1023	SMOKER / N=311
Question: Currently, about what percentage of the retail selling price of a pack of cigarettes do you believe goes to the government as tax? It doesn't have to be an exact number, just your best guess.		
0-10	9%	10%
11-20	13%	15%
21-30	18%	17%
31-40	12%	10%
41-50	15%	16%
51-60	11%	10%
61-70	9%	9%
71-80	8%	7%
81-90	3%	4%
91-100	3%	2%
UNSURE	0%	0%
MEAN	43.7	42.7
MEDIAN	40.0	40.0

Tobacco and Taxation

II. ELASTICITY OF DEMAND: PRICE, CROSS-PRICE AND INCOME

In order for policymakers to assess the impact of their tax policy on various government objectives—raising tax revenues, public health, employment, and so on—it is critical to have a working understanding of several relevant micro-economic concepts, such as price elasticity of demand, cross price elasticity of demand, and income elasticity of demand. Each form of elasticity plays a crucial role for identifying the demand characteristics of tobacco consumption, which in turn will help policymakers formulate the best system of taxation on tobacco products.

A. Price Elasticity of Demand

The price elasticity of demand, which measures the change in quantity demanded in response to a given change in price, is a critical measure for policymakers to consider when determining the optimal taxation level. This section will cover relevant topics concerning tobacco taxation with respect to the price elasticity of demand.

1. ECONOMIC EXPLANATION OF THE PRICE ELASTICITY OF DEMAND

The price elasticity of demand measures the percentage change in the quantity of the good demanded for a given percentage change in the price of that good. For example, if a 10 percent price increase leads to a 10 percent decline in the quantity of that good demanded, then the price elasticity of demand would be -1, which is defined as "unit elastic". If, however, a 10 percent price increase leads to *less than* a 10 percent decline in the quantity demanded, then the elasticity of demand would be more than -1 (e.g., -0.5), which is inelastic. When a good is inelastic, the demand for the product is relatively insensitive to its price changes. Lastly, if a 10 percent price increase leads to a *greater than* 10 percent decline in the quantity demanded, then the price elasticity of demand would be *less than* -1 (e.g., -2), which is elastic. When a good is elastic, then a percentage increase in the price would lead to a relatively larger percentage decrease in the quantity demanded.

It is important to note, that when economists refer to a good or service as being "more" elastic or having a "larger" elasticity, even though on the number scale it is smaller, it is based upon how large the quantity response is, not based upon the mathematically larger number (e.g., -3 is "more" elastic but mathematically smaller than -0.5). In other words, when it comes to elasticities, "larger" or "smaller" is based upon the absolute values of the measured elasticities, which are very rarely positive numbers.

Calculating the price elasticity of demand for a product requires the following inputs: initial price (P_0), initial quantity demanded (Q_0), new price (P_1), and new quantity demanded (Q_1). Some hypothetical prices and quantities are given below in Table 2, which will then be used to demonstrate the calculation for the price elasticity of demand.

Table 2

Hypothetical Price and Quantity Data

Initial Price P_0	$2
Initial Quantity Demanded Q_0	15
New Price P_1	$3
New Quantity Demanded Q_1	10

The equation for calculating the price elasticity of demand is simply the percent change in quantity demanded over the percent change in price[39]—formally:

$$Price\ Elasticity\ of\ Demand = \frac{dQ/Q}{dP/P} = \frac{\%\Delta Q}{\%\Delta P} = \frac{[(Q_1 - Q_0)/Q_0]}{[(P_1 - P_0)/P_0]}$$

Plugging in the numbers from Table 2, the price elasticity of demand is the following:

$$Price\ Elasticity\ of\ Demand = \frac{[(10 - 15)/15]}{[(3 - 2)/2]} = -0.67$$

Therefore, in the example above, a 50 percent price increase (i.e., going from $2 to $3) will reduce quantity demanded by 33.3 percent, which corresponds to a price elasticity of demand of -0.67, indicating an inelastic price elasticity of demand (since the percent change in quantity demand is less than the percent change in price).

2. PRICE ELASTICITY OF TOBACCO DEMAND AND THE INCOME EFFECT

The price elasticity of demand is the result of two effects of a price increase: the income effect and the substitution effect. The income effect occurs because a change of the price of a product (e.g., a price increase) leads to consumers experiencing a resultant change in the real purchasing power of their incomes. To illustrate, if the price per pack of cigarettes is $5.50 prior to a tax increase, and a consumer smokes a pack a day, then his or her annual expenditure on cigarettes is $2,007.50. Assuming this consumer's income is $35,000 annually, then the amount spent on cigarettes constitutes 5.74 percent of the consumer's income. Suppose there is a 10 percent price increase (due to a tax increase), which brings the new cost per pack to $6.05. Using the same consumer information, the amount spent on cigarettes annually will increase from $2,007.50 to $2,208.25, accounting for 6.31 percent of the consumer's income. The consumer will now have $200.75 less to spend annually, either on cigarettes or on other goods and services, which is effectively a reduction in real purchasing power. The impact of this reduction in purchasing power on the consumption of cigarettes is what we refer to as the income effect component of the price elasticity of demand.

3. PRICE ELASTICITY OF TOBACCO DEMAND AND THE SUBSTITUTION EFFECT

In addition to the income effect of a higher tax/price on products, there is also a substitution effect. The substitution effect occurs when the relative price of a good, compared to all other goods, changes when its price changes. For example, if the price of Coca-Cola rises and consumers are indifferent between Coca-Cola, Pepsi-Cola, and Sprite, then Coca-Cola consumers will shift to Pepsi-Cola and Sprite, as both are now relatively cheaper. Generally speaking, the larger the number of substitutes available and the more homogenous those products, the larger the substitution effect will be on the own-price elasticity of demand—and, consequently, the more price elastic the good will be with respect to its own price. While the substitution effect and the cross-price elasticity of demand are related, the substitution effect measures the change in the quantity demanded that is due to other goods becoming either more or less attractive from the change in relative price, while holding utility constant. Therefore, the substitution effect for normal goods implies that own price increases will always decrease the quantity demanded. The cross-price elasticity of demand is specifically measured with respect to

two goods and does not consider the net effect of the relative price changes between all goods. In the context of tobacco, if there is a tax increase on cigarettes, but not on other forms of tobacco (e.g., roll your own, cigarillos, cigars, etc.), then some consumers will switch from cigarettes to the other forms of tobacco, as these are now relatively cheaper. Of course, this assumes that consumers are somewhat indifferent between the different forms of tobacco.

The substitution effect among tobacco products has often been ignored by the literature. Of the studies that do exist, the scope is often limited to the cross-price elasticity of demand rather than the overall substitution effect. However, results do indicate that changes in the relative prices of tobacco products can induce substitution toward the relatively cheaper products.[40] Although the cross-price elasticity of demand is not a complete picture of the substitution effect, the two concepts are related. Therefore, further studies are reviewed in subsection B on the "Cross Price Elasticity of Demand".

While the substitution effect may not be particularly well represented in the research, it has been indirectly addressed by reports focusing on the problem of illicit trade. For example, one of the influences on Ireland's high estimate for the elasticity of demand is due to consumers substituting untaxed cigarettes[41] in lieu of taxed cigarettes.[42] In fact, it is estimated that in 2011, untaxed cigarettes accounted for about 20 percent of total cigarettes consumed in Ireland.[43] The same trend is also present in the E.U. as a whole, where consumption of both untaxed cigarettes and "other tobacco products"[44] increased in 2012.[45] In fact, sales for the other tobacco products category increased 6.8 percent from 2011 to 2012, while taxed cigarette consumption decreased by 5.7 percent over the same period in the E.U.[46]

As far as policymakers are concerned, ignoring the potential for substitution effects can lead to undesirable economic outcomes: if policymakers increase excise taxation on cigarettes, but not on other tobacco products, consumers have the option to substitute the relatively more expensive cigarettes for other relatively cheaper and lower taxed tobacco products. In addition, failing to consider substitution effects leads to an incomplete understanding of consumer demand dynamics, hence of what can be appropriate policies and their actual impact.

The tax structure, a topic that we will discuss in more detail further in this book, also plays an important role in this context. If the tax system is fully *ad valorem*, lower price products will pay a lower tax amount. Moreover, with an *ad valorem* tax, any change in retail price is amplified by the tax itself—as shown below in Table 3, if cigarettes are subject to a 50 percent *ad valorem* tax, low price cigarettes (retail price: $3.00) will pay an excise tax of $1.50 per pack, while premium cigarettes (retail price: $5.00) will pay $2.50. Under *ad valorem* tax systems, if there is either a tax increase or decline in consumer income levels, consumers have a greater financial incentive to downtrade, as lower priced products will have a larger price advantage for consumers (because these products have both a lower pre-tax price as well as paying less excise tax). Moreover, with *ad valorem* tax, if the retail price of premium brands is reduced from $5.00 per pack to $4.00 per pack, the excise tax amount declines by $0.50 per pack—in effect, the *ad valorem* tax subsidizes any retail price reduction.

Table 3

Excise Tax Breakdown
Illustration of *Ad valorem* and Specific Excise Tax

$ per Pack	*Ad valorem* Excise Tax 50 percent on retail price		Specific Excise Tax $2 per pack	
	Low-Price Cigarettes	Premium Cigarettes	Low-Price Cigarettes	Premium Cigarettes
Retail price	$3.00	$5.00	$3.64	$4.38
VAT - 20%*	$0.60	$1.00	$0.73	$0.88
Excise tax	$1.50	$2.50	$2.00	$2.00
Total tax	$2.10	$3.50	$2.73	$2.88
Pre-tax price	$0.90	$1.50	$0.90	$1.50

Note: The effective VAT rate is 20% of the retail price, indicating that the nominal, or statutory, VAT rate is 25%

Conversely, with a "specific" excise tax system, all cigarettes are taxed equally—lessening the incentive to substitute to lower priced products. Furthermore, under a fully specific tax system, a reduction in retail price will not reduce the amount of tax paid.

Since the rationale behind excise taxation on tobacco products is usually to increase government tax revenue, as well as achieve a health goal (i.e., reducing tobacco consumption and therefore, tobacco related illnesses), the substitution effect can potentially undermine both policy objectives. Consequently, this must be accounted for when considering excise tax options.[47]

This book will further address these cases of income effects and substitution effects, as they will help explain the variation of price elasticities of demand across different countries.

4.   MEASUREMENTS OF THE PRICE ELASTICITY OF TOBACCO DEMAND

Chaloupka and Warner (1999) survey the economic literature and find that the price elasticity of cigarette demand estimates range from -0.14 to -1.23, with most studies falling in a range from -0.3 to -0.5.[48]   For high income countries, the range of the estimates falls between -0.25 to -0.5, with a large cluster around -0.4.[49]   In general, the studies reviewed by Chaloupka and Warner (1999) use varying specifications, econometric techniques, and measurements of key variables, but do tend to control for income and other factors, such as advertising. One limitation is that many of the studies do not consider the substitution effect between cigarettes and other tobacco products.

Furthermore, policymakers should exercise caution when using these general estimates from Chaloupka and Warner (1999)—illicit sales may or may not be included, depending on how the demand function is characterized. If the demand function is estimated based on tax paid (i.e., non-illicit) sales of tobacco products (this is a common estimate as tax paid sales data are easily available), then the price elasticity refers to the tax-paid sales only. For instance, if the elasticity measured in this way is -0.5, then a 10 percent price increase is estimated to cause a 5 percent drop in tax paid sales.

This estimate is, of course, highly relevant for the finance authorities, as tax paid sales generate tax revenues. For the health authorities, however, the price elasticity of demand only gives part of the story—a 5 percent drop in tax paid sales does not necessarily denote a 5 percent drop in total tobacco consumption. If consumers are shifting towards untaxed cigarettes or other tobacco products in-

stead, the price elasticity of total consumption could be significantly smaller than -0.5 (e.g., -0.2).

There is empirical evidence that suggests accounting for the illicit tobacco market is important. Using aggregate tax revenue data, Reidy and Walsh (2011)[50] estimate a price elasticity of demand for taxed cigarettes in Ireland to be -3.6, several times larger than previous estimates. Their conclusion is not that Irish consumers are unusually price sensitive, but that contraband, counterfeit, or otherwise-illicit cigarettes are being substituted for their legal counterparts. In fact, the share of cigarette consumption that is represented by contraband and counterfeit cigarettes is approximately 19.1 percent in 2012 for Ireland, which provides further evidence that the illicit market is impacting the price elasticity of demand estimates.[51] Results for the U.K. from 1982 to 2009 also point at very elastic demand, although not as high as in Ireland, with a price elasticity of demand for taxed cigarettes ranging from -0.92 to -1.17.[52] Therefore, policymakers should be careful when considering the price elasticity of cigarette demand—higher estimates may not imply cessation induced by price increases, but rather the substitution effect.

There are still more reasons that careful attention needs to be paid to the estimate of the price elasticity of demand. Although on average researchers estimate the price elasticity of demand at -0.4 for high-income countries, it varies by country as well as over time. In fact, particular cases demonstrate a very large deviation from this average. The price elasticity is also not constant over time and tends to change in different economic climates. For example, the recent financial crisis has stifled economic growth in many European countries (particularly Greece, Portugal, Italy, and Spain) and has reduced the real purchasing power of consumers in those countries, especially in light of the high unemployment rates. Therefore, the price elasticity of demand is likely more elastic during this recessionary period (due to the income effect), than during a more prosperous economic environment.

While most studies focus on developed countries, it is important to also consider the price elasticities of demand for low and middle income countries, where demand tends to be more sensitive to price (with typical estimates for price elasticity being approximately dou-

ble the -0.4 estimate for high-income countries).[53] Similarly, elasticity of demand is higher over longer time horizons because time allows people to adapt to changing circumstances and develop new habits.

Table 4 provides a comprehensive overview of estimated price elasticities for cigarette demand from key research articles comparing different countries and time horizons—and, while it tends to be inelastic, the degree of elasticity varies significantly across countries, studies, and time periods. Furthermore, this variation is not specific to developing nations, but generalizes to higher income countries as well—indicating that tobacco tax policy needs to be uniquely adapted to fit each individual country.

Table 4

Global Price Elasticity of Cigarette Demand Estimates

Countries	Average	Range		Number of Studies
High-Income Countries	-0.461	-0.14	-1.23	6
Argentina	-0.265	-	-	1
Bolivia	-0.85	-	-	1
Brazil	-0.36	-0.11	-0.8	2
Bulgaria	-0.8	-	-	1
Canada	-0.25	-0.11	-0.31	2
Chile	-0.33	-0.21	-0.45	1
China (Sichuan province)	-0.65	-0.47	-0.8	2
China	-0.41	-0.007	-0.84	7
Egypt	-0.545	-0.27	-0.82	1
Estonia	-0.32	-	-	1
Europe	-0.70	-0.40	-1	1
India	-0.56	-0.18	-0.85	2
Indonesia	-0.53	-0.32	-0.61	3
Ireland**	-1.105	-0.29	-3.6	7
Malaysia	-0.419	-0.077	-0.76	1
Maldives	-1	-	-	1
Myanmar	-1.619	-	-	1
Morocco	-1.025	-0.51	-1.54	1
Nepal	-0.886	-	-	1
Papua New Guinea	-0.71	-	-	1
Philippines	-0.87	-	-	1
Russia	-0.227	-0.02	-0.628	2
South Africa	-1.01	-0.59	-1.79	3
Spain	-0.38	-0.12	-0.84	2
Sri Lanka	-0.53	-0.227	-0.908	2
Thailand	-0.384	-0.09	-0.67	3
Turkey	-0.32	-0.169	-0.41	2
Ukraine	-0.39	-0.3	-0.48	2
United Kingdom**	-0.65	-0.25	-1.17	3
United States	-0.32	-0.092	-0.49	5
Uruguay	-0.445	-0.34	-0.55	1
Zimbabwe	-0.85	-	-	1

*Complete details of each study are available in the Appendix I.
**Both Ireland and the United Kingdom have two studies each that measure the price elasticity of tobacco demand, rather than strictly cigarettes. Refer to the appendix for further information.