THE ECONOMICS OF TOBACCO CONTROL IN LOW- AND MIDDLE-INCOME COUNTRIES

EVAN H. BLECHER

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SUPERVISOR:

PROF CORNÉ VAN WALBEEK

ASSOCIATE PROFESSOR

SCHOOL OF ECONOMICS

UNIVERSITY OF CAPE TOWN

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ABSTRACT

Global best practice in tobacco control policy is anchored by the *Framework Convention on Tobacco Control* which recommends that countries use, amongst other things, tax increases and advertising bans to reduce tobacco consumption. Furthermore, this is supplemented by various policy documents and technical manuals produced by the World Health Organisation and the World Bank which provide a more thorough justification of these policy measures. This thesis seeks to examine the application of these tobacco control policy measures on tobacco consumption in low- and middle-income countries.

The thesis focuses on tax policy in low- and middle-income countries by moving the metric from price to affordability (which considers price and income simultaneously). This is important since many low- and middle-income countries are growing rapidly and price increases may not be reducing consumption. First, methods for measuring the affordability of cigarettes are proposed. Secondly, trends in affordability over time and across countries are investigated. Results show that cigarettes have become less affordable in high-income countries and more affordable in low- and middle-income countries since 1990, and at a faster pace in recent years. Furthermore, where cigarettes have become less affordable price increases have been the catalytic factor, while in those countries where cigarettes have become more affordable growth in prices has not kept pace with growth in incomes. The concept of affordability is operationalised by proposing a tax policy rule that explicitly targets affordability using a case study on South Africa.

As taxes increase so do the incentives to avoid and evade taxes. As such the illicit trade in cigarettes can undermine tax policy by diverting legal sales to the illegal market rather than by encouraging a decrease in smoking. However, little country level research which estimates levels of illicit trade and its impact on tobacco control

policy has been conducted. Again this chapter uses a case study on South Africa, as an example of a low- and middle-income county that has pursued a policy of significant tax increases over time. The level of illicit trade is estimated and its impact on tax losses and consumption in the total market analysed. Analysis shows that illicit trade has not undermined tobacco control policy in South Africa.

Finally, the thesis considers the impact that advertising bans have on tobacco consumption in the aggregate, paying particular attention to low- and middle-income countries. By modelling demand in a cross-sectional time series model the chapter concludes that comprehensive advertising bans significantly reduce tobacco consumption and that this impact is more significant in low- and middle-income countries than high-income countries.

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This work was put together in a relatively short space of time. However, it is the culmination of work that has been ongoing in many other forms since 2003. This work has now become my area of specialization within the field of economics. It was midway through 2003 that my interest in tobacco control developed. I was an impressionable and excitable honours student in economics at the University of Cape Town. I chose to work with Professor Corné van Walbeek on my long paper and the rest, as they say, is history. The original goal of the study was to assess the appropriateness of using commonly available consumer goods as a base for valuing foreign exchange rates. That goal failed, but during work on the long paper I began to explore differences in the affordability of cigarettes across countries, leading me into broader issues surrounding the economics of tobacco control.

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Evan Blecher
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CHAPTER 1

INTRODUCTION

In the twentieth century, more than 100 million people died worldwide as a result of tobacco use (World Health Organisation, 2008). About one in twelve people alive today, or approximately 500 million people, will be killed by tobacco use in the future (Levine and Kinder, 2004). Tobacco use is the leading cause of preventable death worldwide and its use kills more people than tuberculosis, HIV/AIDS and malaria combined (World Health Organisation, 2008). By 2030, tobacco use is expected to be the single largest cause of death worldwide (Jha and Chaloupka, 1999). Along with this burden of disease, the economic costs of tobacco use are considerable. In addition to the direct costs of medical treatment for tobacco related diseases, indirect costs accrue through early mortality and morbidity. While few global estimates of these costs exist, the *Tobacco Atlas* (Shafey *et al.*, 2009) estimates the total cost of tobacco use to be as much as 3.6% of global Gross Domestic Product annually, although other estimates place this cost lower, at 0.7% to 2% annually (Campaign for Tobacco Free Kids, 2001).

Tobacco control is the area of public health which focuses on controlling and reducing tobacco use, thereby limiting and reducing its associated mortality and morbidity. Although it is now generally accepted that smoking, as well as passive smoking, is a significant cause of premature death (United States Department of Health and Human Services, 1989) it was not always the case. One of the most important events in the history of tobacco control occurred in 1964 when the United States Surgeon General warned of the proven causal relationship between cigarette smoking and lung cancer (United States Department of Health and Welfare, 1964). Although the medical community had long suspected this, the Surgeon General's report was one of the first authoritative communications on the topic. This was preceded in the United Kingdom by the Royal College of Physicians ground-breaking report *Smoking and Health* (Royal College of Physicians, 1962) (see Peto, 1994, for a thorough review of the early science). This encouraged a wave of regulation and

legislation in high-income countries as governments began to restrict the advertising of cigarettes, place warnings of the dangers of smoking on packaging and increase prices using taxation (Laugesen and Meads, 1991).[1]

By 2020, 70% of those killed by smoking will be in low- and middle-income countries (Jha and Chaloupka, 1999). Gajalakshmi *et al*. (2000: 21) indicate that per capita tobacco consumption in low- and middle-income countries has nearly doubled between the early 1970s and early 1990s. Given this trend, it is becoming increasingly important and necessary to understand which interventions succeed in reducing tobacco consumption in such countries. Although the driving force behind tobacco control is within the realm of public health, economic interventions have been found to be the most successful in reducing tobacco consumption. These economic interventions aim to reduce consumption by reducing the demand for tobacco products.

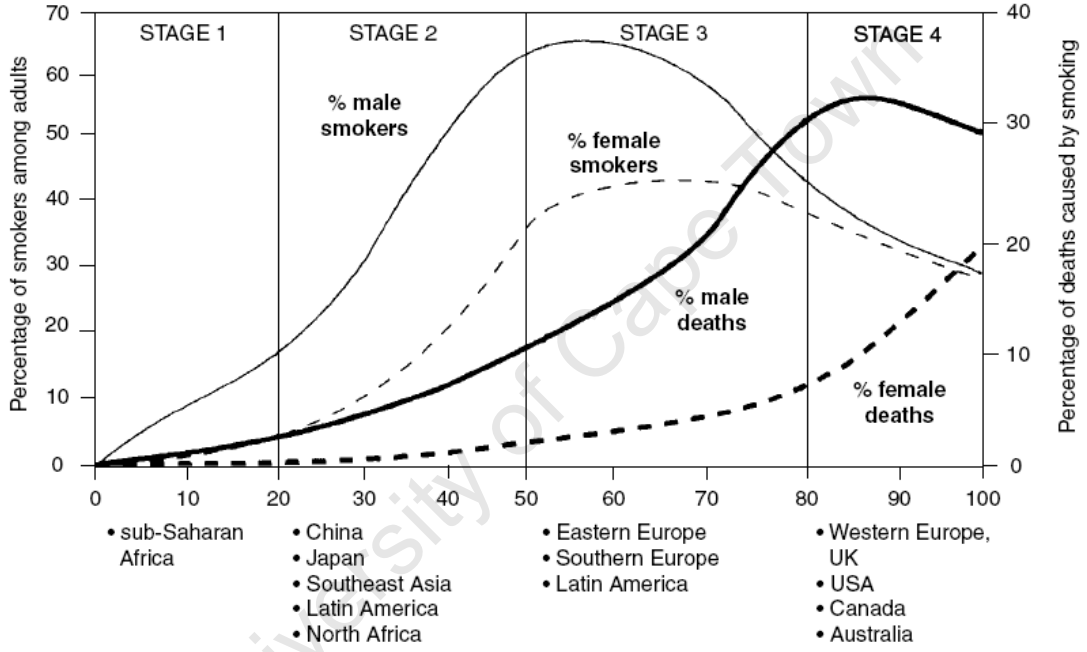
Lopez *et al*. (1994) propose a model which places countries and regions into one of four stages on a continuum of the tobacco epidemic. A country or region can be placed in one of the four stages based on smoking prevalence among men and women as well as deaths attributable to smoking-related disease. This model has gained popularity and is commonly used by researchers and tobacco control advocates to raise the profile of tobacco control in low- and middle-income countries. Many of these countries are at the lower end of the continuum and movement to the higher end of the continuum will be characterised by large increases in smoking prevalence and smoking-related disease. This is presented graphically in Figure 1.1, which shows how smoking prevalence in a country or a region typically develops, first among men, and then among women; it also shows how this will result in a considerable increase in smoking-related disease.

Stage 1 of the tobacco epidemic is characterised by low rates of smoking prevalence--the large majority of which occurs in men--combined with no apparent increases in smoking-related disease. Most countries that are currently considered to be in Stage 1 are in sub-Saharan Africa. These countries are exclusively low- and middle-income

[1] Throughout, I use the term advertising to include the advertising, promotion of, and sponsorship by, tobacco products, but not marketing which includes distribution of tobacco products.

countries, but mostly low-income countries. Stage 2 of the tobacco epidemic includes those countries with growing smoking prevalence among men and early increases in smoking among women. Furthermore, these countries are seeing an increasing shift to youth smoking initiation and an increasing burden of smoking-related disease. Again, most of the countries currently in Stage 2 of the epidemic are low- and middle-income countries. The countries included in Stage 1 and 2 of the epidemic count for more than half the world's population. In other words: more than half the world is yet to see smoking prevalence and smoking-related disease peak.

Figure 1.1: Four stages of the tobacco epidemic



Source: Lopez *et al*. (1994)
Note: The horizontal axis represents a continuum of time in years that each stage of the epidemic is expected to last.

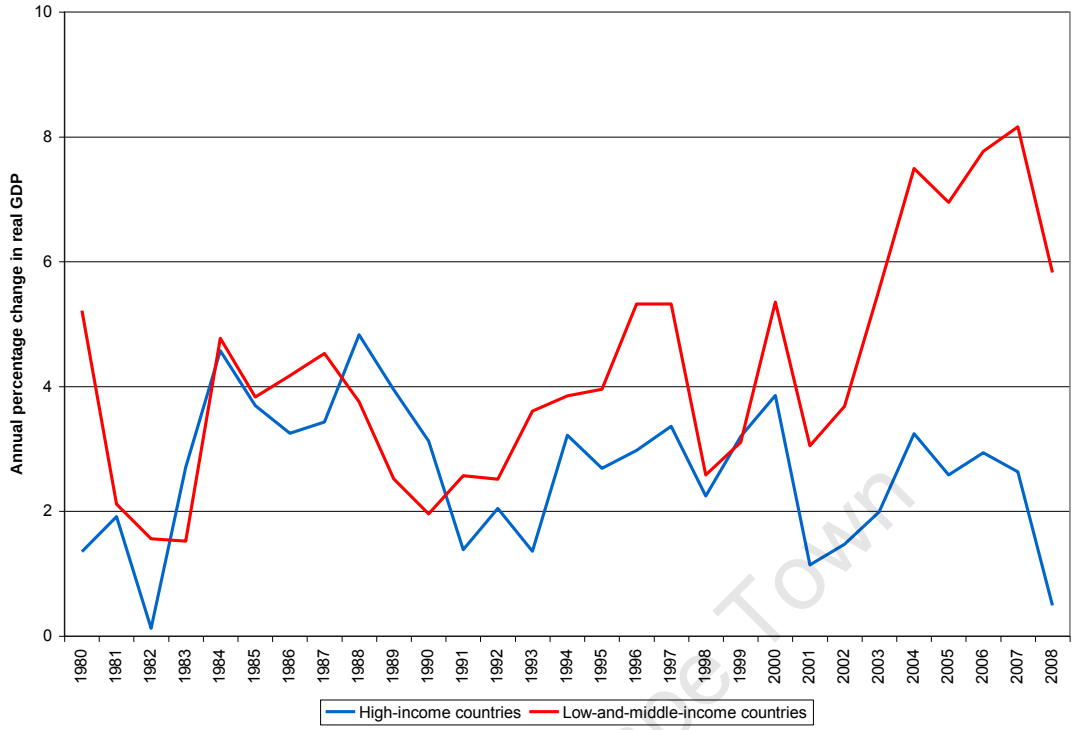
Stage 3 of the epidemic is characterised by declining smoking prevalence among men, and to a lesser extent among women. However, the burden of smoking-related disease continues to rise due to a lag between smoking and the onset of disease. Up to a third of all deaths in countries in Stage 3 of the epidemic can be attributed to smoking, mostly in men. Both high-income and low- and middle-income countries are at Stage 3 of the epidemic. Stage 4 of the epidemic is characterised by significantly declining smoking prevalence in both men and women, as well as declines in the burden of smoking-related diseases among men (although not among women). Smoking prevalence is similar to that of Stage 2; however, in Stage 3, the trends in smoking

prevalence are declining, whereas they are increasing in Stage 2. All Stage 4 countries are currently high-income countries. Many, although not all, of the countries in Stage 4 of the epidemic have taken active steps to reduce tobacco usage through tobacco control programs as well as considerable efforts to reduce the affordability of tobacco products through tax increases. However, a caveat to the Lopez model is that it is based on the experience of rich Western countries. Low- and middle-income countries may or may not follow this trend.

An important observation from the Lopez *et al*. (1994) model is how poorer, less developed countries (i.e. low- and middle-income countries) are located to the left of the continuum and richer, more developed countries (i.e. high-income countries) are to the right. Empirical evidence suggests that incomes in low- and middle-income countries are growing at a significantly more rapid pace than they are in high-income countries, and are thus "catching up" in terms of economic development. Cigarette consumption responds positively to income, and more rapid income growth is likely to result in more rapid growth in cigarette consumption. This "catching-up" has occurred at a more rapid pace in the 2000s (see Figure 1.2 below) and will likely result in many low- and middle-income countries, currently in Stages 1 and 2, moving to the right, into Stages 2 and 3. This has already been happening: per capita consumption in low- and middle-income countries has nearly doubled between the early 1970s and early 1990s (Gajalakshmi *et al.*, 2000: 21). More recent data (ERC, 2007) shows that aggregate consumption increased by 33.6% between 1990 and 2007 in 123 low- and middle-income countries (43.3% if China is excluded) compared to a decline of 22.9% in 39 high-income countries.

For example, Blecher (2010c) notes how the gap between youth smoking prevalence is significantly smaller between African countries and other low- and middle-income countries than the gap between adult smoking prevalence between the same groups of countries. This indicates that, in the future, adult smoking prevalence in Africa is likely to rise, resulting in many of the world's poorest countries moving from Stage 1 to Stage 2 of the epidemic.

Figure 1.2: Economic growth in high-income and low- and middle-income countries (1980-2008)



Source: World Bank's World Development Indicators

The purpose of this thesis is to consider the effectiveness of some important economic tobacco control interventions and to analyse them in the context of low- and middle-income countries. It specifically focuses on two interventions that are argued to reduce the demand for tobacco, namely tax increases and advertising bans.

Tax policy in low- and middle-income countries is different to tax policy in high-income countries. First, the price elasticity of demand is higher, in absolute terms, in low- and middle-income countries than it is in high-income countries (Jha and Chaloupka, 1999). This means that tax policy could be a more effective tool in low- and middle-income countries than in high-income countries. Secondly, and more importantly for this thesis, low- and middle-income countries are growing significantly faster than high-income countries, meaning that the same tax increases may not result in falling consumption since increases in price may be offset by increases in income. Historically, the literature has placed the focus of tax policy explicitly on price. This thesis develops a method of analysis of affordability, i.e. the simultaneous analysis of price and income, in the context of tobacco tax policy. I also investigate how the illicit trade in tobacco products could potentially undermine

taxation policy in the context of a middle-income country which has pursued a relatively aggressive tax policy.

The second set of interventions aimed at reducing demand is a set of policies which restricts and bans the advertising of tobacco products. Advertising is argued to increase the size of the aggregate market and thus policies to restrict or ban advertising are expected to reduce demand. However, this statement is contested by some who argue that policies to restrict and ban advertising should not be included in tobacco control strategies because advertising does not increase the size of the aggregate market, but rather the relative market shares of different brands. Since many countries have chosen to restrict and ban advertising of tobacco products, one can test the impact of such interventions on consumption and this thesis aims to do so.

Before considering the outline of the thesis, the forthcoming section considers these policies in more detail and pays particular attention to the policy recommendations of various international institutions that have created frameworks by which countries can implement the tobacco control policies which are considered to be global best practice.

1.1 TOBACCO CONTROL POLICY IN LOW- AND MIDDLE-INCOME COUNTRIES

During the early twentieth century, with the exception of the Great Depression, cigarette consumption in the United States rose steadily. Per capita cigarette consumption peaked in 1963 (United States Department of Agriculture, 2007), coinciding with the Surgeon General's report, and has declined steadily since. This decline is attributable to greater knowledge of the health consequences of smoking and public advocacy and awareness; however, it is also related to policy interventions that restricted the advertising of tobacco products and increased the price of cigarettes through taxation (see Warner, 2006 for a thorough review of tobacco control in the United States). A similar trend exists in other high-income countries. However, as previously noted, the decline in consumption in high-income countries has been

accompanied by significant growth in consumption in low- and middle-income countries.

International institutions like the World Health Organisation and the World Bank have been at the forefront of developing a set of policy interventions that can be considered global best practice in tobacco control. One of the first frameworks, specifically targeted at low- and middle-income countries, was *Curbing the Epidemic*, by the World Bank (Jha and Chaloupka, 1999). Subsequently, the adoption of the World Health Organisation's Framework Convention on Tobacco Control has created a legally binding obligation for parties with respect to tobacco control policies. Many parties that agreed to the treaty have adopted or are updating national legislation in order to meet these obligations (Nikogosian, 2010). Furthermore, the World Health Organisation's MPOWER strategy provides a cost-effective package of evidence-based interventions that countries can implement (see Section 1.1.3 for an explanation of the acronym MPOWER). The following section briefly describes these tools with particular reference to the areas that this thesis considers, namely tax and price policy, illicit trade (as it relates to tax policy) and bans on the advertising of tobacco products.

1.1.1 World Bank's Curbing the Epidemic

In the late 1990s, as the spectre of tobacco control was turning firmly towards low- and middle-income countries, the World Bank's seminal publication *Curbing the Epidemic* (Jha and Chaloupka, 1999) became an important document since it provided a clear evidence-based framework for tobacco control. Specifically, it provided a strong endorsement of taxation as a tobacco control tool in low- and middle-income countries and provided advice for them in what is now a well-known quotation: "The strategy, tailored to individual country needs, would include: (1) raising taxes, using as a yardstick the rates adopted by countries with comprehensive tobacco control policies where consumption has fallen. In these countries, tax accounts for two-thirds to four-fifths of the retail price of cigarettes" (Jha and Chaloupka, 1999: 83).

Even though most low- and middle-income countries have not implemented policy rules in order to ensure that this target is met, *Curbing the Epidemic* has nevertheless

become an important international benchmark for tobacco taxation policies. Furthermore, it also advocates the implementation of comprehensive advertising bans as a tool to reduce the demand for tobacco. One of the most important factors in the success of this publication was its use of evidence from low- and middle-income countries as well as high-income countries in drawing its recommendations. Evidence of its popularity and success can be measures by its translation into ten languages (in addition to English). Discussions regarding an update of *Curbing the Epidemic* are ongoing.

1.1.2 The Framework Convention on Tobacco Control

The World Health Organisation's Framework Convention on Tobacco Control is the world's first treaty that explicitly and exclusively deals with public health. The official process to negotiate the treaty began in 2000 when the World Health Assembly, the governing body of the World Health Organisation, unanimously adopted a resolution to launch political negotiations between World Health Organisation member states. However, the process of moving towards a global treaty began as early as 1994, when the 9th World Conference on Tobacco or Health adopted a resolution in support of a treaty, but moved forward in 1996, when the World Health Assembly first asked the World Health Organisation to develop the treaty (see Taylor and Roemer, 1996). The treaty was unanimously adopted by the World Health Assembly in 2003 and entered into force in 2005. Currently (as of 29 October 2010) 172 countries are party to the treaty, covering 87% of the world's population.[2] Notable countries that are not party to the treaty include the United States, Switzerland (home to Philip Morris), Malawi and Zimbabwe (two of the world's largest growers of tobacco).

The treaty makes recommendation for tobacco control policies based on global best practice through the treaty text itself, through guidelines developed by the parties, and through working groups or protocols to the treaty approved by the Conference of the Parties, which is the decision making body of the treaty. In addition to best practice

[2] See the website of the Framework Convention Alliance (www.fctc.org) for the most up-to-date statistics.

tobacco control policies, the scope of the treaty includes issues of political and economic integration.

Economic policy interventions developed in the treaty focus on both the demand and supply side. Part 3, "Measures Relating to the Reduction of Demand for Tobacco", deals with tax and price policy (particularly Article 6: "Price and tax measures to reduce the demand for tobacco"), as well as the advertising of tobacco products (Article 13: "Tobacco advertising, promotion and sponsorship"). Article 6 supports the use of taxes and prices as a policy tool to reduce tobacco consumption particularly in the young, in order to contribute to public health objectives. Article 13 recognises that "a comprehensive ban on advertising, promotion and sponsorship would reduce the consumption of tobacco products" and requires countries to implement such bans in accordance with local constitutional and legal principles. Furthermore, the Conference of the Parties has developed guidelines to assist parties to implement Article 13 (World Health Organisation, 2008c). These guidelines clearly go beyond straightforward bans on advertising, recommending restrictions and bans on marketing in the broadest sense, including bans on the display and visibility of tobacco products at retail points of sale, vending machines, internet sales, tobacco industry social responsibility programs and cross-border advertising. Furthermore, the guidelines also target the use of entertainment media and packaging as tools for promotion.

Part 4, "Measures Relating To The Reduction Of The Supply Of Tobacco" deals with reducing the illicit trade in cigarettes (Article 15: "Illicit trade in tobacco products"). In addition to the treaty text, parties will consider adopting a Protocol on Illicit Trade in Tobacco Products at the Fifth Conference of the Parties in November 2012. A final round of negotiations for the protocol is scheduled to take place in March 2012. The purpose of the protocol is to define practices such as licencing, tracking and tracing, and due diligence that would assist in securing the supply chain, in order to assist governments in enforcing local and regional taxation and customs policies. One of the major issues has been the creation of a consistent international tracking and tracing system. Illicit trade is a transnational issue and requires cooperation across borders to eliminate it. The treaty and the protocol make recommendations to reduce illicit trade through the supply side. This thesis does not consider illicit trade as a supply-side

issue, but rather how it undermines tax policy as a tool to reduce the demand for tobacco.

1.1.3 World Health Organization's MPOWER Strategy

In addition to the Framework Convention on Tobacco Control, the World Health Organization has developed the MPOWER strategy as an inexpensive, evidence-based tool aligned with the Framework Convention on Tobacco Control (World Health Organisation, 2008a and 2009). It is a package of six measures, each represented by one of the letters in the abbreviation MPOWER. The letters represent:

- **M**onitor tobacco use and prevention policies
- **P**rotect people from tobacco smoke
- **O**ffer help to quit tobacco use
- **W**arn about the dangers of tobacco
- **E**nforce bans on tobacco advertising promotion and sponsorship
- **R**aise taxes on tobacco

Of interest for this thesis are the "E" and "R" in MPOWER, representing advertising bans and taxation policy, respectively. In terms of advertising bans, MPOWER recommends that *"*a total ban on direct and indirect advertising, promotion and sponsorship, as provided in guidelines to article 13 of the WHO Framework Convention on Tobacco Control, can substantially reduce tobacco consumption*"* (World Health Organisation, 2008a). Its recommendation in terms of tax policy is less prescriptive than *Curbing the Epidemic* or the Framework Convention on Tobacco Control and even other MPOWER measures. However, it is clear on the importance it attaches to tax policy, indicating that "increasing the price of tobacco through higher taxes is the single most effective way to decrease consumption and encourage tobacco users to quit" (World Health Organisation, 2008a).[3]

[3] Subsequently, the 2009 update of MPOWER (World Health Organization, 2009) as well as the World Health Organization Technical Manual on Tobacco Tax Administration (World Health Organization, 2010) provide more detailed recommendations. These are discussed more fully in chapter 6.

1.2 OUTLINE

The thesis consists four main chapters. Chapters 2 and 3 consider the affordability of cigarettes in low- and middle-income countries. The concept of affordability has grown in prominence in recent years as the focus of tobacco control has shifted to low- and middle-income countries. Such countries are experiencing relatively rapid economic growth and the resulting growth in personal incomes means that even if cigarette prices are rising, cigarettes may still be becoming increasingly affordable, because income levels are rising more rapidly. Chapter 2 considers methodological and measurement issues of affordability. It then presents the trends in affordability since 1990, emphasising the importance of this measure rather than the narrower focus on price.

Chapter 3 then considers the relevance of affordability in the context of taxation policy in low- and middle-income countries. It does so by using South Africa as a case study and proposes a policy rule directly linked to affordability. Chapter 4 considers how illicit trade may undermine tobacco control efforts. Again, it uses the case study of South Africa and estimates the volumes of illicit trade and the resulting loss of taxation revenue. It then looks at the net impact of taxation policy on the total—not just the legal—market for cigarettes in South Africa. Chapter 5 evaluates the more controversial question of whether advertising bans on tobacco actually result in lower consumption. It does so using cross-sectional time series data and makes some important methodological improvements over the previous literature, particularly in respect of the measurement and treatment of the advertising ban policy variables and the inclusion of low- and middle-income countries in the sample. The following section provides a more thorough outline of each chapter.

1.2.1 Chapter 2: The affordability of cigarettes in low- and middle-income countries

This chapter provides a methodological contribution to the analysis of the affordability of cigarettes. Furthermore, it uses the understanding of the measurement of affordability to analyse trends in the affordability of cigarettes since 1990.

Cigarette affordability is determined by the interaction of consumers' income levels and cigarette prices. An affordability measure, termed *relative income price*, based on per capita gross domestic product and originally developed by Blecher and Van Walbeek (2004) was calculated for 77 countries, while the *minutes of labour* affordability measures, originally developed by Guindon *et al.* (2002) and based on the Union Bank of Switzerland survey of earnings was calculated for 52 countries.

The chapter shows that, expressed in a common currency, cigarettes are significantly more expensive in high-income countries than in low- and middle-income countries. There is a high degree of variance in cigarette prices within groups of countries with similar levels of income. Despite cigarettes being more expensive in high-income countries in absolute terms, they are on average more affordable than in low- and middle-income countries, especially if per capita gross domestic product is used as the measure of income. If one uses the Union Bank of Switzerland data as the measure of income, the finding that cigarettes are less affordable in low- and middle-income countries is less pronounced. It is argued that per capita gross domestic product is a more comprehensive and representative measure of income than the Union Bank of Switzerland's survey of wages, especially for low- and middle-income countries, and that the relative income price is thus a better measure of affordability.

Since 1990, cigarettes have become less affordable in most high-income countries. In contrast, among the low- and middle-income countries in the sample, cigarettes generally have become more affordable. Since 2000, and especially since 2003, cigarettes in low- and middle-income countries have become more affordable at a more rapid rate. Furthermore, I consider what drives changes in affordability over time. Generally, it is found that where cigarettes have become less affordable over time, the growth in prices has exceeded the growth in income, with the exception being countries suffering from severe economic crises.

It is well-known that price increases, usually through increased taxes, are particularly effective in reducing the demand for cigarettes. While there have been many positive developments in tobacco control in the last decade, the most powerful tobacco control tool--increasing prices and taxes and thus decreasing cigarette affordability--appears to have been ignored in many countries. Although there is some methodological

debate about how to best calculate affordability, the central message of this chapter is that cigarette affordability is an important determinant of consumption. Economic studies should not focus on prices and taxes without also considering incomes. If increasing the excise tax is an important component of a country's tobacco control strategy, the benchmark should be set in terms of affordability, rather than in terms of real prices. If policy makers aim to make cigarettes less affordable, they should raise taxes so that the nominal price of cigarettes increases by more than nominal income (i.e. the sum of the inflation rate and the real per capita income growth rate).

This chapter was originally published in two forms, firstly as a working paper by the *Bloomberg Initiative to Reduce Tobacco Use* (Blecher and Van Walbeek, 2008) and subsequently in the journal, *Tobacco Control* (Blecher and Van Walbeek, 2009). The work in this chapter has been updated with more recent data. The previous incarnations took the analysis up to 2006, while this chapter takes the data up to 2008 for the relative income price method and 2009 for the minutes of labour method. Furthermore, the analysis of what drove changes in affordability over time is unique to this chapter and did not appear in the working paper or journal article. This work on affordability has been a long-time collaboration with Corné Van Walbeek, who also acted as supervisor for this thesis.

1.2.2 Chapter 3: Targeting the affordability of cigarettes: a new benchmark for taxation policy in low- and middle-income countries

This chapter aims to investigate the appropriateness of tax burden benchmarking (in other words, the percentage of the retail price occupied by taxes) in low- and middle-income countries with rapidly growing economies, and to explore the viability of an alternative tax policy rule based on the affordability of cigarettes. The chapter outlines criticisms of tax burden benchmarking, particularly in the context of low- and middle-income countries. It then considers an affordability based benchmark using relative income price as a measure of affordability. Using South Africa as a case study of a middle-income country, future consumption is simulated using both tax burden benchmarks and affordability benchmarks. Results show that a tax burden benchmark is not an optimal policy tool in South Africa and that an affordability benchmark

could be a more effective means of reducing tobacco consumption in the future. Although a tax burden benchmark was successful in increasing prices and reducing tobacco consumption in South Africa in the past, this approach has drawbacks, particularly in the context of a rapidly growing economy. An affordability benchmark represents an alternative that would be more effective in reducing future cigarette consumption.

This chapter was originally published in the journal *Tobacco Control* (Blecher, 2010a). It includes a number of improvements, most notably the use of more recent data. Furthermore, the price and income elasticity of demand have been calibrated to recent data rather than assumed from prior literature, as it was in the original article. Also, various options for how the industry passes on tax increases to the consumer are considered, whereas the previous article made a relatively naive assumption that the tax was passed on to consumers in its entirety. This assumption was not consistent with recent tobacco industry behaviour.

1.2.3 Chapter 4: A mountain or a molehill: is the illicit trade in cigarettes undermining tobacco control policy in South Africa?

This chapter estimates the size of the market for illicit cigarettes in South Africa between 1997 and 2009 in order to consider the impact of the illicit trade in cigarettes on the effectiveness of tobacco control policies. Estimates of the illicit market are made using data on smoking prevalence and simulations of smoking intensity. The paper shows that the size of the illicit market grew substantially from 1997 until peaking in 2000. The most recent estimates suggest that the illicit market occupied a significant portion of the total market, although significantly less than anecdotal claims by the tobacco industry. The chapter then considers the tax loss resulting from illicit trade and the scale of the total market; we find that although the scale of the illicit market is significant, it has not significantly undermined tobacco control policy. Consumption in the total market, i.e. the illicit and legal market, has declined consistently over time. At the same time, tax revenue from higher excise taxes has offset the tax losses as a result of illicit trade. The chapter ends with a postscript

examining the most recent claims of the tobacco industry. It compares the rhetoric of the tobacco industry with the actual situation.

Although it is not necessarily possible to generalise from the results of this case study to other low- and middle-income countries, South Africa is seen as an important case study of illicit trade since it is one of the better known examples of a middle-income country in which taxation has been used as a tobacco control tool.

This chapter was originally published in the journal *Trends in Organized Crime* (Blecher, 2010b). Like the preceding chapter, it includes a number of slight improvements, most notably the postscript and its use of more recent data.

1.2.4 Chapter 5: The impact of tobacco advertising bans on consumption in low- and middle-income countries

Tobacco advertising bans are commonplace in high-income countries but are less prevalent in low- and middle-income countries. The importance of advertising bans as part of comprehensive tobacco control strategies has been emphasised by the Framework Convention on Tobacco Control, which calls for comprehensive bans on tobacco advertising. The empirical literature suggests that comprehensive advertising bans have played a role in reducing consumption in high-income countries but that limited policies have not. This chapter extends this literature to include a significant number of low- and middle-income countries in the sample. In addition to the inclusion of the low- and middle-income countries, the chapter presents an econometric model that develops alternative methods to account for policies that restrict and ban tobacco advertising. These alternative methods are developed in response to a number of weaknesses and criticisms in the previous literature. A cross-country time series demand model is employed where consumption is specified as a function of price and income, and advertising bans enter the model as a policy intervention in each country and time period. Fixed effects are used to control for differences between countries and time periods. The chapter finds that comprehensive advertising bans are effective in reducing consumption and that comprehensive bans have a greater impact on consumption in low- and middle-income countries than they

do in high-income countries. Data from 76 countries, of which 41 are low- and middle-income countries, between 1990 and 2005, are used.

Like Chapter 2, this chapter was originally published in two forms, firstly as a policy paper by *Economic Research South Africa* (Blecher, 2008b) and subsequently in the *Journal of Health Economics* (Blecher, 2008a). The work in this chapter has been updated significantly. Improved consumption data, which allows for a more complete dataset and allows me to include significantly more countries in the dataset, has been sourced. Furthermore, greater attention is paid to the price data by using three measures rather than one, although the same source is used. Additionally, improvements have been made to the methods used in order to include advertising bans in an econometric model.

1.3 OTHER ISSUES

1.3.1 Data issues

Data that interests researchers in low- and middle-income countries is usually scarce and of poorer quality than data in high-income countries. However, this is less of a problem when using aggregate data, which this thesis relies on, since a number of private sector firms have taken an interest in collecting aggregate data for a large cross-section of countries (including many low- and middle-income countries).

A number of the chapters employ data from similar sources. Chapter 2 relies heavily on price data sourced from the Economist Intelligence Unit. This source has become popular in recent times since it is the only source of consistently collected time series data on prices that includes a large number of low- and middle-income countries. Chapter 2 also supplements the price data with income data from the World Bank's World Development Indicators database. Chapter 3 uses data from local sources in South Africa, including data collated and organised by Van Walbeek (2005), which has been updated from the original sources using the same methods. This is supplemented with data from Statistics South Africa and the South African Reserve

Bank. Population data is sourced from the Actuarial Society of South Africa since it provides the necessary population projections. A detailed appendix discussion of the data is included. Chapter 4 also uses data from same sources as Chapter 3. In addition, other estimates of illicit trade volumes are sourced from Euromonitor. Chapter 5 uses consumption data from the ERC Group in addition to price data from the Economist Intelligence Unit and income data from the World Bank's World Development Indicators database. Data on tobacco control policies in individual countries are obtained from a number of different sources, including international organizations, reference texts, original policy documents and interviews with country experts. The individual data sources are discussed and evaluated in detail in each chapter.

Rather than using the terms developed and developing countries, I follow the World Bank's country classification and refer only to high-income and low- and middle-income countries. Low- and middle-income countries are sometimes broken down into three smaller groups: upper-middle-income countries, lower-middle-income countries and low-income countries. This standardization of high-income countries and low- and middle-income countries has no purpose other than to avoid confusion over the definitions of developed and developing country. The World Bank definitions are less subjective than other terms since they are defined by quantitative measures of per capita Gross Domestic Product. One country included in some samples is Taiwan, which is not a member of the World Bank and thus is not included in the listing. However, I consider Taiwan to be a high-income country.

CHAPTER 2

THE AFFORDABLITY OF CIGARETTES IN LOW- AND MIDDLE-INCOME COUNTRIES[4]

2.1 INTRODUCTION

Numerous studies over the past decades have shown that the demand for cigarettes is heavily influenced by changes in cigarette pricing.[5] By raising the excise tax, policy makers are able to increase the retail price of cigarettes, thereby making the product less affordable.[6] Whereas increases in cigarette price temper demand, an increase in income tends to increase the demand for cigarettes.

The literature does not focus much on the impact of income on the demand for cigarettes. Even if it were known how much cigarette consumption changes in response to a change in consumers' incomes, it would have limited policy relevance, since few economists would argue against economic growth on the grounds that it would increase the demand for cigarettes.

In recent decades, some countries, mainly in Asia, have achieved unprecedented economic growth rates. In China, India, Indonesia, Vietnam and Bangladesh real per capita gross domestic product (GDP) has grown at annual rates of 6% or more. Rapid economic growth increases purchasing power. Cigarette demand generally increases with income, especially in low- and middle-income countries (Van Walbeek, 2005

[4] This chapter is an updated version of work previously published as a working paper by the Bloomberg Imitative to Reduce Tobacco Use (Blecher and van Walbeek, 2008) and in the journal *Tobacco Control* (Blecher and van Walbeek, 2009). I would like to thank Kelly Henning and Jan Schmidt-Whitley for their assistance, Emmanuel Guindon, Steven Birch, Susan Cleary, Stephan Rabimov, Emil Sunley and three anonymous referees for their comments and suggestions, Thembi Dladla for research assistance, and Angela McClean of the Economist Intelligence Unit for providing some of the data. I would like to acknowledge the financial support of Bloomberg Initiative to Reduce Tobacco Use.

[5] For comprehensive reviews see Chaloupka and Warner (2000), Van Walbeek (2005) and IARC (2011).

[6] Although excise tax increases are the policy tool that governments use it does not necessarily mean that prices rise as a result. Manufacturers determine prices and can elect to pass on the tax increase to consumers or to absorb it.

and IARC, 2011). As their incomes increase, people find that many things, including cigarettes, become more affordable.

This chapter focuses on the *affordability* of cigarettes. Affordability considers the simultaneous effect of income and cigarette price on a consumer's decision. Most studies to date considered price and income effects in isolation.[7] One can investigate the level of affordability (usually in a comparative context at a particular point in time), or changes in affordability over time. Both are analysed in this chapter. A number of definitions of affordability have been developed in the recent past, but essentially affordability refers to the quantity of resources required to buy a pack of cigarettes (in terms of time, money or other products).

I have two aims with this chapter: firstly, I wish to present the latest cigarette affordability statistics and trends in affordability for as many countries as the data allows. Secondly, I wish to address certain methodological issues--especially with regard to the measurement of income--when calculating affordability measures. The chapter consists of six sections: section 2.2 provides a brief overview of the existing affordability literature. Section 2.3 describes the data and the derivation of the various affordability measures. Section 2.4 presents the results, which are discussed in more detail in section 2.5. Section 2.6 concludes the chapter.

2.2 LITERATURE REVIEW

A limited number of published studies have explicitly investigated the affordability of cigarettes. Scollo (1996) and Lal and Scollo (2002) compared the price of cigarettes to that of a Big Mac hamburger. They found that between 1995 and 2002 cigarettes had become relatively more expensive than Big Mac hamburgers in 15 of the 16 (high-income) countries included in their two surveys. While this is encouraging from a tobacco control perspective, the conclusion is limited to high-income countries. Another criticism is that these studies use the price of the Big Mac hamburger as the

[7] The typical demand study includes both price and income as independent variables in a regression equation predicting consumption. However, one interprets the estimated coefficients in isolation, i.e. the effect of price on consumption holding income constant.

reference point. As such, they did not investigate affordability *per se*, but simply the price of cigarettes relative to an internationally standardised product (i.e. the Big Mac). This measure says as much about the affordability of Big Mac hamburgers as it says about the affordability of cigarettes.

Guindon *et al.* (2002) used an explicit measure of income by considering the time worked to purchase a pack of cigarettes. Based on the weighted average hourly earnings of twelve occupations monitored by the Union Bank of Switzerland's survey of earnings,[8] they calculated the average number of working minutes required to purchase a pack of local brand or Marlboro (or equivalent) cigarettes. They found that between 1990 and 2000 cigarettes became more affordable in 6 of the 25 (24%) high-income countries and in 4 of the 11 (36%) low- and middle-income countries in the sample. However, for the majority of both high-income and low- and middle-income countries, cigarettes became less affordable. From a tobacco control perspective, this is again an encouraging outcome.

Earlier studies focused primarily on high-income countries and used cross-sectional data at discrete points in time. Blecher and Van Walbeek (2004) considered a larger sample of 70 countries, of which 28 were high-income countries and 42 were low- and middle-income countries. They defined affordability in terms of per capita gross domestic product (GDP), which is a more encompassing definition of income than average earnings of a number of occupations. Despite being more expensive when expressed in a common currency, Blecher and Van Walbeek found that cigarettes were generally more affordable, in absolute terms, in high-income countries. Of the 28 high-income countries considered, cigarettes became more affordable in 11 (39%) and less affordable in 17 (61%) countries during the 1990s. Of the 42 low- and middle-income countries considered, cigarettes become more affordable in 24 (57%) and less affordable in 18 (43%) countries. For high-income countries these results corresponded with previous studies. However, the finding that cigarettes became more affordable in a majority of low- and middle-income countries is disappointing from a tobacco control perspective.

[8] Gross wages are adjusted for differences in working time, holidays and vacations. The twelve occupations are primary school teachers, bus drivers, automobile mechanics, building labourers, skilled industrial workers, cooks, department managers, electrical or mechanical engineers, bank clerks, secretaries, saleswomen, and female industrial workers.

Kan (2007) investigated the affordability of cigarettes in 60 cities in 2006. Using a similar methodology to that used by Guindon *et al.* (2002), Kan calculated the percentage of daily income required to purchase a pack of cigarettes. Rather than using the average earnings of all fourteen occupations monitored by the Union Bank of Switzerland,[9] Kan considered the seven occupations with the lowest earnings, on the grounds that (1) the average wage is not distorted by the inclusion of highly paid occupations, and (2) it better reflects the income patterns of the poor (who, in many countries, are more prone to smoke, and typically spend a larger proportion of their income on cigarettes than the rich). Kan (2007: 429) found that cigarette affordability "remained high" in most cities surveyed, and concluded that there is scope for further tax increases. Kan also warned that cigarettes would become more affordable in the fast-growing emerging economies if cigarette prices do not keep pace with rate of economic growth.

The previous literature is not without its problems; the goal here is to learn from these problems in order to refine the methodology used in this chapter. Affordability is a relative, not absolute, concept. One cannot, as Kan does, claim that cigarettes are affordable or not affordable. One can only say that cigarettes are more or less affordable relative to another country or point in time. The choice of income measure is potentially important since some measures of income are more representative than others. Particularly narrow measures of income, like the use of a single product, are potentially misleading, since it may say more about the affordability of the underlying product than the affordability of cigarettes. This chapter will analyse this choice of income measure in detail to understand what each one means in the context of affordability.

2.3 METHODOLOGY

Since affordability incorporates price and income components, the challenge is to obtain data that accurately reflect these two magnitudes.

[9] Guindon *et al.* (2002) used all twelve occupations surveyed by the Union Bank of Switzerland at the time although the sample was subsequently increased to fourteen occupations.

2.3.1 Price data

Price data are drawn from the "Worldwide Cost of Living Survey" of the *Economist Intelligence Unit*. This survey is conducted every six months in order to assess the prices of goods and services in 120 of the world's major cities. The prices used in this study were collected in the first week of September in the earlier years of the sample and in December of the later years; it covers each year for the period of 1990 to 2009. For most countries, a single city is monitored. In countries where multiple cities are monitored,[10] an unweighted average price is calculated. In 1990 the survey included 103 cities in 69 countries. By 2009 this number had risen to 120 cities in 77 countries. Over the period of investigation, the Economist Intelligence Unit expanded the coverage of their survey to include cities in countries that were already represented in the survey in 1990.[11] Such cities were excluded from the analysis because they bias the average price when the average cost of living differs significantly between the city (or cities) in the original survey and the newly included city.[12]

The survey considers the prices of two cigarette brands: Marlboro (or nearest international equivalent) and a popular local brand, sold at two types of outlets: high volume supermarket, and mid-price retail outlet. Since the emphasis is on

[10] Namely Australia (5), Brazil (2), Canada (4), China (5), France (2), Germany (5), India (2), Italy (2), Japan (2), New Zealand (2), Russia (2), Saudi Arabia (3), Spain (2), the United Arab Emirates (2), the United Kingdom (2), the United States (16) and Vietnam (2). The number of cities is shown in parenthesis.

[11] Namely China, Russia, the United Kingdom, the United States and Vietnam. See the appendix for a list of the cities that are included in the analysis.

[12] The example of China is useful here. In 1990 only Beijing was included in the survey. In 1993 two further cities, Guangzhou and Shanghai, were added, and in 1999 Shenzhen and Tianjin were added to the survey. Compared to the previous period (which included only Beijing), the average price in 1993 would be artificially lowered, because the cost of living (and the price of cigarettes) was substantially lower in Guangzhou and Shanghai compared to Beijing. It is quite conceivable that, in 1993, the average price of cigarettes including Guangzhou and Shanghai increased despite the decrease in price in the whole sample. This would clearly be a misrepresentation of the true underlying price trend. The same is possible for the inclusion of Shenzhen and Tianjin in 1999.
Having said this, including or excluding cities that were included in the survey after 1990 from the analysis does not have a large quantitative impact on the price and affordability indicators. For most countries the issue is moot, because no new cities were included in the sample after 1990. Even for countries for which it would matter, the correlation coefficient between the prices based on the average of the original and the expanded pool of cities is in excess of 0.95.
For the five affected countries the affordability measures for 2008 and 2009 (presented in Figure 2.1 through 2.5 and Table 2.2) are based on the expanded sample of cities while the measures investigating the trends in affordability over time (presented in Figures 2.6 and 2.7 and Tables 2.3 and 2.4) use only the cities included in the survey in 1990. The differences in the trend in affordability in these five countries is so small that it had no material impact on the summary tables.

affordability, the lowest of the four prices was selected for each year. In practically all cases this was the local brand, sold at the supermarket.[13]

The Economist Intelligence Unit collects price data in local currency. Calculating affordability measures does not require that the price data be converted to a common currency, because income data are also collected in local currency. To compare cigarette prices between countries, all prices were converted to United States dollars using two exchange rates: (1) market exchange rates on the day of the survey from the Economist Intelligence Unit,[14] and (2) purchasing power parity (PPP) conversion factors from the World Bank's "World Development Indicators" online database.

2.3.2 Income data

While price is conceptually quite easy to comprehend, income is more complex. Firstly, how does one define income? Should one use a broad definition (e.g. per capita GDP) or a narrow definition (e.g. after-tax income)? While a broad definition of income is less sensitive to differences in tax regimes and government's role in providing goods, services and grants, a narrow definition is typically better understood by the public. For example: "A London teacher's net hourly earnings in 2006 was £ 8.65" versus "Per capita GDP in the United Kingdom in 2006 was £ 21 084". Secondly, there is the issue of income distribution. Two countries may have a similar average level of income, but if the income distributions are dissimilar, affordability measures in such countries would not be comparable. Given the same cigarette price, cigarettes are likely to be more affordable in a middle-income country with a relatively equal income distribution than in a country with a similar average level of income, but where a large proportion of the population may be desperately poor.

[13] In 2008 the local brand was cheapest in 69 countries; Marlboro was cheapest in 3 countries; and the local brand and Marlboro were equally priced in 5 countries.
[14] The data are provided by the *Economist Intelligence Unit* in both local currencies and United States dollars. They indicate that the conversion is made using the market exchange rate on the day of the survey.

I use two income measures. Per capita GDP is a broad measure of income and has the advantage of being calculated using a consistent methodology. It is generally regarded as a good indicator of average living standards, despite the fact that it does not take differences in the distribution of income into account. GDP data were drawn from the World Bank's "World Development Indicators" online database. Local currency aggregate GDP was converted into per capita terms using population statistics from the same database. All countries who are members of the World Bank are reported in the database.[15]

The second income measure is the Union Bank of Switzerland survey of earnings, also used by Guindon *et al.* (2002) and Kan (2007). The survey calculates gross and net hourly earnings in a number of occupations in the most important commercial cities around the world.[16] I used five surveys (1997, 2000, 2003, 2006 and 2009) to construct a discrete time series of median earnings. The surveys were based on twelve occupations in 1997 and 2000, thirteen in 2003 and fourteen in 2006 and 2009.[17]

2.3.3 Measures of affordability

The *relative income price* is a broad measure of affordability developed by Blecher and Van Walbeek (2004). This measure has received significant attention in the literature and has featured in country level studies (Guindon *et al.*, 2010) and global publications like the *Cancer Atlas* (Mackay *et al*., 2006a: 56-57). The relative income price calculates the percentage of per capita GDP required to purchase the 100 cheapest packs of cigarettes. The higher the relative income price, the less affordable cigarettes are, and vice versa.

[15] Taiwan is a notable exclusion since it is not considered an independent country by the World Bank.
[16] This included 55 cities in 48 countries in 1997, 58 cities in 50 countries in 2000, 70 cities in 59 countries in 2003 and 70 cities in 58 countries in 2006 and 2009.
[17] The occupations were primary school teachers, bus drivers, automobile mechanics, building labourers, skilled industrial workers, cooks, department managers, engineers, bank credit clerks, secretaries, saleswomen, and female industrial workers. The additional occupation in 2003 was a product manager and the additional occupation in 2006 was a call centre agent.

The relative income price was calculated for each year in the period 1990 to 2008, for as many countries as the data allowed.[18] During the period under investigation some countries experienced hyperinflation, which complicated the data analysis. In some cases manual adjustments were required to make the GDP data and the price data comparable. These are indicated in the appendix. Furthermore, the observation for Poland in 1992 was excluded due to an extreme value (one tenth the value of the preceding year and one sixth the value in the following year).

The *minutes of labour* method was developed by the World Health Organisation (World Health Organisation, 1998) but popularised by Guindon *et al.* (2002). It has also gained a significant amount of attention in the literature including in publications like the *Tobacco Atlas* (Mackey *et al.*, 2006b). It is defined as the minutes of labour required to purchase the cheapest pack of cigarettes (as surveyed by the *Economist Intelligence Unit*), based on net earnings.[19] There are a number of variations of this methodology. Guindon *et al.* (2002) use the weighted average of all occupations as calculated by the Union Bank of Switzerland. Alternatively one may choose to use the simple average or the median. In this chapter I use the median for calculating the minutes of labour method because it is not affected by outliers of earnings in specific occupations.[20]

Kan (2007) defines affordability as the percentage of daily income required to buy a pack of cigarettes. I did not use Kan's measure in this chapter because it is essentially the reciprocal of Guindon *et al.'s* minutes of labour method. However, Kan's focus on the lower paying jobs is useful in the context of affordability of cigarettes among the poor. Therefore, I specify an additional affordability measure as the number of minutes required to buy a pack of cigarettes by a person earning a relatively low

[18] The relative income price is calculated until 2008 since income data from the World Bank is not available for 2009. Price data from the Economist Intelligence Unit and income data from the Union Bank of Switzerland are available in 2009 and thus these measures are calculated for 2009.
[19] Although Guindon *et al.* calculate the measure using the international and local brand of cigarette I use the cheapest pack of cigarettes for all measures to ensure consistency.
[20] The minutes of labour method can be distorted by differences across countries at a point in time in average hours as well as for a given country over time as hours change – the former is likely to be particularly important in understanding differences in measures between countries based on income levels, and the latter in understanding trends in affordability, particularly in rapidly developing countries where the benefit of development has been a reduction in average hours at the same time as wages are rising. I am indebted to an examiner for raising this.

wage. Following Kan's lead, I did this by calculating the median net wage of the lowest paid half of the occupations surveyed by Union Bank of Switzerland.[21]

2.3.4 Other issues

The typical way to determine whether cigarettes have become more or less affordable in the years since 1990 would be to compare the most recent value to a past value. Using only the starting and ending values the average annual growth rate is computed using the standard formula: $(Y_t/Y_{t-1})^{1/n} - 1$. If no information on prices is available for the period between the starting and ending years, this is the appropriate procedure. However, if the intermediate values are known and the starting and/or ending values are outliers, i.e. significantly different from the underlying trend, the calculated growth rate will be unrepresentative of the true trend. To prevent such distortions, a constant growth regression line was fitted to all observations (see Gujarati, 2003: 178-181). This entails fitting the regression line $ln(Y_t) = \alpha + \beta t + \varepsilon_t$ where $t = 0, 1, 2, \ldots$. The estimated value of β is the estimated constant growth rate of the variable Y. An advantage of this approach is that even if some values are missing (even at the extremities), one can still estimate the value of β.

Although the statistics are interpreted in the same manner, they will provide differing results. Although the constant growth regression is the most accurate measure, it is not always appropriate given that of some of the data used in this chapter (i.e. the Union Bank of Switzerland earnings data) are not available on an annual basis. Both measures were reported where possible.

Although all reasonable measures have been taken to ensure that the data are correct, a variety of factors--including changes in currencies, hyperinflation, temporary spikes in cigarette prices, errors in collection, volatile exchange rates, etc.--could result in incorrect and possibly outlier values. Of the two measures of central tendency (mean and median), I typically used the median, because it is not susceptible to the influence

[21] The lowest six occupations were used in 1997, 2000 and 2003 while the lowest seven occupations were used in 2006 and 2009. What this means in practice is that the fourth lowest wage is used in 2006 and 2009 and the average of the third and fourth lowest in 1997, 2000 and 2003.

of outliers, whereas the mean is. When calculating correlations, I typically used Spearman rank correlations, rather than simple (Pearson) correlations, for two reasons: firstly, Spearman correlations do not assume a linear relationship, whereas the Pearson correlations do. Secondly, Spearman correlations are not affected by outliers, whereas Pearson correlations are. Zar's (1972) tables were used to test the significance of the Spearman coefficients.

The sample consists of 78 countries where GDP was used as the measure of income (based on 123 cities for which price data were available), and 53 countries (68 cities) where the Union Bank of Switzerland data were used. The World Bank's classification in July 2009 (World Bank, 2009) was used to divide the countries into four income categories: high (34 [30] countries), upper-middle (19 [14] countries), lower-middle (20 [8] countries) and low (5 [1] countries).[22]

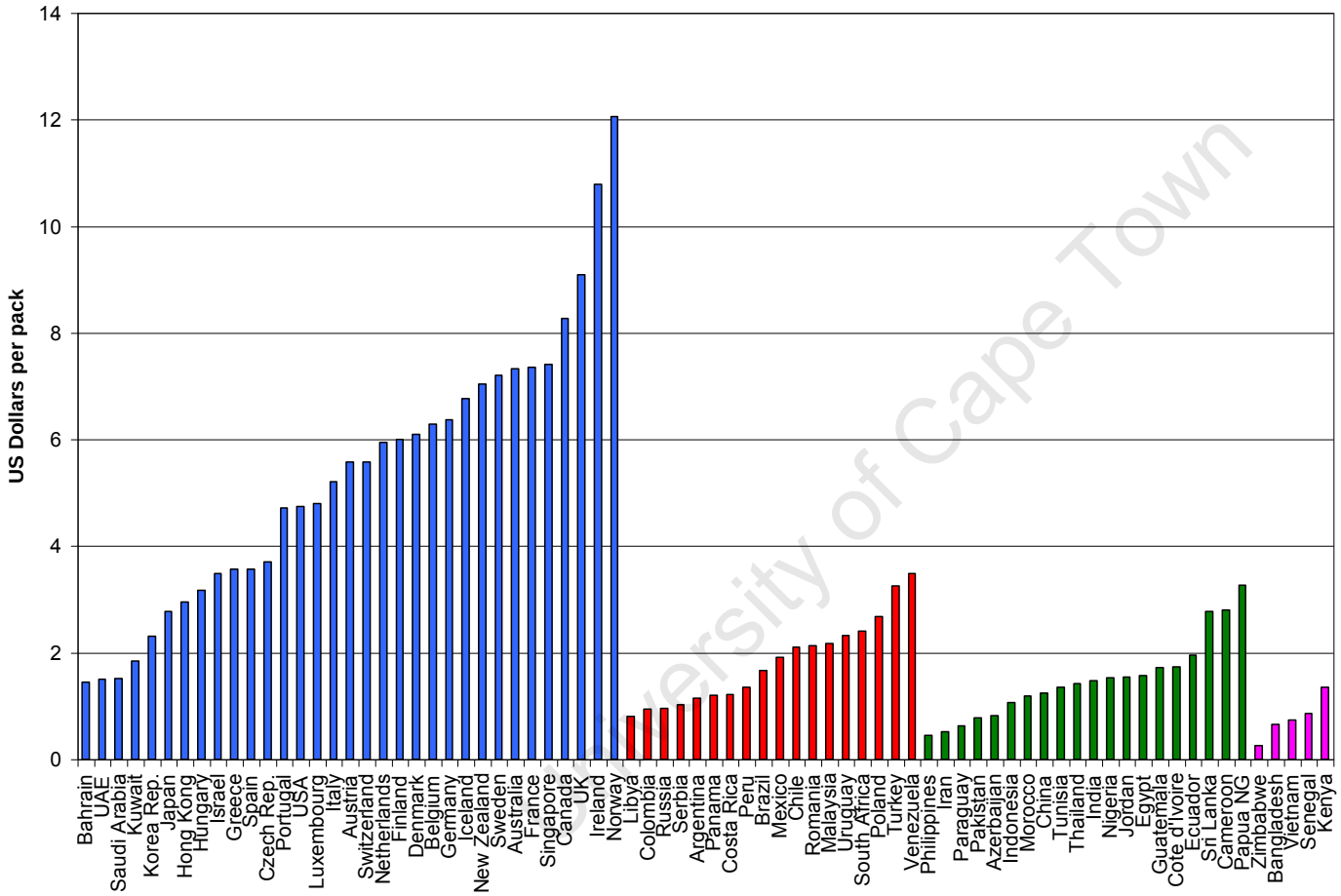
2.4 RESULTS

2.4.1 The situation in 2008 and 2009

Conventional wisdom tells us that cigarette prices, expressed in a common currency, are much higher in high-income countries than in low- and middle-income countries (World Bank, 1999 and Jha and Chaloupka, 2000). This is illustrated by Figure 2.1, which first ranks countries according to their income status (high-income, upper-middle-income, lower-middle-income and low-income) and then according to the United States dollar price per pack of cigarettes in 2008. Cigarettes are, on average, between three to four times more expensive in high-income countries than in middle-income countries and almost seven times more expensive in high-income countries than in low-income countries. However, among the low- and middle-income countries in the sample, I find that average prices in upper-middle and lower-middle countries are similar and slightly higher than low-income countries.

[22] The first number refers to GDP data, and the second number to Union Bank of Switzerland data.

Figure 2.1: Price per pack of cigarettes expressed in US dollars, 2008



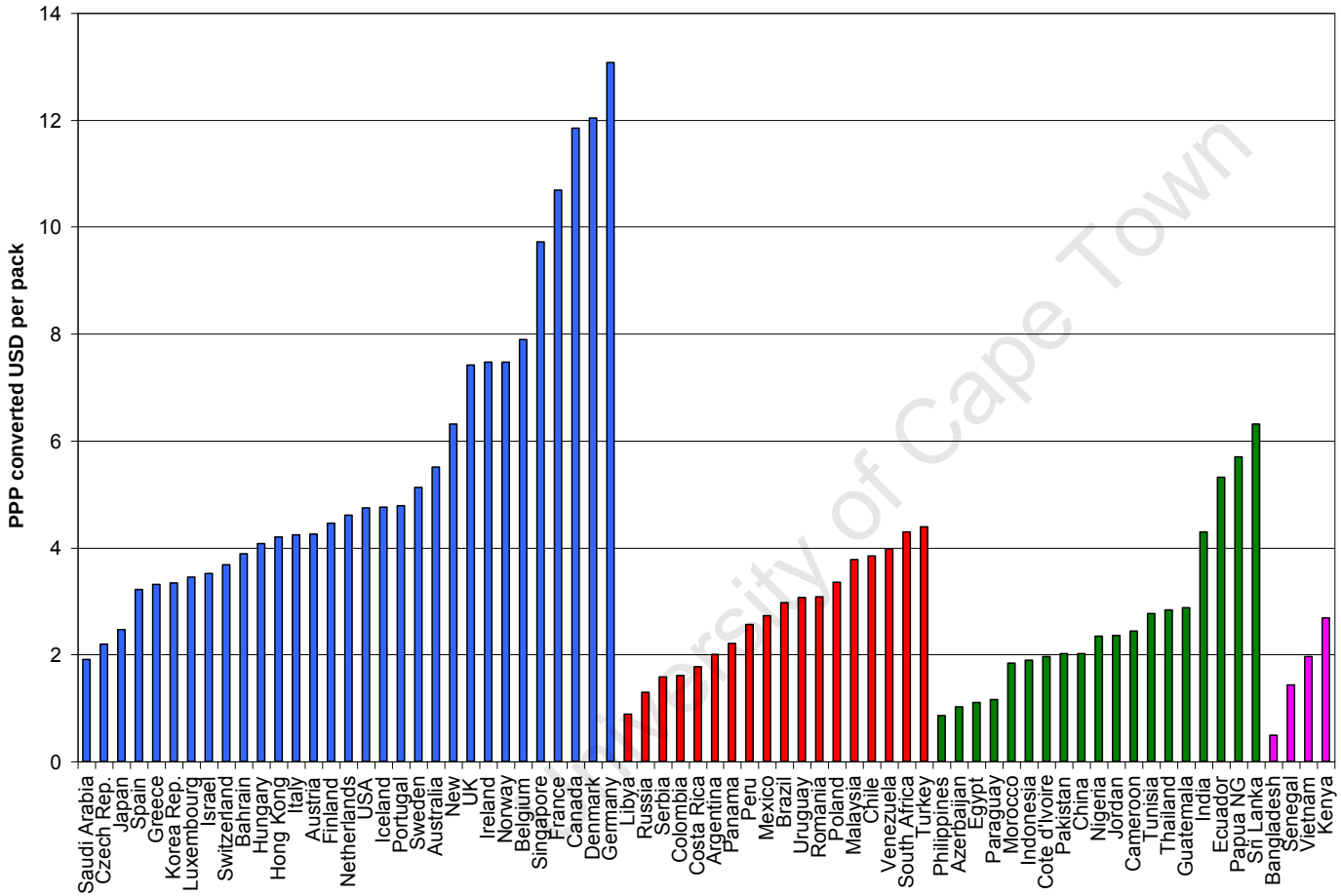
Note: The figure does not include countries which have no observation for 2008. High-income countries are in blue, upper-middle-income countries in red, lower-middle-income countries in green and low-income countries in pink. This convention is followed throughout.
Source: Economist Intelligence Unit

A second feature of Figure 2.1 is the very large variability in the US dollar prices among countries with a similar level of development. For high-income countries, with a mean price of $5.55 (median $5.57) and standard deviation of $2.61, the coefficient of variation is 0.47. Among low- and middle-income countries the coefficient of variation is 0.59 (=$0.80/$1.36). Countries with high costs of living (e.g. Norway) and those that have taken strong tobacco control action (e.g. Australia, Canada, Ireland, New Zealand and the United Kingdom) have the most expensive cigarettes. Middle Eastern countries tend to have the cheapest cigarettes among the high-income countries.

Purchasing power parity (PPP) conversion rates quantify price differences between countries based on a large basket of goods and services. PPP-adjusted cigarette prices account for the fact that average price levels differ between countries, and as such it is an alternative price measure. PPP-adjusted United States dollar prices per pack of cigarettes in 2008 are presented in Figure 2.2, sorted according to their income status and according to price. The average PPP-adjusted United States dollar price among high-income countries is more than double that of low- and middle-income countries. Average PPP-adjusted US dollar prices are similar in upper-middle-income and lower-middle-income countries, and slightly higher than they are in low-income countries. Differences in average cigarette prices between high-income and other countries are compressed when one uses PPP-adjusted prices vis-à-vis prices calculated with current exchange rates.[23]

[23] Summary statistics for both price and affordability measures are presented in Table 2.2.

Figure 2.2: Price per pack of cigarettes expressed in PPP adjusted US dollars, 2008



Note: The figure does not include countries which have no observation for 2008.
Source: Economist Intelligence Unit and the World Bank

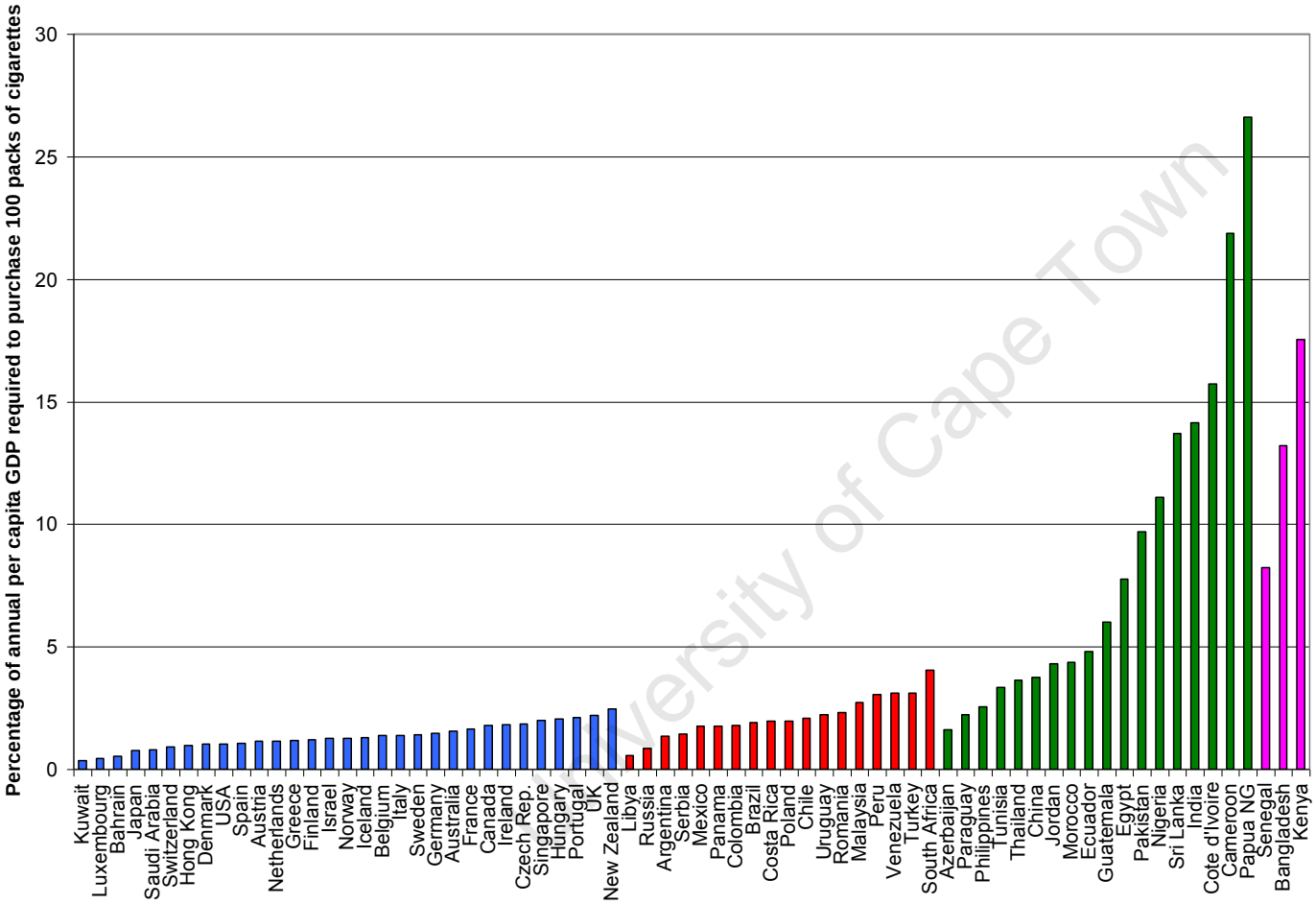
Do excise tax rate differences adequately explain the differences in retail prices? Based on data published in a recent World Health Organisation report (World Health Organisation, 2008), I calculated a Spearman ranked correlation coefficient of 0.40 ($n = 120$, $P < 0.001$) between US dollar-denominated retail prices (calculated using the current exchange rate) and the national excise tax incidence (i.e. excise tax as percentage of the retail price, but excluding provincial/state, local and general sales taxes).[24] While the correlation is significantly positive, most of the variation in retail prices is explained by other factors. These factors include market structure, trade restrictions and manufacturer pricing strategies. However, this does not mean that excise taxes are not the single most important factor affecting prices.

Figure 2.1 is certainly useful in some circumstances. To know that cigarettes are very expensive in Norway is useful information for a smoker travelling to that country. Similarly, multinational cigarette companies would be interested to know the after-tax prices, expressed in a common currency. (The prices shown in Figure 2.1 are the tax-inclusive prices). However, one cannot infer anything about the affordability of cigarettes from Figure 2.1, because it does not incorporate the level of income. This is also true for Figure 2.2, which only tells us about the price of cigarettes in relation to the prices of a basket of other goods and services.

The relative income price of cigarettes – the percentage of per capita GDP required to buy 100 packs of cigarettes – is shown in Figure 2.3. The lower this percentage, the more affordable the cigarettes are. The countries are again sorted, first by income status, and then by relative income price.

[24] The United States and Canada levy cigarette excise taxes primarily at the state/provincial level. Since national excise tax burdens severely understate the true tax burden, these two countries are excluded from the calculation.

Figure 2.3: Relative income price of cigarettes, 2008



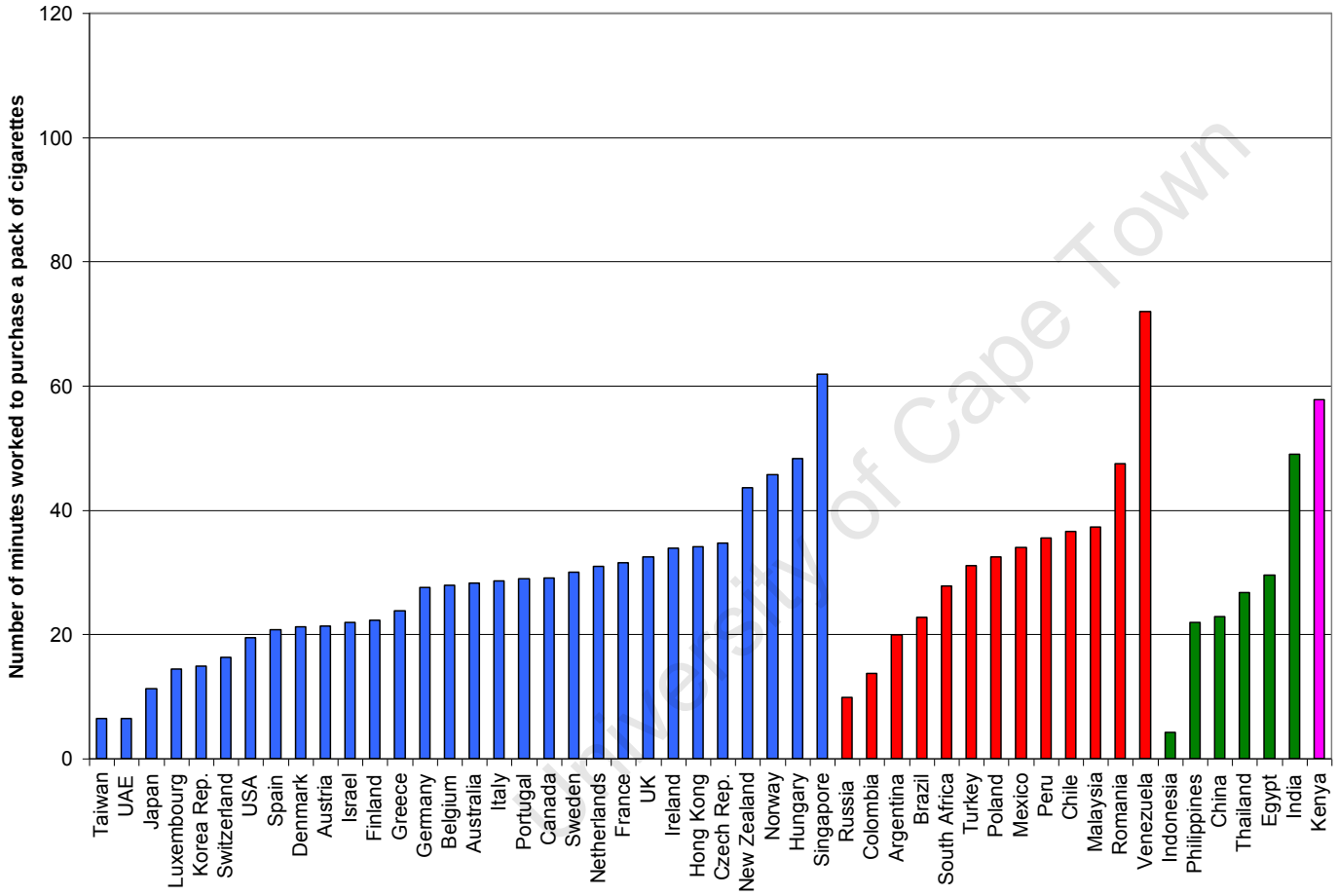
Note: The figure does not include countries which have no observation for 2008.
Sources: Economist Intelligence Unit and the World Bank

Using this measure of affordability, cigarettes are not significantly more affordable in high-income countries than they are in upper-middle-income countries. However, they are significantly more affordable in high-income countries than they are in lower-middle-income and low-income countries. This is despite the fact that they are typically more expensive in absolute terms in high-income countries. This is explained by the fact that, although cigarettes in high-income countries are about three to four times more expensive in absolute terms than they are in low- and middle-income countries, per capita GDP in high-income countries exceeds per capita GDP in low- and middle-income countries by a much greater factor.

Figures 2.4 and 2.5 indicate the number of minutes of work required to buy a pack of cigarettes in 2009, based on the Union Bank of Switzerland survey. The greater the number of minutes of labour required to purchase a pack of cigarettes, the less affordable the product. For both figures, the countries are sorted first according to income status, and then according to the minutes of labour required to buy a pack of cigarettes. Figure 2.4 approximates Guindon *et al.'s* (2002) method and aims to estimate affordability of cigarettes for the median employed person.[25] Figure 2.5 is derived from Kan's (2007) method and is based on the median wage earned by the seven lowest-earning occupations surveyed by the Union Bank of Switzerland (i.e. the 25th percentile of jobs surveyed). Figure 2.5 thus specifically focuses on the affordability of cigarettes among poorer employed people. By construction the numbers in Figure 2.5 are always higher than the numbers in Figure 2.4.[26]

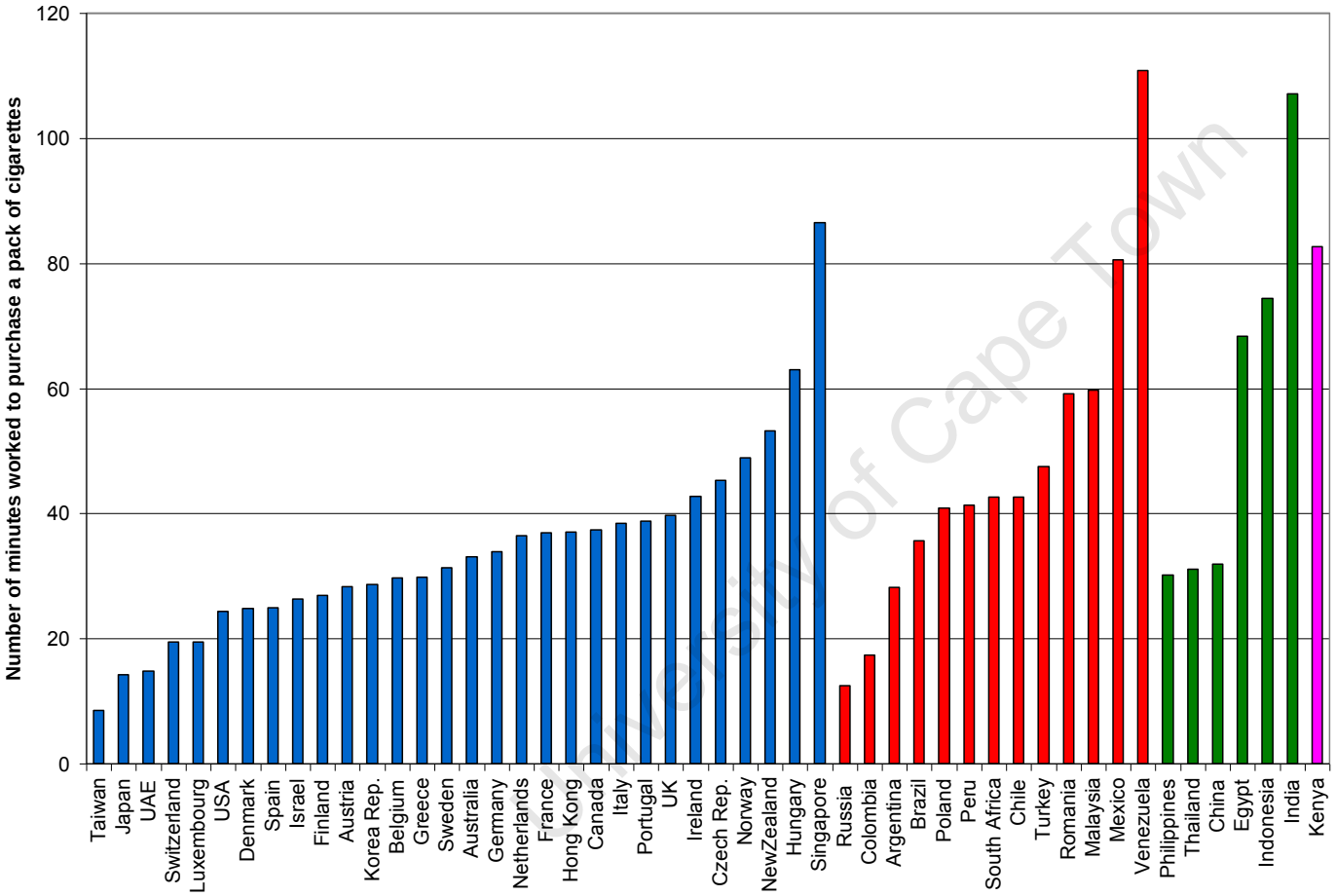
[25] Guindon *et al.* use the weighted average while I use the median since it is less prone to outliers.
[26] The scales on the vertical axes in Figures 2.4 and 2.5 are standardized to make comparing the two easier.

Figure 2.4: Number of minutes of labour required to purchase a pack of cigarettes (median of all occupations), 2009



Sources: Economist Intelligence Unit and the Union Bank of Switzerland

Figure 2.5: Number of minutes worked to purchase a pack of cigarettes (median of seven lowest paid occupations), 2009



Sources: Economist Intelligence Unit and the Union Bank of Switzerland

The relatively few observations for middle-income, and low-income countries, prevent us from making strong conclusions. Nevertheless, what Figure 2.4 does suggest is that the level of cigarette affordability, using the minutes of labour method, does not vary significantly between high-income and middle-income countries. While there is a high degree of variation in cigarette affordability within groups of countries with a similar level of development, there is not much variation between the averages (and medians) of the different groups. The statistical moments (mean, median and standard deviation) of high-income, upper-middle-income and lower-middle-income countries are very similar.

Figure 2.4 stands in stark contrast to Figure 2.3, which found that cigarette affordability decreases sharply as we move from high-income to low-income countries.

In Figure 2.5, as with Figure 2.4, the degree of variation within the same group is high. However, as one moves from high-income to low-income countries, there is a suggestion that cigarettes, on average, become relatively less affordable (at least more so than Figure 2.4). What is implied is that poorly remunerated occupations in middle-income and low-income countries yield comparatively lower earnings in such countries than similarly remunerated occupations in high-income countries. This issue is discussed in more detail in Section 2.5.

Spearman rank correlation coefficients were calculated for the three different affordability indices for the comparable years (1997, 2000, 2003 and 2006 for those involving the relative income price, and additionally 2009 for the minutes of labour measures), and are shown in Table 2.1. The purpose of this is to show how similar or different the measures are. All the calculated test statistics are statistically significant indicating that they are different from zero. The correlations are consistently higher between the Guindon and Kan minutes of labour methods than for the comparisons between the minutes of labour methods and relative income price – presumably because they are based on the same earnings data. Correlations are also higher in high-income countries than in low- and middle-income countries for all three comparisons, meaning that the choice of measure makes less difference in high-income countries than it does in low- and middle-income countries. With few

exceptions the correlation coefficients are high, meaning that although conceptually different, these measures indicate similar things. The Kan minutes of labour method shows slightly higher correlations to the relative income price (between 0.74 to 0.82 for all countries) than the Guindon minutes of labour method to the relative income price (0.62 to 0.68 for all countries). Possible explanations for the divergence of these affordability measures, especially in low- and middle-income countries, are provided in section 2.5, together with a discussion of the implications of the result.

Table 2.1: Spearman rank correlation coefficients between the different affordability measures

Year	All countries	High-income countries	Low- and middle-income countries
	Relative income price – Guindon's minutes of labour		
1997	0.656** (44)	0.852** (28)	0.662** (16)
2000	0.682** (45)	0.849** (28)	0.564* (17)
2003	0.661** (49)	0.922** (29)	0.714** (20)
2006	0.622** (47)	0.865** (28)	0.596** (19)
	Relative income price – Kan's minutes of labour		
1997	0.784** (44)	0.846** (28)	0.756** (16)
2000	0.811** (45)	0.843** (28)	0.605** (17)
2003	0.824** (49)	0.944** (29)	0.672** (20)
2006	0.743** (47)	0.920** (28)	0.437* (19)
	Guindon's minutes of labour – Kan's minutes of labour		
1997	0.934** (44)	0.983** (28)	0.888** (16)
2000	0.917** (45)	0.987** (28)	0.858** (17)
2003	0.875** (49)	0.917** (29)	0.853** (20)
2006	0.844** (47)	0.892** (28)	0.763** (19)
2009	0.842** (49)	0.948** (29)	0.728** (20)

Note: Number of observations are shown in parentheses. It is not possible to calculate Spearman rank correlation coefficients between the relative income price and the minutes of labour in 2009 since the relative income price is only calculated until 2008 and the minutes of labour are not calculated for 2009. * Significantly different from zero at 5 per cent level. ** Significantly different from zero at 1 per cent level.
Sources: Economist Intelligence Unit, the Union Bank of Switzerland and the World Bank

Table 2.2 is a summary of the three affordability measures and the price expressed in a common currency. Four statistics are shown in each case: the mean, median, standard deviation and the coefficient of variation (standard deviation/mean). As mentioned previously, this chapter regards the median as the better measure of central tendency, as it is not affected by extreme values.

Table 2.2: Summary of affordability indices in 2008/2009

Indicator	Unit	Measure	High-income countries	Upper-middle-income countries	Lower-middle-income countries	Low-income countries
Price (2008)	USD per pack (nominal, converted with market exchange rates)	Observations	33	18	20	5
		Mean	$5.35	$1.82	$1.49	$0.78
		Median	$5.57	$1.79	$1.45	$0.74
		Std. dev.	$2.61	$0.81	$0.76	$0.39
		CV	0.47	0.45	0.52	0.53
Price (2008)	USD per pack (nominal, converted using PPP conversion factors)	Observations	31	18	19	4
		Mean	$5.67	$2.79	$2.69	$1.64
		Median	$4.60	$2.85	$2.35	$1.69
		Std. dev.	$3.02	$1.07	$1.59	$0.92
		CV	0.41	0.38	0.68	0.54
Relative income price (Blecher & Van Walbeek's measure) (2008)	Percentage of per capita GDP to buy 100 packs	Observations	31	18	18	3
		Mean	1.34%	2.11%	8.73%	12.98%
		Median	1.27%	1.96%	5.40%	13.19%
		Std. dev.	0.53%	0.86%	7.17%	4.66%
		CV	0.41	0.44	1.32	0.35
Median minutes of labour (14 occupations) (Guindon's measure) (2009)	No. of working minutes to buy one pack of cigarettes	Observations	30	13	6	1
		Mean	27.3 min	32.3 min	25.7 min	57.7 min
		Median	28.1 min	32.5 min	24.8 min	57.7 min
		Std. dev.	12.1 min	15.8 min	14.4 min	n/a
		CV	0.43	0.49	0.58	n/a
Median minutes of labour (7 lowest paid occupations) (Kan's measure) (2009)	No. of working minutes to buy one pack of cigarettes	Observations	30	13	6	1
		Mean	34.1 min	47.6 min	57.2 min	82.6 min
		Median	32.2 min	42.6 min	50.1 min	82.6 min
		Std. dev.	15.3 min	26.1 min	31.5 min	n/a
		CV	0.48	0.61	0.61	n/a

Note: Nominal prices are presented in 2008 in order to make them comparable to the PPP prices which are not available in 2009.
Sources: Economist Intelligence Unit, the Union Bank of Switzerland and the World Bank

A number of features in this table stand out. Price, by itself, is a misleading indicator of affordability, since it does not take income into account. In fact, based on this sample of countries, price, expressed in a common currency, is unrelated, or even negatively related, to affordability.[27] This is not meant to suggest that price is altogether not important, but it is to say that level of income is equally important in determining affordability. The data confirm the notion that cigarettes are more expensive in absolute terms in richer countries than they are in poorer countries. The median price in high-income countries is approximately seven times higher than in it is in low-income countries, and between three and four times higher than it is in middle-income countries.

The relative income price provides strong support for the hypothesis that cigarettes are significantly less affordable in middle-income and especially low-income countries than they are in high-income countries. The median relative income price increases tenfold as we move from high-income to low-income countries. Kan's (2007) minutes of labour measure of affordability, which focuses on relatively poorly remunerated workers, comes to a similar conclusion, although it is not nearly as strong. Median cigarette affordability decreases by a factor of 2.6 (32 minutes vs. 83 minutes) as one moves from high-income to low-income countries. For upper-middle and lower-middle income countries the factors are 1.3 and 1.6, respectively. On the other hand, Guindon *et al.'s* (2002) minutes of labour approach, which focuses on the affordability of cigarettes for the median worker, finds little evidence to suggest that cigarette affordability varies significantly between groups of countries. In high-income countries, the minutes of labour required to purchase a pack of cigarettes is 2.1 times greater than in low-income countries, and 1.2 and 0.9 times higher (lower if the ratio is less than one) than in upper-middle and lower-middle-income countries, respectively.

[27] Spearman's correlation coefficient between the United States dollar price and the relative income price is -0.48, between United States dollar price and Guindon *et al.'s* minutes of labour affordability measure it is 0.24 and between United States dollar price and Kan's minutes of labour affordability measure it is -0.22. The last two coefficients are not significant at the 5% level.

2.4.2 Trends in affordability between 1990 and 2008/9

The previous discussion considered the situation in the most recent year for which data were available, i.e. 2008/9. An equally, if not more important issue, concerns trends in affordability. One would expect that, given the increased awareness of the dangers of smoking and the increased activism of tobacco control lobby groups around the world, a majority of governments would have heeded their call and implemented strategies to make cigarettes less affordable. Furthermore, the entry into force of the World Health Organisation's *Framework Convention on Tobacco Control* has improved the policy environment in which tobacco control operates. However, the market power of the global tobacco industry has also greatly increased over time, given globalization and merger and acquisition activity has likely offset some of the strength of tobacco control (see Gilmore *et al*, 2010).

The aim of this section is to investigate briefly trends in cigarette affordability since 1990. Two approaches are used. I first consider growth rates in cigarette prices and the three affordability measures for the period 1997 to 2008/9. I am limited to this period because the minutes of labour affordability measures are available only for the years 1997, 2000, 2003, 2006 and 2009. Subsequently, I use the relative income price to consider trends in cigarette affordability for a longer period (1990-2008) and some sub-periods.

Table 2.3 shows the average annual growth rates in the real United States dollar price of cigarettes and the three affordability measures for the periods 1997-2000, 2000-2003, 2003-2006, 2006-2009 and 1997-2008/9.[28] Countries were divided into two groups: high-income countries and low- and middle-income countries. The growth rates are based on the median values for the appropriate groups of countries for the relevant years. A positive value implies that cigarettes have become less affordable, while a negative value implies that cigarettes have become more affordable.

[28] These growth rates were calculated according to the standard formula: $[(Y_t/Y_{t-n})^{1/n} - 1] \times 100$. It was impossible to calculate growth rates with a constant growth regression model, because in-between values for the minutes of labour affordability measure do not exist.

Table 2.3: Growth rates in cigarette price and affordability measures for 1997-2006, based on the median for the country categories

Indicator	Unit	Country category	Median annual growth rate					Percentage of countries with growth rates > 0				
			1997-2000	2000-2003	2003-2006	2006-2008/9	1997-2008/9	1997-2000	2000-2003	2003-2006	2006-2008/9	1997-2008/9
Real price	Constant 2000 USD per pack	High-income counties	-3.8% (32)	8.8% (33)	3.7% (33)	6.5% (33)	4.0% (32)	31%	88%	66%	79%	84%
		Low- and middle-income countries	-3.9% (43)	0.7% (40)	1.6% (36)	4.1 (38)	1.4% (42)	37%	53%	58%	66%	62%
Relative income price	Percentage of per capita GDP to buy 100 packs	High-income counties	-0.2% (32)	1.9% (33)	-1.9% (33)	0.7% (31)	0.3% (30)	47%	67%	30%	55%	53%
		Low- and middle-income countries	-0.3% (43)	-0.7% (42)	-7.1% (38)	-3.8% (35)	-1.7% (38)	49%	48%	11%	23%	26%
Median minutes of labour (14 occupations) (Guindon's measure)	Number of working minutes to buy one pack of cigarettes	High-income counties	3.0% (28)	0.8% (29)	1.6% (29)	1.3% (29)	1.7% (29)	71%	55%	59%	69%	76%
		Low- and middle-income countries	5.1% (16)	-1.5% (16)	-0.6% (18)	5.0% (19)	0.0% (15)	75%	44%	44%	58%	53%
Median minutes of labour (7 lowest paid occupations) (Kan's measure)	Number of working minutes to buy one pack of cigarettes	High-income counties	1.3% (28)	4.6% (29)	2.6% (29)	2.8% (29)	1.3% (29)	64%	72%	69%	62%	86%
		Low- and middle-income countries	3.4% (16)	1.0% (16)	-4.4% (18)	1.8% (19)	1.4% (15)	63%	50%	33%	63%	53%

Note: Number of observations is shown in parentheses. The periods until 2008 are used for the real price and relative income price and 2009 for the minutes of labour.
Sources: Economist Intelligence Unit, the Union Bank of Switzerland and the World Bank

Table 2.3 reveals a fairly consistent picture regarding trends in cigarette affordability over the period 1997-2008/9. There is strong evidence that high-income countries, as a group, have been able consistently to reduce the affordability of cigarettes. All three measures indicate a decrease in cigarette affordability over the longest sample and through most sub-samples. Throughout the period, cigarettes have become less affordable at the rate between 0.3% to 1.7% per annum depending on the measure used. The most significant change is found when using Kan's measure while the smallest change is found using the relative income price. From a tobacco control perspective this is an encouraging result, indeed.

The picture for low- and middle-income countries is less optimistic. Despite minor inconsistencies between the three affordability measures, Table 2.3 suggests that cigarettes have become *more* affordable between 1997 and 2008/9. The relative income price measure certainly indicates this. In the period 2003 to 2006 all three measures indicate that cigarettes have become significantly more affordable in low- and middle-income countries. For two measures, the relative income price (-7.1% per year) and Kan's minutes of labour measure (-4.4% per year), the decreases were substantial, while Guindon *et al.'s* minutes of labour suggests a less dramatic decrease (-0.6% per year). These years (2003-2006) saw rapid economic growth in many low- and middle-income countries. The evidence clearly indicates that the price of cigarettes did not keep pace with the growth in income and that, as a result, cigarettes became more affordable.

Table 2.4 considers trends in cigarette affordability over a longer period (1990-2008) using only the relative income price as a measure of affordability. The growth rates are calculated using both the constant growth regression method as well as the average annual growth rate method. The two methods show relatively similar results, in terms of direction and magnitude, for both the shorter and longer sub-periods.

Among high-income countries there has been an increase of 1.1% per annum over the entire sample in the relative income price using the average annual growth rate method; much of it occurred between 2000 and 2003. However, when using the constant growth regression method, growth in the relative income price is unchanged.

However, the most recent years, 2006 to 2008, indicate that cigarettes have become less affordable in high-income countries, independent of the method used.

Table 2.4: Median of the average annual percentage change in relative income price, 1990-2008

Period	High-income countries	Upper-middle-income countries	Lower-middle-income countries	Low-income countries	Low- and middle-income countries
Average annual growth rate method					
1990-1995	0.4% (31)	-3.9% (15)	-3.3% (18)	4.5% (4)	-2.6% (37)
1995-2000	-0.6% (32)	0.8% (19)	-1.5% (19)	-4.3% (5)	-0.8% (43)
2000-2003	1.9% (33)	-0.7% (17)	0.3% (20)	-1.8% (5)	-0.7% (42)
2003-2006	-1.9% (33)	-5.0% (16)	-7.0% (19)	-7.9% (3)	-7.1% (38)
2006-2008	0.7% (31)	-3.5% (16)	-3.8% (17)	-7.6% (2)	-3.8% (35)
2000-2008	0.4% (31)	-2.9% (18)	-3.6% (18)	-2.9% (3)	-3.2% (39)
1990-2008	1.1% (34)	-1.5% (15)	-3.2% (16)	-1.2% (3)	-1.6% (34)
Constant growth regression method					
1990-1995	0.4% (32)	-2.6% (19)	-4.5% (19)	4.6% (5)	-3.2% (43)
1995-2000	0.2% (34)	1.1% (19)	-1.0% (20)	-4.7% (5)	-0.1% (44)
2000-2003	2.2% (34)	-1.1% (19)	0.2% (20)	-2.6% (5)	-0.9% (44)
2003-2006	-1.7% (33)	-6.3% (18)	-7.7% (20)	-7.8% (5)	-7.1% (43)
2006-2008	0.7% (33)	-4.5% (18)	-3.1% (18)	-6.5% (3)	-4.1% (39)
2000-2008	-0.5% (34)	-3.4% (19)	-6.5% (20)	-2.9% (5)	-4.6% (44)
1990-2008	0.0% (34)	-0.6% (19)	-1.6% (20)	-2.2% (5)	-1.6% (44)

Note: Number of observations is shown in parentheses.
Sources: Economist Intelligence Unit and the World Bank

When considering low- and middle-income countries, the two methods show a consistent picture. The relative income price has declined in lower- and middle-income countries between 1990 and 2008 meaning cigarettes became more affordable. This is consistent for all three subgroups (upper-middle, lower-middle and low-income countries). The decrease in the relative income price was sharpest between 2003 and 2006, and remained significant between 2006 and 2008, indicating that the decline in the relative income price accelerated in the most recent years.

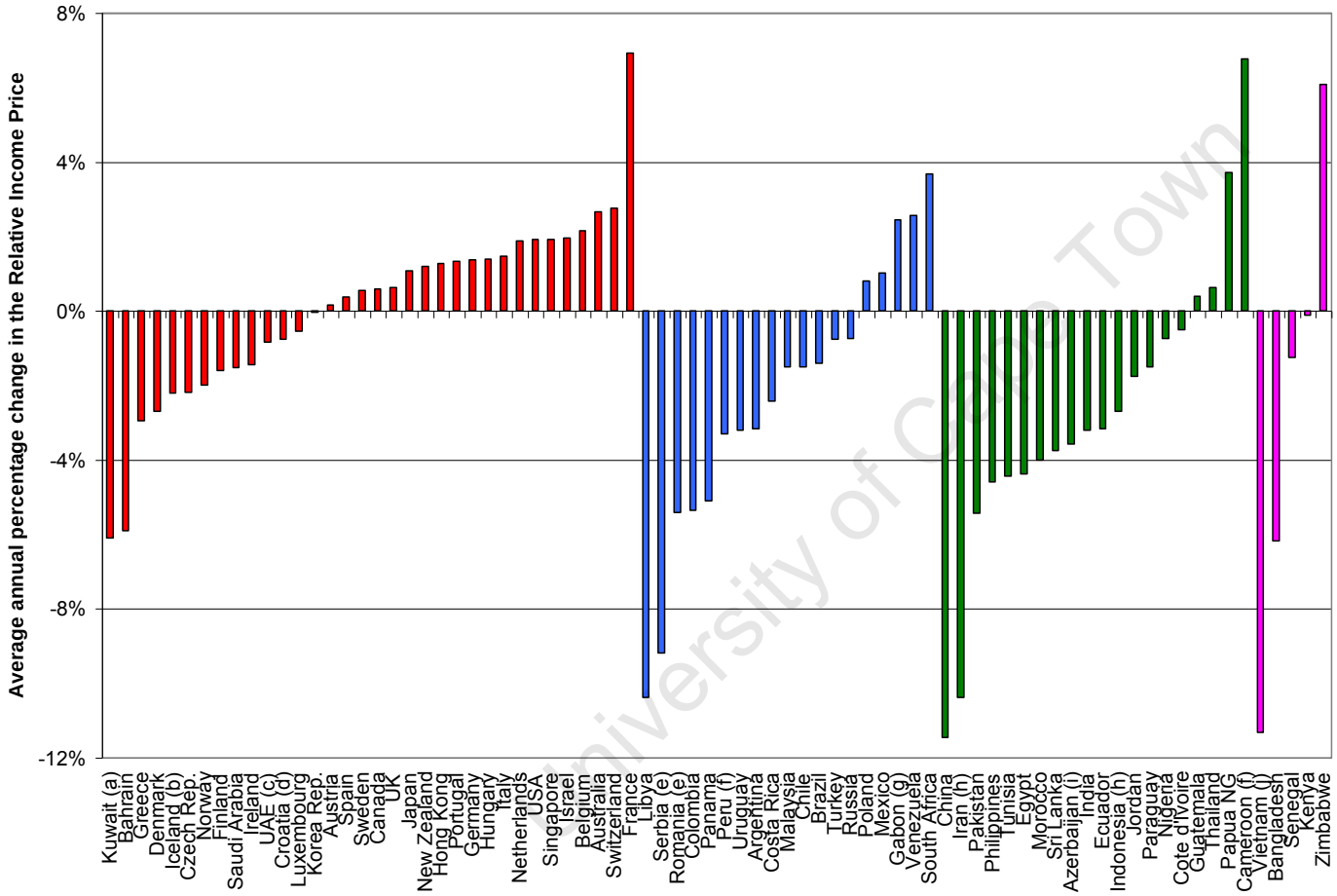
Figure 2.6 indicates the growth in cigarette affordability for individual countries for the period of 1990 to 2008. The countries are sorted in the usual way, first by income status, and then by growth in affordability. Note that an increase in the affordability measure implies that cigarettes have become less affordable. From a tobacco control perspective, the picture is disappointing. Of the 78 countries represented in Figure 2.6, cigarettes became more affordable in 48 (62%) and less affordable in 30 (38%) countries. As mentioned previously, among high-income countries, where cigarette affordability declined in 20 of the 34 countries (59%), the situation is somewhat more encouraging. However, among low- and middle-income countries, cigarettes became more affordable among 34 of the 44 countries (77%), while they became less affordable in the remaining 10 (23%) countries. Within the context of the mortality impact of tobacco, especially on the low- and middle-income countries (World Bank, 1999: 13-15), and the many empirical studies that have shown tax and price increases to be particularly powerful in discouraging tobacco consumption, this is a disconcerting finding.

Figure 2.6, together with Table 2.4, indicates a clear dichotomy between high-income and low- and middle-income countries. Cigarettes are becoming significantly more affordable in low- and middle-income countries, while becoming less affordable in high-income countries, although not necessarily by large magnitudes.

Changes in affordability can be broken down into changes in prices and incomes. Income can be considered exogenous since one should not expect tobacco control policies to have any significant impact on changes in income, at least in the short run. Furthermore, one cannot advocate reducing incomes as a means of reducing the affordability of cigarettes. Figure 2.7 shows the breakdown of the changes in the relative income price into its two components. Income has been inverted (i.e. a positive value on the figure implies a decline in income, and vice versa) in order for the aggregated change in price and income to represent the change in affordability.[29]

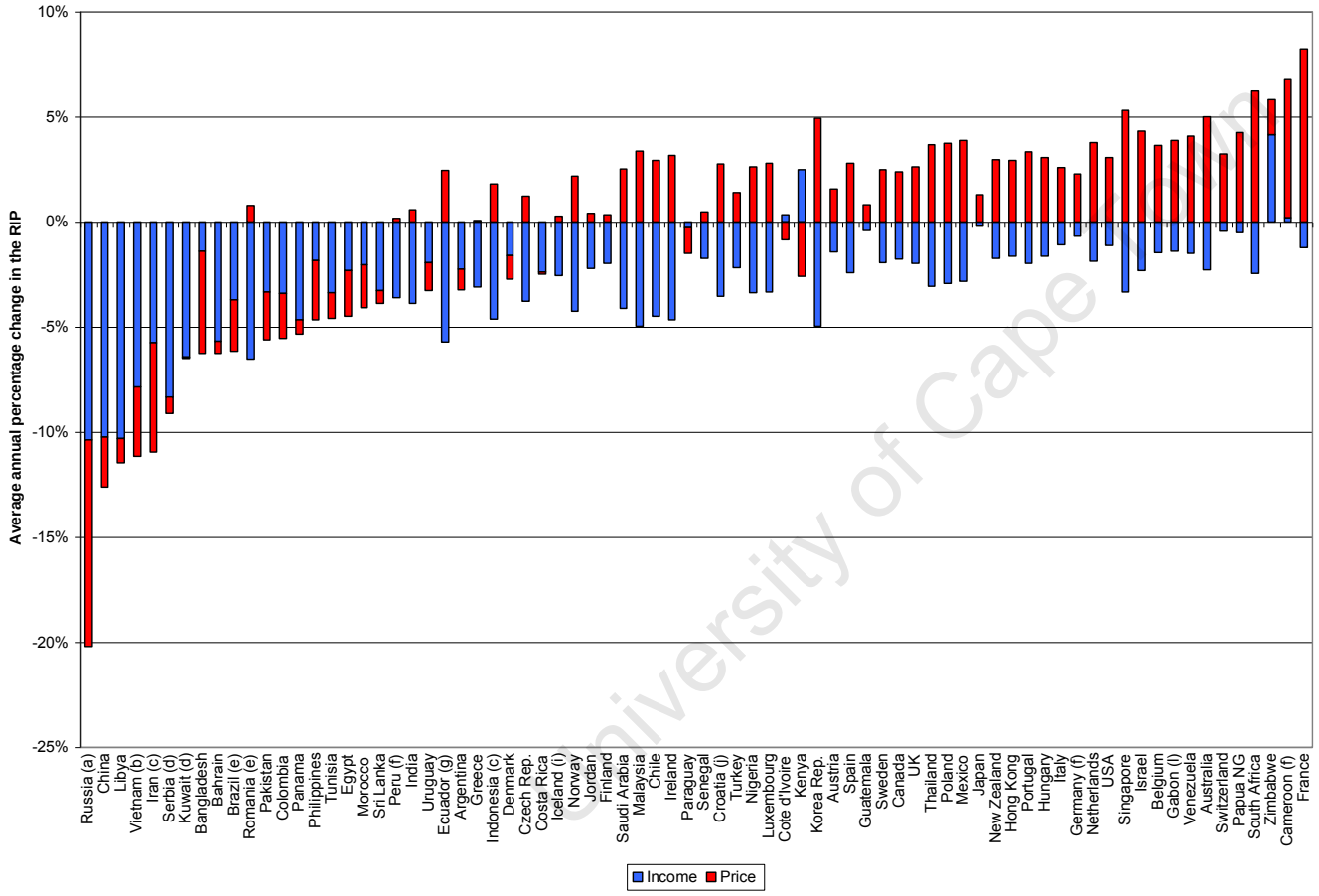
[29] This may not seem immediately obvious but consider a decrease in the price (negative magnitude) combined with an increase in income (positive magnitude), which will both result in an increase in affordability (negative magnitude in terms of the relative income price). By inverting the magnitude of the change in income, both a decrease in the price and an increase in income will be represented by negative magnitudes and will aggregate, graphically, to the change in affordability.

Figure 2.6: Average annual percentage change in the relative income price, 1990-2008



Note: Some time periods are not 1990-2008, they are: (a) 1995-2008, (b) 1999-2008, (c) 1990-2007, (d) 1998-2002, (e) 1994-2008, (f) 1991-2008, (g) 1991-2002, (h) 1990-2006, (i) 1998-2008, (j) 1993-2006 and (k) 1990-2005.
Sources: Economist Intelligence Unit and the World Bank

Figure 2.7: Breakdown of the average annual percentage change in the relative income price into income and price components, 1990-2008



Note: Some time periods are not 1990-2008, they are: (a) 1995-2008, (b) 1999-2008, (c) 1990-2007, (d) 1998-2002, (e) 1994-2008, (f) 1991-2008, (g) 1991-2002, (h) 1990-2006, (i) 1998-2008, (j) 1993-2006 and (k) 1990-2005. Azerbaijan and the United Arab Emirates were excluded due to lack of data.
Sources: Economist Intelligence Unit and the World Bank

For 76 countries it was possible to attribute the changes in affordability to changes in price and income. For 29 of the 30 countries that have experienced decreases in cigarette affordability between 1990 and 2008, larger increases in the real cigarette price offset increases in real per capita GDP. In Cameroon, however, decreases in real per capita GDP reinforced increases in the real price.

Of the 46 countries which experienced an increase in cigarette affordability, 21 saw increases in real prices. In all 21, the growth in real income exceeded the growth in real prices. Of the 25 countries which saw declines in real prices, 23 saw increases in real income. However, two countries—(Cote de'Ivoire and Kenya) had declines in real income. In these countries, cigarettes become more affordable despite the decrease in real income because price declined more than income.

In all countries where cigarettes become more affordable the growth in real income exceeded the growth in real prices. Only in two cases have declines in real price primarily contributed to the increase in affordability. This clearly indicates the danger that rapid economic growth poses to affordability and public health. This analysis indicates that countries that have experienced increases in cigarette affordability cannot attribute this to economic growth alone. In most cases, a decrease in the real retail prices has exacerbated the impact of rapid increases in GDP growth.

2.5 DISCUSSION

Economists have consistently advocated for excise tax increases as an appropriate and effective tobacco control strategy (World Bank, 1999 and Jha and Chaloupka, 2000). Higher taxes increase the retail price and thereby decrease the demand for cigarettes. The focus of economic studies in tobacco control are often on the implications of an increase in the excise tax and/or price of cigarettes—for example, in the form of reduced demand, reduced smoking prevalence, or increased government revenue, etc. (Guindon *et al.*, 2003 and Chaloupka *et al.*, 2000). Usually, changes in income play a comparatively minor role in simulations and analysis (see, for instance, Van Walbeek, 1996).

In recent decades some countries, mainly low- and middle-income countries--specifically those in Asia--have achieved unprecedented high economic growth rates. China and India are growing at approximately 10% per year, followed by other populous countries like Indonesia, Vietnam and Bangladesh at only slightly lower rates. In such countries, even if the real price increases by, say, 5% per year, cigarettes are increasingly affordable.

Tax and price increases, together with other policy interventions (i.e. advertising bans, smokefree areas, etc.), are two tobacco control levers that policy makers have control over. Tobacco control policy makers have no direct control over the level of or growth in average incomes. But the growth in average income does have a large and significant impact on the affordability of cigarettes. What this chapter argues is that policy makers should not only focus on price and tax, but on affordability as well.

This means the recommendation put forth by the World Health Organisation and the World Bank (Guindon *et al.*, 2003: 19)--to increase tax rates so that the prices of all tobacco products increase by at least 5% in real terms every year--is not appropriate in all contexts, and especially not for rapidly growing countries. A more useful and more general guiding policy would be to recommend that the tax (or price) be increased such that cigarettes become increasingly less affordable. This recommendation implies that the nominal price of cigarettes should increase by at least the growth rate of nominal income (i.e. the sum of the inflation rate and the real per capita income growth rate). For China, with inflation of about 8% and a per capita income growth rate of about 10% , nominal cigarette prices would have to increase by 18% each year to prevent cigarettes from becoming more affordable. In South Africa, the per capita growth is more modest at a rate of about 4%, but the inflation rate is similar to China's; nominal cigarette prices would therefore have to increase by 12% to prevent cigarettes from becoming more affordable.

The recommendation that the real price should increase by 5% per year would have been appropriate for South Africa, since cigarettes would have become less affordable by about 1% per year. However, it would have been inappropriate for China, because, even though cigarettes would have become more expensive in nominal and real terms, they would have become more affordable at the rate of about 5% per year.

This chapter introduced and analysed a variety of affordability measures. These affordability measures were based on the same price data, but on different income data. It was found that the choice of income variable has a significant impact on the affordability measure. This requires explanation. The debate about methodology is a technical issue, and should not take our attention away from the central message of this chapter, which is that policy makers should not focus on cigarette taxes and prices only, but equally on the concept of cigarette affordability. The policy prescriptions that derive from the affordability concept are more general than the policy prescriptions that derive solely from a focus on (real) price, because of the fact that it takes differences in income growth rates into account.

For 2008 and 2009 it was shown that, if GDP is used as the income measure (i.e. the relative income price), cigarette affordability decreases sharply as we move from high-income to middle-income and low-income countries. When implementing the minutes of labour approach used by Kan (which focused on the poorly paid occupations surveyed by the Union Bank of Switzerland), a similar trend was seen, although it was not nearly as dramatic as for the relative income price. When implementing Guindon *et al.'s* minutes of labour approach, there was less evidence that affordability decreases as we move from high-income to low-income countries. Why is this?

The explanation has to do with representativeness of the income data. GDP measures total output, and thus income, of the country. By dividing aggregate GDP by the total population, one gets an indication of the average income of the people living in that country. While there are many criticisms against per capita GDP as a measure of income (see Sloman, 2006: 376-377 or McConnell and Brue, 2005: 125-126), it is designed to be the most encompassing measure of economic activity in a country.
The Union Bank of Switzerland survey of earnings is not designed to be representative of average earnings in the country as a whole. Firstly, within a particular country, it focuses only on one or two cities, usually the commercial centres. Typically earnings in commercial centres are higher than in other cities, and urban earnings are usually higher than rural earnings, especially in low- and middle-income countries. Secondly, even though the Union Bank of Switzerland aims to survey earnings among a representative cross-section of occupations, most

occupations surveyed require some or even substantial training (see earlier footnote for a list of occupations covered). Menial jobs, for example, gardeners, rubbish/garbage collectors, cleaners and domestic servants are not included in the Union Bank of Switzerland survey. Thirdly, the Union Bank of Switzerland surveys formal sector employers only. Wages in the informal sector are typically much lower than in the formal sector, and these are not covered in the Union Bank of Switzerland survey. Fourthly, the Union Bank of Switzerland considers only employed persons. An unemployed person, who may or may not receive a government grant, would not feature in the Union Bank of Switzerland survey at all. Fifthly, the Union Bank of Switzerland does not take into consideration the average size of the family that depends on the wage of the breadwinner(s). For example, the average standard of living--and thus the disposable income--for a family with two breadwinners and only one or two children is likely to be much higher than that of a family with one breadwinner and four or five children.

In terms of these five issues, low- and middle-income countries differ notably from high-income countries. In low- and middle-income countries, the urban/rural wage differential is larger; the unemployment rate is higher; the labour participation rate (especially among women) is lower (Hill, 1986); the average number of dependents is higher; and the proportion of people working in the informal sector is higher than in high-income countries (Todaro and Smith, 2003). All these factors suggest that the Union Bank of Switzerland survey incorporates only a small portion of the labour market in low- and middle-income countries.

These arguments against the use of the Union Bank of Switzerland data are equally valid against GDP. Although GDP data are collected using a standardised methodology many of the measurement issues are exacerbated in low- and middle-income countries. Particularly, GDP is unable to account for inequalities in income which I was able to do, to some extent, with the Union Bank of Switzerland data by using Kan's method. It may also understate economic activity by excluding non-market transactions, the black market and the non-monetary economy, especially in low- and middle-income countries.

In Table 2.1 Spearman ranked correlations between the different affordability measures are shown separately for high-income and low- and middle-income countries. It is immediately obvious that the correlations between the relative income price and the minutes of labour measures are much higher for high-income countries than they are for low- and middle-income countries. Most Spearman correlation coefficients for high-income countries are between 0.85 and 0.98, while for low- and middle-income countries they lie between 0.44 and 0.89. This means that the choice of measure is less important in high-income countries than it is in low- and middle-income countries. The high correlation between the two minutes of labour approaches for both high-income and low- and middle-income countries reflects the fact that measures are derived from the same sources. Kan's minutes of labour method shows higher correlations to the relative income price than does Guindon's.

The high correlation between the affordability measures for high-income countries is an encouraging finding, because it suggests that the choice of income does not matter much for these countries. However, one cannot say this about low- and middle-income countries. For low- and middle-income countries, cigarettes seem much more affordable using Union Bank of Switzerland data rather than GDP data for the measure of income. Given that the Union Bank of Switzerland survey covers only a small and typically unrepresentative portion of the labour markets in low- and middle-income countries, caution is recommended in the interpretation of affordability measures based on Union Bank of Switzerland survey data for these countries.

One cannot pass objective judgment on the level of cigarette affordability for any individual country at any particular point in time.[30] The fact that the "median person" in Australia has to work 29 minutes to buy a pack of cigarettes does not objectively indicate whether cigarettes are affordable or not. Similarly, if it requires 4.3% of annual per capita GDP to buy 100 packs of cigarettes in South Africa, that in itself does not say whether cigarettes are affordable or not. The level of cigarette affordability is only useful in a comparative context. This can either be in comparison

[30] In this regard the following statement from Kan (2007: 429) is problematic: "*cigarette affordability for most of the sampled cities, especially those in high income countries, is high*". Kan considered cigarettes to be highly affordable in cities where a pack of cigarettes cost less than 10% of the average daily wage of the seven lowest paid occupations. Why 10%? Why not 12%, or 8%? The point is that one cannot make normative statements based on an arbitrary cut-off point.

to other countries, or in comparison with past levels of affordability in the same country.

Considering changes in cigarette affordability over time, there is a wide divergence between the experiences of high-income and low- and middle-income countries. Cigarettes have become less affordable in a majority of high-income countries since 1990. The trend towards less affordable cigarettes has been remarkably consistent in most countries throughout this period. This suggests that, at least at an aggregated level, high-income countries are actively trying to discourage smoking by making cigarettes less affordable through fiscal and possibly other means (e.g. imposing an "implicit" tax in the form of the "Tobacco Master Settlement Agreement" in the United States).[31]

Since 1990, cigarettes have become much more affordable in many low- and middle-income countries. In many large, populous countries in Asia, particularly China, Pakistan, Bangladesh and Vietnam, cigarettes have become more affordable at the rate of 5% or more each year.

While one could possibly argue that the 1990s was a "period of ignorance" for many low- and middle-income countries and that governments turned a blind eye to tobacco, this is not true for the current decade. Negotiations for the *Framework Convention on Tobacco Control* started in the late 1990s, and most low- and middle-income countries signed and subsequently ratified the treaty. The *Framework Convention on Tobacco Control*, as well as much academic and policy research, indicates that increasing the price and reducing the affordability of cigarettes is critical in a comprehensive tobacco control strategy. In the context of such awareness and commitment (as indicated by the number of countries ratifying the treaty), it is a major tobacco control failure that cigarettes have continued to become more affordable in the 2000s.

[31] It is also possible that tobacco companies have increased the retail price by increasing the real net-of-tax price. This has happened in Jamaica (Van Walbeek *et al.*, 2005), South Africa (Van Walbeek, 2005) and the United States (Keeler *et al*., 1996).

Nowadays, one regularly hears of tobacco control "victories": countries ratifying the *Framework Convention on Tobacco Control*, legislation successfully passed or implemented, research indicating that people are happy with the changes, etc. More and more countries have implemented non-price measures such as advertising bans to reduce tobacco consumption, including many low- and middle-income countries.[32] While there have been great strides in certain aspects of tobacco control, this chapter suggests that the single most important tool, i.e. decreasing the affordability of cigarettes, has been neglected.

Many countries have experienced unprecedented economic growth in the past decade or two. While this creates great opportunities (e.g. reducing poverty and increasing standards of living) it creates tobacco control challenges as well. We saw in Figure 2.6 that countries which experience rapid economic growth are more likely to find that cigarettes become more affordable. Furthermore, as seen in Figure 2.7, those countries which have found that cigarettes have become less affordable have seen this occur through increases in prices while those which have seen cigarettes become more affordable have seen incomes outgrow prices.

This chapter does not argue against economic growth on the grounds that it is bad for tobacco control. What is does argue is that countries experiencing rapid economic growth face tobacco control challenges that slower growing countries do not face. To the extent that tobacco control is a priority area for government and policy makers, tobacco taxes and prices should be adjusted against some standard of affordability, not only against a standard of a real tax or price.

One may also speculate about what may happen in the future with respect to affordability. In most high-income countries one should expect the trend of declining affordability to continue, maybe even at a more aggressive pace as governments look to exploit tobacco taxes as a revenue source in light of falling revenue from income, corporate and consumption taxes and increased fiscal deficits as a result of the global economic slowdown. This is compounded by slower growth and even declines in incomes. In low- and middle-income countries incomes will continue to grow, albeit

[32] See Chapter 5 for evidence of this.

at a slower pace. Thus in low- and middle-income countries the current trend of increasing affordability is likely to persist unless specific and deliberate attempts to reduce affordability are advanced. The next chapter investigates the possibility of linking tax and price policies explicitly to growing incomes by explicitly targeting the affordability of cigarettes.

However, there are some limitations to this study that should be considered. Firstly, the quality of the price data should be evaluated. The data are not collected for the purposes of rigorous economic analysis but rather for business travellers to make city-by-city comparisons. Although every effort has been taken to ensure the accuracy of the data there are some cases where individual data points raise significant questions about the quality and accuracy of the data. Also, price data may not be particularly representative of local purchasing trends; however, this risk is mitigated by using the cheapest cigarettes. Furthermore, these risks have also been mitigated by using the median as a measure of central tendency, the use of constant growth regressions for the analysis of percentage changes, and the use of the Spearman ranked correlation coefficients. Also, price data are collected by the Economist Intelligence Unit on a city level and are aggregated to the country level. In most cases a single city is used to represent the country but in some cases multiple cities are averaged to find the country level. This is necessary since GDP data are presented on a country level, as it is not possible to disaggregate GDP to city level. The policy interventions, including tax and price policy, tend to occur on a country level and we therefore need to consider affordability at the country rather than city level.

2.6 CONCLUSION

The aim of this chapter was to present a synthesised update of cigarette affordability for as many countries as possible. Three different affordability measures, for the period 1990 to 2009 (and sub-periods thereof), were calculated. Affordability is determined by price and income. Price is uncontroversial in its interpretation and measurement. Finding the appropriate measure of income is far more complex. What this chapter has shown is that the choice of "income variable" can have a significant impact on the affordability measure.

The chapter confirmed the conventional wisdom that cigarettes, expressed in a common currency, are substantially more expensive in high-income countries than in low- and middle-income countries. However, despite being more expensive in absolute terms, cigarettes are more affordable in high-income countries. The magnitude of the difference in affordability depends greatly on the choice of income measure, especially for low- and middle-income countries. Of the two income measures used--per capita GDP and the Union Bank of Switzerland's survey of earnings--I argued that affordability measures based on per capita GDP are preferable. This is because GDP is the most encompassing measure of income, while the Union Bank of Switzerland's survey tends to be unrepresentative of the labour market in low- and middle-income countries. For high-income countries the choice of the income measure used in the affordability measure matters less. Secondly, the GDP-based measure of affordability allows for a comparison amongst a greater number of countries, particularly low- and middle-income countries, and over a longer period of time.

This chapter's central message is that, despite methodological and data issues, policy makers should focus more on the affordability of cigarettes and less on the (real) price in isolation of income, especially in low- and middle-income countries. A price-based policy prescription ("The real price should increase by X%") may not be sufficient to reduce the affordability of cigarettes in fast-growing countries. An affordability-based policy prescription ("The excise tax (or price) should be adjusted so that cigarettes become less affordable by X% per year") is more general, and possibly more useful as a tobacco control target, especially in rapidly growing countries. The next chapter moves the concept of affordability into the realm of taxation policy. It looks at the current global best practice, and at how the understandings of affordability developed in this chapter can be used to improve taxation policy, especially in the context of rapidly growing countries. It uses the case study of South Africa as an example of a middle-income country which has experienced relatively rapid economic growth (more rapid than most high-income countries but less rapid than other low- and middle-income countries such as China and India). Furthermore, it is an example of a progressive tobacco control policy regime which has embraced taxation as a tobacco control and fiscal policy tool.

APPENDIX A: ADDITIONAL DATA

Table A1: Countries included in the Economist Intelligence Unit price database and World Bank income group classification

Country	Cities included	Cities excluded	World Bank Classification
Argentina	Buenos Aires		Upper-middle-income
Australia	Adelaide, Brisbane, Melbourne, Perth, Sydney		High-income
Austria	Vienna		High-income
Azerbaijan	Baku*		Lower-middle-income
Bahrain	Bahrain		High-income
Bangladesh	Dhaka		Low-income
Belgium	Brussels		High-income
Brazil	Sao Paulo, Rio De Janeiro		Upper-middle-income
Cameroon	Douala*		Lower-middle-income
Canada	Calgary, Montreal, Toronto, Vancouver		High-income
Chile	Santiago		Upper-middle-income
China	Beijing	Guangzhou*, Shanghai*, Shenzen*, Tianjin*	Lower-middle-income
Colombia	Bogota		Upper-middle-income
Costa Rica	San Jose		Upper-middle-income
Cote d'Ivoire	Abidjan		Lower-middle-income
Croatia	Zagreb*		High-income
Czech Republic	Prague		High-income
Denmark	Copenhagen		High-income
Ecuador	Quito		Lower-middle-income
Egypt	Cairo		Lower-middle-income
Finland	Helsinki		High-income
France	Lyon, Paris		High-income
Gabon	Libreville*		Upper-middle-income
Germany	Berlin, Düsseldorf, Frankfurt, Hamburg, Munich		High-income
Greece	Athens		High-income
Guatemala	Guatemala City		Lower-middle-income
Hong Kong	Hong Kong		High-income
Hungary	Budapest		High-income
Iceland	Reykjavik*		High-income
India	Mumbai, New Delhi		Lower-middle-income
Indonesia	Jakarta		Lower-middle-income
Iran	Tehran		Lower-middle-income
Ireland	Dublin		High-income
Israel	Tel Aviv		High-income
Italy	Milan, Rome		High-income
Japan	Osaka/Kobe, Tokyo		High-income
Jordan	Amman		Lower-middle-income
Kenya	Nairobi		Low-income
Korea	Seoul		High-income
Kuwait	Kuwait*		High-income
Libya	Tripoli		Upper-middle-income
Luxembourg	Luxembourg		High-income
Malaysia	Kuala Lumpur		Upper-middle-income

Country	Cities included	Cities excluded	World Bank Classification
Mexico	Mexico City		Upper-middle-income
Morocco	Casablanca		Lower-middle-income
Netherlands	Amsterdam		High-income
New Zealand	Auckland, Wellington		High-income
Nigeria	Lagos		Lower-middle-income
Norway	Oslo		High-income
Pakistan	Karachi		Lower-middle-income
Panama	Panama City		Upper-middle-income
Papua New Guinea	Port Moresby		Lower-middle-income
Paraguay	Asuncion		Lower-middle-income
Peru	Lima*		Upper-middle-income
Philippines	Manila		Lower-middle-income
Poland	Warsaw		Upper-middle-income
Portugal	Lisbon		High-income
Romania	Bucharest*		Upper-middle-income
Russia	Moscow	St Petersburg*	Upper-middle-income
Saudi Arabia	Al Khobar, Jeddah, Riyadh		High-income
Senegal	Dakar		Low-income
Serbia (Montenegro)	Belgrade		Upper-middle-income
Singapore	Singapore		High-income
South Africa	Johannesburg		Upper-middle-income
Spain	Barcelona, Madrid		High-income
Sri Lanka	Colombo		Lower-middle-income
Sweden	Stockholm		High-income
Switzerland	Zurich		High-income
Thailand	Bangkok		Lower-middle-income
Tunisia	Tunis		Lower-middle-income
Turkey	Istanbul		Upper-middle-income
United Arab Emirates	Abu Dhabi, Dubai		High-income
United Kingdom	London	Manchester*	High-income
United States	Atlanta, Boston, Chicago, Cleveland, Detroit, Houston, Los Angeles, Miami, New York, Pittsburgh, San Francisco, Seattle, Washington DC	Honolulu*, Lexington*, Minneapolis*	High-income
Uruguay	Montevideo		Upper-middle-income
Venezuela	Caracas		Upper-middle-income
Vietnam	Ho Chi Minh City*	Hanoi*	Low-income
Zimbabwe	Harare		Low-income

Note: Most cities were surveyed annually by the EIU since 1990. * indicates that the city was included in the survey after 1990.

Table A2: Adjustments made to relative income price dataset adjusting for hyperinflation

Country	Years	Adjustment
Argentina	1990, 1991	Divided by 10 000
Azerbaijan	1998 to 2005	Divided by 10 000
Brazil	1990 to 1993	Copied USD series
Ecuador	1990 to 1999	Copied USD series
Jordan	2001 to 2003	Divided by 1 000
Mexico	1990 to 1992	Divided by 1 000
Poland	1990 to 1994	Divided by 10 000
Romania	1994 to 2002	Divided by 10 000
Russia	1990 to 1997	Copied USD series
Turkey	2003 to 2006	Multiplied by 1 000 000
Uruguay	1990 to 1992	Divided by 1 000
Venezuela	2007	Divided by 1 000

Notes: This table indicates adjustments made to the relative income price series. Often in countries where there have been problems with hyperinflation a number of decimal places are removed from the currency. This takes place formally when the state or central bank makes an official announcement. Alternatively this takes place informally when the public just ignore a number of decimal places. I use a different series for prices and incomes and under hyperinflationary conditions; one series may make an adjustment while the other does not. This results in extreme values for the relative income price which are not in line with the values prior to or after the hyperinflationary problem. I make adjustments to the relative income price to account for this by either by manually adjusting the decimals places by dividing or multiplying by a factor of 1 000, 10 000 or 1 000 000; where this does not solve the problem I replace the relative income price by that calculated using prices and incomes in United States Dollars instead of the local currency.

Table A3: Relative income price

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Argentina	2.41	2.28	1.85	1.79	1.67	1.69	1.62	1.65	1.63	1.74	1.75	2.29	1.93	2.12	2.40	2.19	1.79	1.51	1.35
Australia	0.97	0.99	1.09	1.32	1.30	1.40	1.41	1.48	1.52	1.52	1.57	1.67	1.60	1.61	1.63	1.72	1.67	1.63	1.56
Austria	1.12	1.10	1.09	1.18	1.17	1.24	1.27	1.21	1.19	1.22	1.20	1.20	1.23	1.27	1.26	1.27	1.12	1.09	1.15
Azerbaijan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.30	2.11	2.56	2.29	4.72	4.03	3.41	2.34	3.34	1.82	1.60
Bahrain	1.55	1.24	1.24	1.03	1.03	0.96	0.97	1.17	1.38	1.45	1.23	1.15	1.10	1.06	0.95	0.82	0.68	0.60	0.52
Bangladesh	41.48	38.53	32.80	35.55	33.66	30.54	28.61	26.88	26.00	24.16	24.47	23.33	23.55	21.82	16.72	15.30	17.34	13.36	13.19
Belgium	0.93	0.87	0.91	1.10	1.17	1.22	1.23	1.17	1.16	1.16	1.15	1.16	1.14	1.27	1.22	1.32	1.26	1.35	1.37
Brazil	2.47	2.11	3.53	4.82	4.51	2.74	2.91	2.70	2.67	2.57	2.36	2.13	2.18	2.37	2.13	2.26	2.07	2.05	1.91
Cameroon	n.a.	7.17	7.71	7.04	12.96	11.75	13.95	15.70	14.74	14.15	12.36	15.03	14.27	19.89	23.09	22.19	20.90	22.59	21.86
Canada	1.62	1.91	2.00	2.00	1.32	1.34	1.27	1.30	1.33	1.24	1.27	1.29	1.88	1.91	1.88	1.80	1.76	1.76	1.80
Chile	2.74	2.32	2.54	2.74	2.38	2.24	2.48	2.26	2.47	2.46	3.23	3.04	2.89	3.12	2.76	2.45	2.13	2.14	2.09
China	27.54	53.23	43.73	20.01	29.67	29.73	27.37	25.70	26.49	25.17	15.27	11.60	10.64	9.49	8.11	7.09	7.52	2.56	3.08
Colombia	4.83	5.13	5.29	4.26	2.24	2.40	2.40	2.10	2.53	2.82	2.98	4.36	3.38	3.10	2.97	2.99	2.71	1.78	1.79
Costa Rica	3.04	4.13	3.31	2.17	2.56	2.31	2.38	2.01	1.91	1.57	1.56	2.63	2.37	3.99	3.48	3.02	n.a.	2.05	1.95
Cote d'Ivoire	17.22	17.68	13.72	13.35	15.53	13.44	12.22	11.39	10.61	10.38	11.27	11.02	11.91	11.03	15.30	12.86	12.12	16.97	15.71
Croatia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.78	3.21	3.25	2.95	2.70	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Czech Republic	2.73	2.37	2.68	2.68	2.27	1.90	1.72	2.16	1.80	1.98	1.83	1.91	1.66	1.62	1.72	1.69	1.59	1.87	1.84
Denmark	1.65	1.58	1.53	1.56	1.49	1.46	1.43	1.41	1.39	1.34	1.28	1.28	1.31	1.28	1.10	1.03	1.03	1.04	1.01
Ecuador	8.58	7.43	5.67	7.47	7.03	5.80	4.46	3.64	2.80	3.89	6.18	8.81	7.63	6.73	5.99	5.44	4.93	3.93	4.81
Egypt	17.37	16.85	14.78	13.88	13.22	11.55	10.47	9.56	9.02	8.58	7.91	8.60	10.15	12.38	11.23	9.97	8.85	7.79	7.76
Finland	1.60	1.80	1.54	1.43	1.57	1.50	1.51	1.42	1.42	1.47	1.41	1.36	1.37	1.40	1.34	1.35	1.26	1.24	1.20
France	0.49	0.47	0.53	0.66	0.86	0.85	1.12	1.09	1.04	1.11	1.12	1.15	1.19	1.32	1.64	1.60	1.60	1.65	1.64
Gabon	n.a.	2.53	2.69	2.68	2.33	3.89	3.40	3.27	3.95	3.73	3.03	3.23	3.30	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	1.15	1.12	1.08	1.15	1.12	1.12	1.11	1.03	1.03	1.06	1.07	1.14	1.18	1.20	1.25	1.43	1.46	1.52	1.47
Greece	1.98	2.18	2.05	1.79	1.78	1.63	1.81	1.57	1.57	1.64	1.28	1.55	1.53	1.59	1.48	1.38	1.42	1.23	1.16
Guatemala	5.57	6.93	5.17	8.16	7.18	6.56	5.77	5.80	5.16	5.40	5.59	5.55	6.43	6.68	6.80	6.26	5.77	6.60	5.99
Hong Kong	0.76	1.50	1.33	1.43	1.33	1.27	1.20	1.19	1.52	1.56	1.52	1.81	1.70	1.76	1.71	1.51	1.43	1.24	0.96
Hungary	1.59	1.29	1.41	1.75	1.47	1.67	1.44	1.49	2.19	1.93	1.70	1.58	1.45	1.52	1.85	2.01	1.99	2.01	2.04
Iceland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.59	1.53	1.52	1.58	1.70	1.62	1.66	1.52	1.24	1.30
India	25.40	22.55	23.59	23.03	21.25	18.83	17.68	22.19	21.16	20.22	19.57	23.99	22.61	21.17	15.89	15.80	14.48	14.53	14.14

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Indonesia	7.75	8.46	7.61	7.81	7.21	6.79	6.61	4.10	9.46	9.26	8.90	7.93	7.27	8.00	6.26	5.70	5.01	n.a.	n.a.
Iran	7.70	5.55	6.34	5.71	5.11	6.02	4.82	4.16	4.13	3.30	4.17	3.65	2.69	2.36	1.89	1.58	1.34	n.a.	n.a.
Ireland	2.38	2.45	2.51	2.41	2.41	2.27	2.25	2.13	1.79	1.64	1.72	1.59	1.55	1.65	1.64	1.59	1.45	1.60	1.83
Israel	0.89	0.92	0.95	1.07	0.96	1.03	0.99	1.06	1.03	1.05	1.02	1.37	1.60	1.46	1.43	1.50	1.42	1.31	1.26
Italy	1.07	1.06	0.94	1.12	1.04	0.89	1.14	1.03	1.01	1.03	0.98	0.98	0.96	0.97	1.17	1.20	1.27	1.35	1.39
Japan	0.62	0.59	0.57	0.57	0.57	0.56	0.55	0.57	0.58	0.64	0.65	0.64	0.66	0.70	0.70	0.69	0.68	0.74	0.75
Jordan	5.94	6.21	5.69	6.84	6.34	6.05	6.16	4.34	4.34	4.46	5.60	5.41	5.19	5.00	4.58	4.80	5.28	5.22	4.31
Kenya	17.89	18.35	18.88	27.77	26.45	23.41	18.28	18.59	17.24	19.85	22.20	18.45	25.21	23.56	20.95	18.90	18.41	18.61	17.54
Korea	1.15	1.53	1.70	1.52	1.31	1.13	0.91	0.94	0.96	1.76	1.62	1.22	1.04	1.12	0.99	1.19	1.31	1.14	n.a.
Kuwait	n.a.	1.18	n.a.	n.a.	n.a.	0.78	0.70	0.75	0.87	0.78	0.64	0.72	0.91	0.79	0.66	0.51	0.41	0.38	0.34
Libya	3.97	3.70	8.30	12.38	14.19	19.13	18.12	10.60	4.00	7.36	3.00	2.98	2.26	n.a.	1.44	1.07	n.a.	0.70	0.55
Luxembourg	0.49	0.43	0.45	0.48	0.48	0.49	0.49	0.45	0.44	0.41	0.40	0.41	0.41	0.42	0.41	0.42	0.40	0.41	0.45
Malaysia	3.60	3.39	3.37	3.03	1.83	1.61	1.45	1.75	2.09	2.17	2.75	2.88	2.72	2.54	2.65	2.51	2.78	2.69	2.74
Mexico	1.46	1.52	2.19	2.38	2.48	3.22	3.11	2.22	1.73	1.68	2.14	2.04	2.39	1.90	2.25	1.97	1.82	1.60	1.76
Morocco	9.08	4.07	15.50	15.38	13.96	20.64	21.03	21.43	11.51	11.62	11.65	10.91	10.64	10.20	9.75	4.94	n.a.	3.80	4.36
Netherlands	0.82	0.79	0.96	1.11	1.08	1.06	1.05	0.93	0.96	0.99	0.98	1.10	1.11	1.12	1.10	1.07	1.05	0.97	1.15
New Zealand	1.99	2.44	2.39	2.31	2.22	2.15	2.19	2.19	2.49	2.38	2.72	2.74	2.72	2.66	2.54	2.53	2.51	2.35	2.47
Nigeria	12.68	6.22	16.14	21.30	42.84	27.56	19.84	31.35	33.47	30.28	21.35	31.18	30.31	23.24	20.40	22.20	19.32	12.74	11.09
Norway	1.83	1.88	1.90	1.86	1.93	1.86	1.81	1.82	1.92	2.06	1.71	1.64	1.85	1.79	1.66	1.55	1.51	1.36	1.27
Pakistan	26.49	22.87	19.79	20.09	18.36	15.74	14.79	12.70	12.78	11.47	9.10	11.89	12.51	12.93	12.13	11.36	9.90	9.00	9.69
Panama	4.54	3.79	3.78	3.53	3.38	3.72	3.51	2.76	2.85	2.78	3.05	3.06	2.99	2.89	2.69	2.50	2.31	2.06	1.77
Papua New Guinea	13.77	13.93	14.57	18.28	14.43	15.52	17.75	16.13	17.20	n.a.	25.90	31.28	28.51	27.00	27.37	26.87	24.30	30.89	26.61
Paraguay	2.93	2.36	2.77	2.86	3.37	3.68	4.94	5.06	4.75	5.99	7.37	7.42	6.95	5.89	4.18	3.91	3.52	2.49	2.24
Peru	n.a.	5.40	6.03	5.32	4.28	3.65	3.63	3.13	3.32	4.39	4.60	6.69	6.67	5.46	5.80	4.92	4.18	4.24	3.05
Philippines	5.96	6.01	6.15	6.66	4.74	7.00	6.11	5.29	6.01	6.11	5.53	5.21	4.86	4.55	4.20	3.99	3.67	3.47	2.56
Poland	1.70	3.22	n.a.	1.85	2.32	1.77	1.92	2.14	2.09	2.31	2.12	2.21	2.22	2.04	1.86	1.91	1.89	1.91	1.96
Portugal	1.66	1.65	1.88	1.77	1.67	1.65	1.83	1.62	1.65	1.66	1.61	1.57	0.15	1.59	1.62	1.72	1.76	1.95	2.11
Romania	n.a.	n.a.	n.a.	n.a.	5.02	4.09	5.81	8.03	6.02	5.35	6.70	4.74	2.73	2.53	2.29	2.33	2.02	2.09	2.31
Russia	0.97	4.10	4.53	4.45	3.75	3.75	4.91	5.17	6.42	5.46	3.60	2.94	2.41	2.84	2.28	1.79	1.28	1.03	0.85
Saudi Arabia	1.05	1.33	1.22	1.39	1.41	1.38	1.31	1.47	1.80	1.65	1.30	1.36	1.40	1.40	1.32	1.06	0.95	0.95	0.79
Senegal	10.28	10.58	10.57	11.26	13.18	12.25	11.84	7.52	7.17	6.90	6.64	6.34	9.38	8.95	8.48	8.05	n.a.	8.77	8.22

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Serbia (and Montenegro)	n.a.	n.a.	n.a.	n.a.	5.58	4.54	4.24	3.99	3.27	15.44	13.22	2.11	1.79	1.70	1.42	1.16	1.36	1.79	1.45
Singapore	1.41	1.56	1.48	1.55	1.46	1.42	1.35	1.28	1.48	1.47	1.48	1.67	1.56	1.98	2.03	2.15	2.01	1.86	1.99
South Africa	2.11	2.00	2.20	2.23	2.26	2.32	2.56	3.37	3.36	4.38	4.46	4.56	4.49	4.36	4.92	4.42	4.31	4.19	4.05
Spain	0.97	1.00	0.92	0.99	1.01	1.03	1.07	1.02	0.98	0.81	0.76	0.80	0.79	0.97	0.92	0.96	0.98	1.03	1.04
Sri Lanka	27.29	25.60	24.17	21.19	20.08	20.37	20.29	18.77	18.44	18.94	20.01	18.63	18.02	18.58	16.30	15.76	14.82	13.42	13.71
Sweden	1.27	1.13	1.24	1.54	1.48	1.51	1.50	2.07	1.54	1.46	1.42	1.42	1.41	1.37	1.31	1.32	1.24	1.34	1.40
Switzerland	0.55	0.54	0.52	0.54	0.58	0.67	0.64	0.65	0.72	0.79	0.80	0.80	0.81	0.83	0.86	0.90	0.89	0.93	0.90
Thailand	3.25	4.42	3.97	2.70	3.02	2.65	2.43	2.52	3.78	3.81	3.74	4.59	4.36	4.05	3.73	3.44	3.81	3.61	3.64
Tunisia	7.54	4.15	3.72	3.90	4.24	3.68	12.87	11.91	11.17	10.35	9.69	9.08	5.88	4.58	4.25	4.31	4.02	3.65	3.33
Turkey	3.57	4.09	3.04	3.60	4.70	2.78	3.40	4.44	3.43	3.85	3.52	4.80	4.39	5.11	4.96	4.44	4.75	3.46	3.11
United Arab Emirates	0.36	0.56	0.58	0.58	0.63	0.61	0.57	0.56	0.72	0.64	0.59	0.68	0.72	0.66	0.59	0.45	0.18	0.31	n.a.
United Kingdom	1.86	2.01	2.09	2.18	1.98	2.22	2.12	2.11	2.23	2.52	2.65	2.54	2.57	2.33	2.36	2.41	2.30	2.23	2.08
United States	0.73	0.83	0.82	0.81	0.76	0.74	0.74	0.70	0.74	0.90	1.00	1.09	1.13	1.09	1.03	1.00	0.96	0.98	1.03
Uruguay	4.00	3.87	3.39	3.11	2.90	2.84	2.67	2.38	2.38	2.50	2.44	2.41	2.66	2.62	2.18	2.44	2.49	2.63	2.23
Venezuela	1.97	2.68	2.33	2.36	2.96	2.75	3.08	2.57	3.23	3.22	2.75	2.51	2.92	3.44	2.46	2.20	1.94	1.96	3.11
Vietnam	n.a.	n.a.	n.a.	41.13	36.94	28.70	24.04	20.45	20.14	18.41	16.70	16.35	14.88	15.83	13.80	10.10	8.64	n.a.	n.a.
Zimbabwe	4.92	4.54	6.80	6.03	5.79	6.62	7.01	6.51	5.33	6.83	8.24	10.68	9.02	7.81	18.96	11.91	n.a.	n.a.	n.a.

Table A4: Minutes of work required to purchase a packet of cigarettes

Country	Median of all occupations					Median of lowest half				
	1997	2000	2003	2006	2009	1997	2000	2003	2006	2009
Argentina	19.8	20.1	20.3	16.2	19.9	23.6	21.2	42.2	29.3	28.2
Australia	25.7	28.8	33.4	29.7	28.3	27.8	29.8	35.1	38.8	33.0
Austria	19.3	20.2	23.2	21.1	21.3	24.7	25.5	28.2	23.9	28.2
Belgium	19.9	21.4	19.3	24.6	27.8	26.2	27.2	28.2	26.6	29.7
Brazil	21.6	19.4	18.6	17.5	22.8	28.1	27.0	33.0	28.5	35.6
Canada	15.8	19.1	29.3	28.6	29.0	19.5	22.9	38.0	42.9	37.4
Chile	n.a.	27.5	29.3	30.7	36.5	n.a.	48.4	48.2	40.5	42.6
China	117.6	67.5	41.9	52.1	22.9	186.6	79.2	48.7	91.7	31.9
Colombia	12.1	17.2	18.7	20.4	13.7	20.4	27.1	28.9	34.7	17.4
Czech Republic	37.4	n.a.	39.8	33.3	34.7	41.8	n.a.	45.6	35.2	45.3
Denmark	24.8	24.7	22.3	20.8	21.2	27.5	27.4	23.3	22.3	24.8
Egypt	n.a.	n.a.	n.a.	n.a.	29.6	n.a.	n.a.	n.a.	n.a.	68.3
Finland	28.3	29.7	24.4	23.0	22.2	33.9	34.4	28.6	27.3	26.9
France	19.3	19.2	23.0	31.9	31.5	25.2	23.8	32.2	42.1	36.9
Germany	17.7	19.5	19.9	23.2	27.5	21.8	22.3	25.5	28.4	33.9
Greece	17.6	16.7	21.4	24.2	23.8	22.3	20.9	30.1	32.5	29.8
Hong Kong	28.0	29.1	34.2	47.5	34.2	32.3	33.6	46.8	56.9	37.0
Hungary	45.3	52.2	25.0	45.0	48.3	57.6	69.0	38.3	57.0	62.9
India	64.8	69.1	104.8	40.2	48.9	87.0	96.7	127.2	74.5	107.0
Indonesia	15.7	44.9	36.9	31.2	4.2	28.7	114.2	101.8	51.0	74.4
Ireland	36.1	33.2	30.7	30.1	33.8	42.1	37.3	36.2	35.2	42.7
Israel	17.7	15.7	21.7	n.a.	21.9	22.8	21.5	29.3	n.a.	26.3
Italy	18.0	21.1	20.5	28.6	28.6	20.7	24.3	25.8	32.2	38.4
Japan	7.9	9.3	9.5	11.7	11.3	10.9	10.7	12.7	15.3	14.2
Kenya	83.5	105.9	67.7	31.8	57.7	168.5	188.9	137.5	38.8	82.6
Korea	9.8	16.5	11.9	13.6	14.8	12.8	21.4	27.8	37.3	28.6
Luxembourg	8.7	10.0	12.1	14.3	14.4	13.6	15.5	16.3	20.0	19.5
Malaysia	10.8	20.7	19.8	28.4	37.3	25.8	50.6	30.6	42.6	59.7
Mexico	31.2	40.9	32.0	22.8	34.0	41.7	45.9	52.7	57.1	80.5
Netherlands	14.9	18.2	21.8	20.8	31.0	19.9	22.7	24.2	27.0	36.4
New Zealand	n.a.	38.8	43.6	34.8	43.6	n.a.	43.5	58.5	39.7	53.2
Nigeria	n.a.	n.a.	66.2	n.a.	n.a.	n.a.	n.a.	96.7	n.a.	n.a.
Norway	40.1	44.8	37.1	38.9	45.8	42.6	46.5	38.6	40.5	48.9
Pakistan	n.a.	n.a.	59.0	n.a.	n.a.	n.a.	n.a.	137.8	n.a.	n.a.
Panama	20.6	21.8	n.a.	n.a.	n.a.	30.2	37.7	n.a.	n.a.	n.a.
Peru	n.a.	n.a.	37.0	30.6	35.5	n.a.	n.a.	55.2	41.3	41.3
Philippines	30.8	35.8	21.0	23.2	21.9	46.5	47.4	38.7	34.2	30.1
Poland	37.2	43.3	32.9	37.2	32.5	45.3	55.0	41.3	39.7	40.8
Portugal	24.3	27.0	25.9	33.6	29.0	31.4	33.9	36.8	43.3	38.8
Romania	n.a.	n.a.	3.4	33.1	47.5	n.a.	n.a.	5.3	46.8	59.1
Russia	64.2	47.1	34.6	16.9	9.8	155.9	114.4	39.1	20.3	12.5
Singapore	39.2	40.4	45.1	58.2	61.9	55.4	49.8	61.4	76.4	86.5
South Africa	18.3	21.9	24.4	24.2	27.7	29.0	28.1	34.9	32.1	42.6

Country	Median of all occupations					Median of lowest half				
	1997	2000	2003	2006	2009	1997	2000	2003	2006	2009
Sweden	41.3	29.5	27.8	28.3	30.0	45.1	31.8	29.3	30.6	31.3
Switzerland	8.8	12.8	11.9	14.1	16.3	11.4	15.9	15.9	17.9	19.5
Taiwan	7.1	6.8	5.6	6.2	6.5	8.3	8.0	10.6	8.2	8.5
Thailand	12.4	18.7	27.8	45.6	26.8	31.5	39.9	62.3	65.4	31.1
Turkey	n.a.	n.a.	n.a.	36.5	31.1	n.a.	n.a.	n.a.	52.9	47.5
United Arab Emirates	10.0	10.8	11.8	6.6	6.5	13.5	14.1	18.0	12.0	14.8
United Kingdom	31.3	45.3	35.6	35.8	32.5	42.3	55.8	45.4	45.8	39.7
United States	9.1	15.6	17.4	17.0	19.4	11.2	17.9	21.1	22.4	24.4
Venezuela	29.7	27.3	29.4	30.4	71.9	41.8	39.1	63.1	44.8	110.8

CHAPTER 3

TARGETING THE AFFORDABILTY OF CIGARETTES: A NEW BENCHMARK FOR TAXATION POLICY IN LOW- AND MIDDLE-INCOME COUNTRIES[33]

3.1 INTRODUCTION

The previous chapter provided a thorough analysis of the methods for analysing the affordability of cigarettes. Furthermore, it provided a thorough analysis of global trends in the affordability of cigarettes. In doing so, it proposed the use of affordability as a tool for understanding and analysing tax and price policy in the context of tobacco control. Furthermore, it highlighted the differences in affordability between high-income and low- and middle-income countries and changes in affordability over time and particularly the risks that robust economic growth and development pose to tobacco use and thus public health. This chapter takes the previous chapter one step further by investigating how this concept of affordability can be used in the context of establishing a policy rule for taxation in a rapidly growing low- and middle-income country.

In order to do so, this chapter outlines two approaches to tobacco taxation policy: (1) tax burden[34] benchmarking and (2) affordability benchmarking. Firstly, it outlines problems with tax burden benchmarking, identifying particular issues in the context of low- and middle-income countries that have experienced rapid economic growth, particularly where growth in real income exceeds the growth in real prices. It then proposes an alternative policy benchmarking the affordability of cigarettes, exploring some methodological issues surrounding the measurement of affordability and the construction of an affordability policy

[33] This chapter was previously published in the journal *Tobacco Control* (Blecher, 2010a) and has improvements in a number of areas including data and simulation assumptions. I would like to acknowledge Corné van Walbeek, Hana Ross, Anna Gilmore, Frank Chaloupka, Emmanuel Guindon and an anonymous reviewer for their useful comments and suggestions, as well as Erik Nesson for research assistance. All other errors and omissions remain mine exclusively.

[34] The published version of this chapter (Blecher, 2010a) used the term *incidence* instead of *burden*. Some advocates prefer incidence to burden since it does not have a negative connotation (i.e. that a tax is a burden on the consumer). However, the term incidence is misleading since it is used by economists to describe the different portions of tax born by the consumer and producer; it is therefore misleading to use it in this context. In the absence of a better term, I use burden.

rule. Finally, it uses South Africa as a case study of a low- and middle-income country to simulate future tobacco assumption applying the affordability policy rule, as well as other policy options.

3.2 BACKGROUND – APPROACHES TO TOBACCO TAXATION

Tobacco control advocates have long promoted higher excise taxes on cigarettes as a means of reducing cigarette consumption. This proposal has been supported by a large body of research that has cemented the negative relationship between cigarette prices and consumption. Governments are motivated to increase taxes since they are able to raise significant revenue and because lower consumption has important public health benefits. South Africa is a good example of this; between 1993 and 2009, real excise taxes rose by 419%, resulting in real retail prices increasing by 237%. As a result, per capita consumption of cigarettes fell by 51% and real excise revenue increased by 245%.[35]

Since the World Bank publication *Curbing the Epidemic* (Jha and Chaloupka, 1999), tobacco control advocates have promoted benchmarking the percentage of the retail price occupied by tax. Based on tax rates used in countries with comprehensive tobacco control policies, the World Bank recommended that tax account for two-thirds to four-fifths of the retail price of cigarettes (Jha and Chaloupka, 1999). Sometimes also referred to as the tax burden, the percentage of the retail price occupied by tax can refer to excise and sales taxes combined (the total tax burden), or just excise taxes (the excise tax burden). This approach has created an easily understandable method by which countries can "benchmark" their tax burden against global best practice.

A number of notable examples of this practice exist. The European Union has, since 1993, required member states to meet a minimum excise tax burden of 57% (Commission for the European Communities, 1992; Sunley *et al.*, 2000; Gilmore and McKee, 2004). The European Union has a minimum Value Added Tax rate of 15% (which is 13% on a tax-inclusive basis) that cannot be levied at a reduced rate on cigarettes. The minimum total tax burden is therefore effectively 70%. However some countries, like the United Kingdom, with

[35] See the appendix for a detailed discussion on the data.

an excise tax burden of 63% and a total tax burden of 76%, set their taxes above the European Union benchmark but within the World Bank range (World Health Organisation, 2008). Another example is South Africa where a total tax burden of 50% was targeted between 1994 and 2004 and 52% since 2004 (Van Walbeek, 2005). However, South Africa does not meet the target set by the World Bank range.

As is evident from Chapter 2, a growing literature considers the affordability of cigarettes (Guindon *et al.*, 2002; Blecher and Van Walbeek, 2004; Kan, 2007; Blecher and Van Walbeek, 2009;;;). The concept of affordability is useful since it considers the simultaneous influence of price and income on cigarette demand. Generally, demand is considered *ceterus paribus* (all else held constant) with the impact of prices and incomes considered in isolation. Affordability is becoming increasingly important as consumption shifts from the slow growing high-income countries to rapidly growing low- and middle-income countries. In high-income countries, slower economic growth allows advocates to focus on raising prices in order to reduce consumption. This "price benchmarking" is appropriate in contexts where growth in prices will exceed the growth in income. However, in low- and middle-income countries, many of which are experiencing rapid economic growth, focusing on price alone ignores rising incomes. Thus even increasing real prices may not reduce consumption since the growth in income may outweigh the growth in real prices.

3.3 A CRITIQUE OF TAX BURDEN BENCHMARKING

Using tax burden as a benchmark brings about a number of problems. Political will is required to raise cigarette taxes, especially in low- and middle-income countries where the tobacco industry may be particularly influential and a tax burden benchmark may therefore be difficult to change once attained or established. Furthermore, recent World Health Organisation data show that the two-thirds to four-fifths total tax burden target is rarely reached with the median excise tax burden of 57% in high-income countries (Max 69%, S.D. 20%, n=37) and of 35% in low- and middle-income countries (Max 79%, S.D. 19%, n=99) in 2007 (World Health Organisation, 2008).

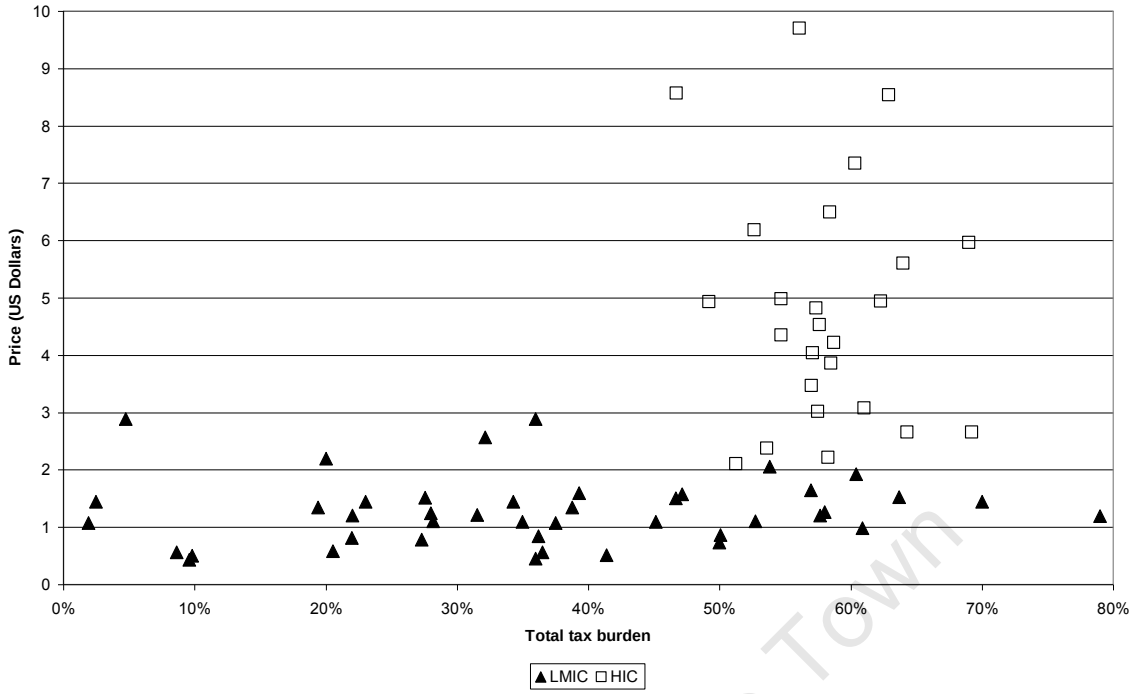
Benchmarking the tax burden raises the question of whether one should target simply the excise tax or the total tax burden. This one-size-fits-all approach does pose difficulties since different countries have vastly different tax regimes and uses for those taxes.

The setting of tax burden benchmarks ultimately provides greater ability for the tobacco industry to set retail prices. Once a target is set, excise taxes need to be reviewed on a regular basis to ensure that the target continues to be met.[36] If the tobacco industry chooses to raise industry/base/net-of-tax prices, excise taxes would have to be increased to ensure the tax burden benchmark is maintained. Conversely, if the tobacco industry chooses to reduce industry/base/net-of-tax prices, the excise tax may, depending on whether the excise tax is specific or *ad valorem*, have to be reduced in order to maintain the tax burden benchmark.[37] The tobacco industry's pricing decision is likely to be based on a number of factors, including the market structure of the sector, the maturity of the market, the affordability of the product and the structure of excise taxes (i.e. specific versus *ad valorem*). Thus, once the tax burden benchmark is attained, the tobacco industry's pricing strategy will become the deciding factor in influencing retail prices, since even specific taxes can then be treated as *ad valorem* taxes. This leads to the removal of tax as a public health tool and grants the tobacco industry the *de facto* ability to set the public health agenda.[38]

Finally, a high tax burden benchmark does not necessarily result in high prices. Some countries already have a high tax burden but still have cheap and affordable cigarettes. Figure 3.1 depicts the total tax burden and retail price of cigarettes (in United States dollars) for a number of countries.

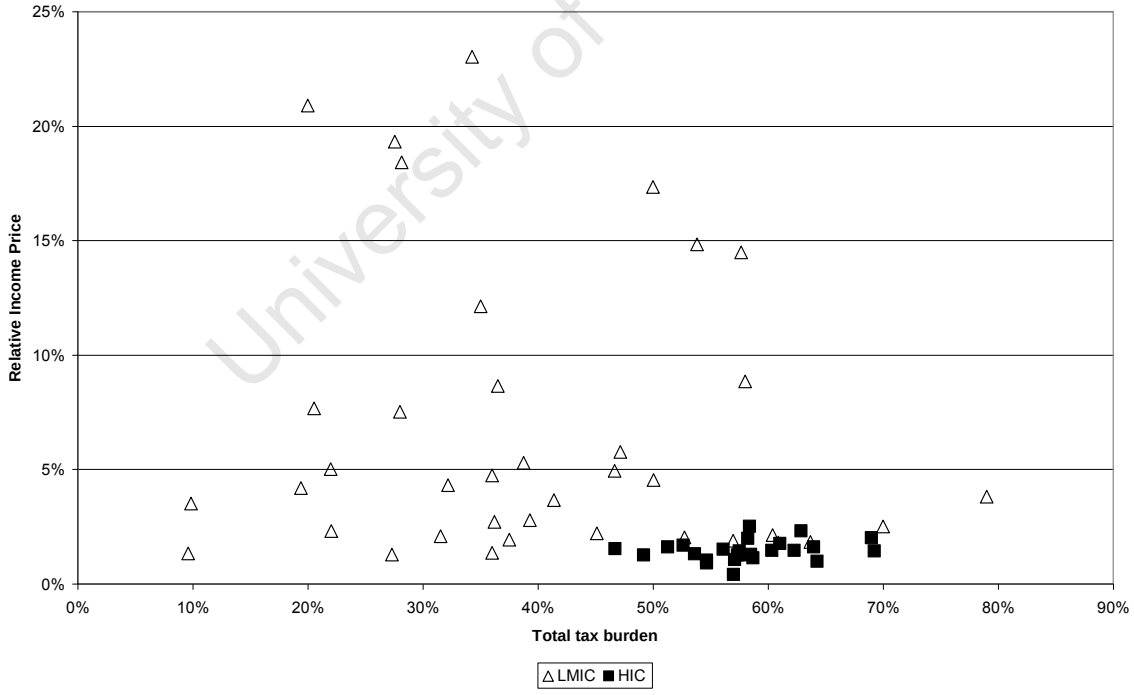
[36] This is especially so if specific excise taxes are used.
[37] This point may seem trivial since most regimes set a tax burden benchmark as a floor, so a decline in the industry/base/net-of-tax price would not require specific excise taxes to be reduced to maintain the benchmark; rather it would leave the actual tax incidence/burden above the benchmark. However, if an *ad valorem* tax is used, a decline in the industry/base/net-of-tax price may result in a decline in the absolute amount of excise tax while tax burden remains unchanged.
[38] However, very few countries meet the benchmark and moving towards meeting the benchmark in some reasonable period of time would require substantial tax increases that are almost certainly going to outpace income growth.

Figure 3.1: Total tax burden and prices in a cross section of countries



Source: Blecher and Van Walbeek (2009) and World Health Organisation (2008)

Figure 3.2: Total tax burden and affordability in a cross section of countries



Source: Blecher and Van Walbeek (2009) and World Health Organisation (2008)

Using a Spearman rank correlation statistic, the correlation between total tax burden and price is -0.04 (n=25) for high-income countries and 0.26 (n=38) for low- and middle-income

countries (neither of which are statistically significant at the 5% level). This indicates no statistical relationship between price and total tax burden. Figure 3.1 shows that high-income countries generally have a high total tax burden while prices vary significantly, and low- and middle-income countries have large variation in total tax burden with relatively low prices. Figure 3.2 depicts the total tax burden and the affordability of cigarettes as measured by the relative income price for the same group of countries. The Spearman rank correlation between total tax burden and affordability is 0.25 (n=25) in high-income countries and -0.14 (n=38) in low- and middle-income countries (neither of which are statistically significant at the 5% level). Again, this indicates no statistical relationship between total tax burden and affordability.

3.4 THE AFFORDABILTY BENCHMARK

The literature, discussed in detail in Chapter 2, suggests two measures of affordability using narrow (Guindon *et al.*, 2002; Kan, 2007) and broad measures of income (Blecher and Van Walbeek, 2004 and 2009). A broad measure of income differs from a narrow measure in that it values non-money income, like the provision of public goods and services. I will use a broad measure of income (per capita GDP) as the base for affordability since such a measure is more practical in the context of low- and middle-income countries. In low- and middle-income countries large portions of the population are dependent on the state provision of goods, services and grants. Narrow measures of income such as money income or wages do not adequately consider the provision of public goods such as education, medical and security services. Furthermore, the broad measure of income can be used in almost all countries on an annual basis, while the narrow measures are only available in smaller isolated samples and often in a low-frequency series (Blecher and Van Walbeek, 2009).

I use the relative income price measure of affordability developed by Blecher and van Walbeek which is defined as the percentage of annual per capita GDP required to purchase 100 packs of cigarettes. Affordability is expressed as a percentage, where higher percentages indicate less affordable cigarettes. An increase in the relative income price means that a greater proportion of income is required to purchase cigarettes, and hence cigarettes have become less affordable. A decrease in the relative income price means that a smaller proportion of income is required to purchase cigarettes, and hence cigarettes have become

more affordable. An increase in the price decreases affordability, as does a decrease in income.

A country may benchmark affordability in one of two ways, firstly by committing to maintaining the level of affordability, or secondly by committing to decrease the level of affordability over time. The first would involve increasing the excise tax in such a way that ensures prices rise by the combination of inflation and growth in per capita GDP. The second would involve increasing the excise tax in such a way that ensures the price increases by a greater magnitude than the combination of inflation and growth in per capita GDP. Given the effects of compounding, a small premium can result in a significant change in affordability over several years. Tax increases have a small inflationary impact since cigarettes are almost always part of the basket of goods and services used to calculate inflation.[39]

3.5 SOUTH AFRICA – THE CURRENT SYSTEM

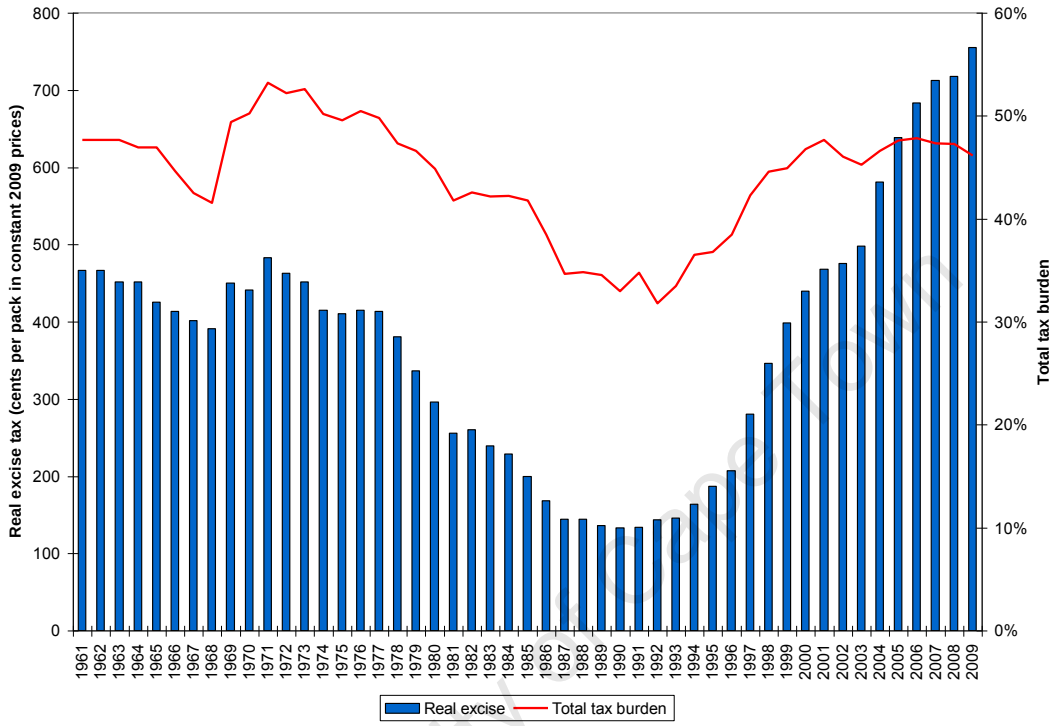
Prior to 1993 South Africa had no tobacco control strategy as a result of particularly close links between the state and the tobacco industry. Inflation was allowed to erode the value of the specific excise tax in real terms over a number of years. The total tax burden fell from a peak of over 52% in 1972 to a low of 29% in 1992 (see Figure 3.3). In 1994, the government of national unity, led by the African National Congress, proposed that excise taxes should amount to 50% of the retail price of cigarettes, implying a total tax burden of nearly 63% (Van Walbeek, 2005).[40] Consistent increases in excise taxes, above the rate of inflation over a number of years were required in order to achieve the target (Malan and Leaver, 2003).

The higher excise taxes resulted in significantly higher real prices which, in turn, led to sharp declines in aggregate and per capita consumption. Even though the benchmark was originally set as an excise tax burden benchmark, the National Treasury (Ministry of Finance) has since interpreted the benchmark as 50% total tax burden (Van Walbeek, 2005).[41] In 2004 the benchmark was adjusted upwards to 52% total tax burden for a three year period, and in 2008

[39] For example, tobacco contributes 2.3% to the total Consumer Price Index in South Africa (Statistics South Africa, 2009).
[40] VAT of 14% is applied on the sum of the industry/base/net-of-tax price as well as the excise tax and is levied on most goods and services in South Africa.
[41] Representing an excise tax incidence/burden of 38% when VAT is excluded.

excise taxes rose by their smallest amount since the introduction of the tax burden benchmark.[42] The actual tax burden is found to be lower than the target, but this is a result of the different price data used by the National Treasury and this paper (see Appendix for a detailed discussion).

Figure 3.3: Total tax burden and excise tax of cigarettes in South Africa, 1961-2009

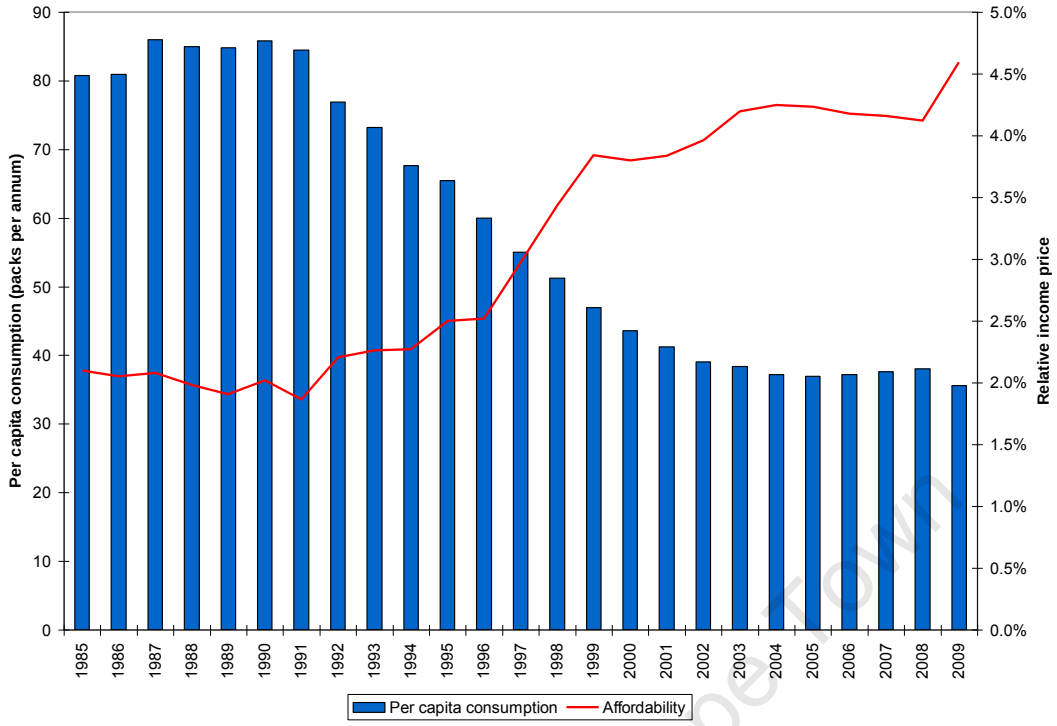


Note: Tax burden is read off the secondary Y axis.
Source: Van Walbeek (2005), National Treasury and Statistics South Africa

Higher prices also resulted in a sharply higher relative income price until 1999, indicating a sharp decline in the affordability of cigarettes (Figure 3.4) as economic growth was slow. Since 1999, however, the affordability of cigarettes has declined at a much slower pace and, unsurprisingly, per capita consumption has remained flat (see Figure 3.4). The small decline in affordability is attributable both to stronger economic growth and less aggressive tax increases.[43] However, for the last year of data (2009), a significant increase in the retail price by the tobacco industry and a decline in income due to a recession resulted in a sharp decline in both affordability and consumption.

[42] The nominal increase was smaller than inflation resulting in a real decline in excise in 2008.
[43] Per capita GDP growth averaged 0.5% between 1994 and 1999 and 2.7% between 2000 and 2008. In 2009 per capita GDP declined by 2.8% as a result of the recession (South African Reserve Bank, 2010).

Figure 3.4: Affordability and per capita consumption of cigarettes in South Africa, 1986-2009



Note: The relative income price is defined as the percentage of per capita GDP required to purchase 100 packs of cigarettes. An increase in the relative income price means that a greater proportion of income is required to purchase cigarettes and hence cigarettes have become less affordable. A decrease in the relative income price means that a smaller proportion of income is required to purchase cigarettes and hence cigarettes have become more affordable. The normal convention of using the adult population of 15 years and older in calculating per capita consumption is followed. I use the Actuarial Society of South Africa population estimates since they also provide a population forecast which is used later on. The source only provides estimates from 1985 onwards.
Source: Van Walbeek (2005), South African Reserve Bank (2008) and Actuarial Society of South Africa

Van Walbeek (2005) notes that the National Treasury claimed to have reached the total tax burden target of 50% in 1997 although he indicates this to be "more illusory than real". Disagreement over whether or not the target has been met most likely results from a timing issue. National Treasury does not set excise taxes in a forward-looking manner; they do not forecast the impact of inflation and tobacco industry reaction when setting the excise tax for the year to come. As a result of the tax increase, prices rise as the tobacco industry passes the tax onto consumers, thereby reducing the excise tax burden. Furthermore, the tobacco industry decision of how much of the tax to shift onto consumers also influences the excise tax burden. Historically, this has involved shifting the entire tax onto consumers as well as raising the industry/base/net-of-tax price (over-shifting) resulting in a lower than expected total tax burden (Van Walbeek, 2005). The net result is that the actual/current total tax burden is lower than the target.

3.6 SOUTH AFRICA – SIMULATING ALTERNATIVES

From a tobacco control perspective there are several options that South Africa can pursue in order to see continuing declines in tobacco consumption. Either the tax burden benchmark needs to be increased, or an alternative strategy needs to be proposed.[44] The proposal of a higher tax burden benchmark will only be a temporary solution, since at some point it will be achieved, after which the same stagnation will likely be seen again. The particular concern is the lag between the reaching of the target and the implementation of an alternative strategy.

The last increase in the tax burden benchmark in South Africa occurred in 2004, when the total tax burden benchmark was raised to 52%, initially for a three year period; since 2007 there has been no change in the benchmark. During this period the decline in consumption has ended. An alternative benchmark based on affordability will see a dynamic solution that results in an affordability target being met on an ongoing basis, and where the affordability target adjusts dynamically to ensure declining consumption. The principle of an affordability benchmark is that excise taxes should be increased on an annual basis to ensure that affordability is always at least being maintained or reduced.

The important consideration is what will occur in the future if the tax burden benchmark is maintained at 52% total tax burden (or its current level). This chapter simulates the effect on per capita consumption of *maintaining the current tax burden benchmark* ("a") as well as four alternative proposals.[45] First, it simulates *maintaining affordability* ("b") by increasing excise in such a way as to maintain the current level of affordability. Second, it simulates *reducing affordability* ("c") by promoting a continuously rising relative income price (i.e. making cigarettes continuously less affordable) by increasing excise by 2 percentage points more each year. Third, it simulates annually *increasing the total tax benchmark* ("d") by 10 percentage points over the next ten years (i.e. on average 1 percentage point per year). This examines the impact of regularly adjusting the benchmark upwards. Fourth, it simulates *benchmarking real excise taxes* ("e"), following the example of the United Kingdom in the late 1990s when excise taxes increased by 5% in real terms annually (Secretary of State for

[44] Simply meeting the current rule may also be a short term possibility. However, the fact that the current tax burden is below the target is not a result of a policy failure but simply a data issue. If resolved, once the target is met the same stagnation issues will occur again.

[45] Given the previously discussed data issues I do not assume that the tax burden to be maintained is 52% but rather that the current tax burden is maintained.

Health and Secretary of State for Scotland, Wales and Northern Ireland, 1998; Excise Social Policy Group, HM Customs and Excise, year unknown).[46]

For the purposes of the simulation a price elasticity of demand of -0.46 and an income elasticity of demand of 0.78 are assumed. These estimates are calibrated using a dynamic in-sample forecasting model from 2004 to 2009 (a more detailed discussion of how these estimates were achieved is included in the appendix). Furthermore, an annual rate of per capita GDP growth of 2.5% is assumed, which is consistent with the recent past.[47] A secondary, high economic growth scenario of 5% is also used. This is specifically included to show how more rapid economic growth undermines public health and why a rule that dynamically adjusts to economic growth is useful, especially in low- and middle-income countries.

Further assumptions about how the tobacco industry shifts the tax to the consumer need to be made. Historically, the tobacco industry has over-shifted the tax to the consumer by increasing the industry/base/net-of-tax price by more than the increase in tax (Van Walbeek, 2005). However, we make three assumptions regarding how tax changes influence prices in order to illustrate the power that the tobacco industry has in using prices to manipulate various tax policy rules. Firstly, the price can increase by the same amount as the excise tax[48] (labelled price factor 1), meaning that the tax increase is passed onto the consumer. Secondly, the price can increase by half the increase in tax (price factor 0.5), meaning that the price increases by less than the increase in tax and that a portion of the tax increase is absorbed by the tobacco industry (under-shifting). Thirdly, the price can increase by one and a half the increase in tax (price factor 1.5), meaning that the price increases by more than the increase in tax and that the tobacco industry increases their retail margin in addition to passing on the entire tax increase to the consumer (over-shifting).

The simulation is run on an annual basis and estimates for ten years are displayed (until 2019). The historical series since 2000 is also displayed. Figure 3.5 shows the simulated impact of the five scenarios on per capita cigarette consumption for price factor 0.5. Figures 3.6 and 3.7 show the simulated impacts of the five scenarios on per capita cigarette

[46] This option is analogous to the price benchmarking discussed earlier.
[47] Per capita GDP growth averaged 2.7% between 2000 and 2008 (South African Reserve Bank, 2010).
[48] As well as to the VAT attributable to the increase in excise tax.

consumption for price factors of 1.0 and 1.5, respectively. Figures 3.5, 3.6 and 3.7 show the simulations of results for the low economic growth scenario of 2.5% per annum only. Table 3.1 summarises the percentage changes in consumption over the 10 year forecast and the annual percentage change in excise for each scenario.

Maintaining the current tax burden benchmark ("a") will result in an increase of per capita consumption by 12.2% over the ten years under all three pricing scenarios. All three pricing scenarios result in the same outcome for per capita consumption, since no real excise tax increase will be necessary in order to maintain the tax burden. Maintaining the current level of affordability ("b") will result in slightly declining per capita consumption under all three scenarios, between 0.4% and 1.2% over the ten years. Decreasing affordability ("c") will result in declining per capita consumption between 4.6% and 6.4% over the ten years. Increasing the tax burden benchmark ("d") will result in an increase in per capita consumption between 2.1% and 8.5% over the ten years for price factors 0.5 and 1.0. However, if the tobacco industry over-shifts the tax (i.e. price factor 1.5) per capita consumption will decline by 12.1% over the ten years. Under the final scenario of benchmarking the tax directly ("e"), per capita consumption will decline by between 2.8% over the ten years for the price factor of 1.5. However, per capita consumption would increase by between 1.6% and 6.5% if the price factors were 0.5 and 1.0.

Figure 3.5: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 2.5% per annum and price factor 0.5)

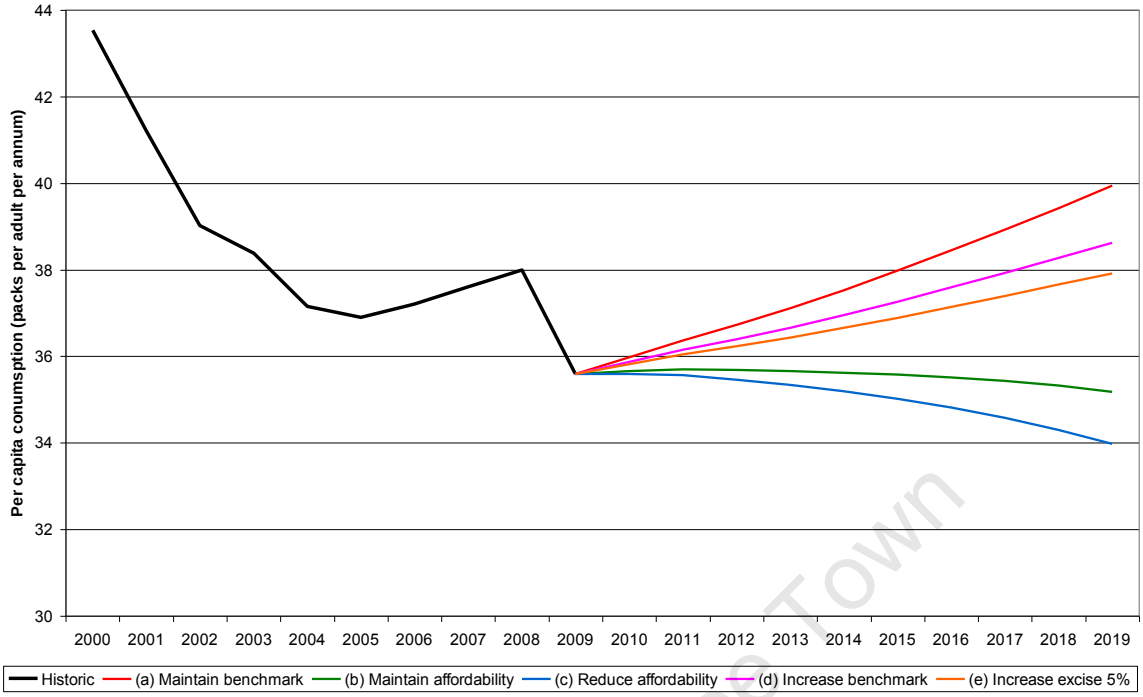


Figure 3.6: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 2.5% per annum and price factor 1)

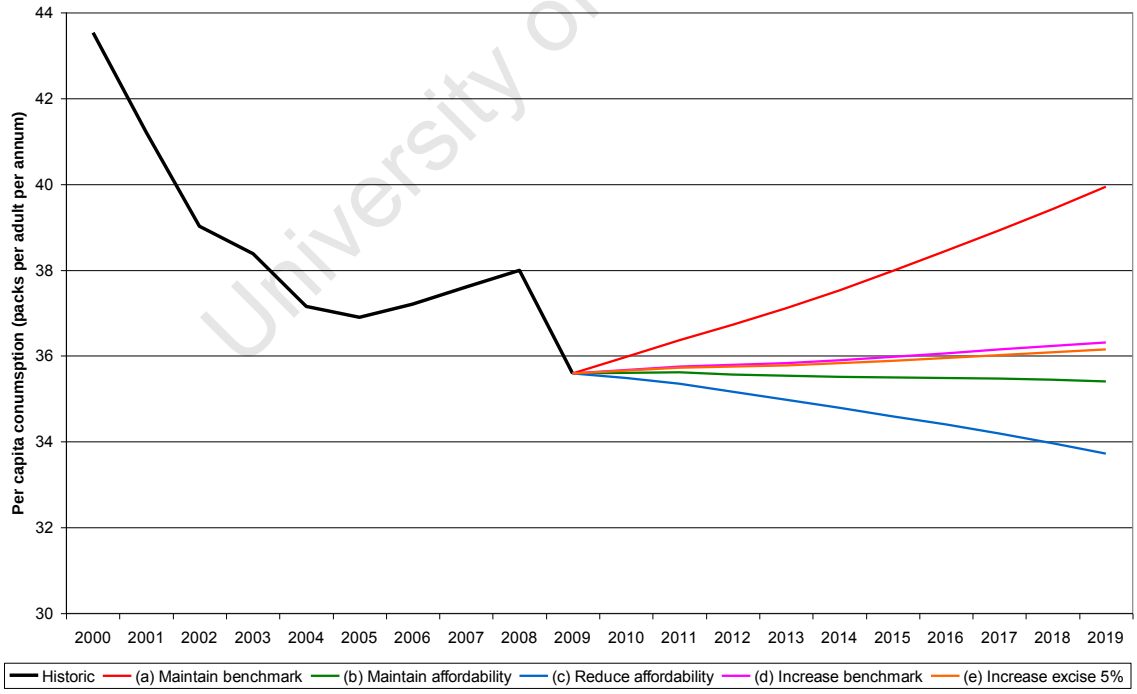
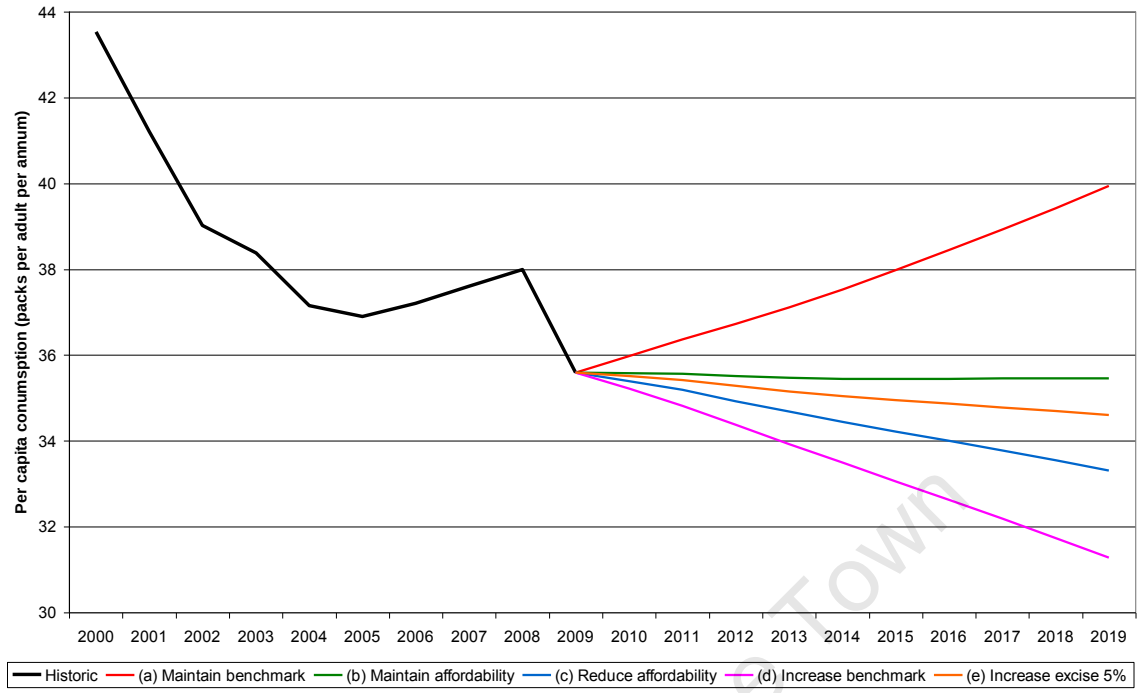


Figure 3.7: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 2.5% per annum and price factor 1.5)



The simulation is then rerun on an annual basis with an assumed economic growth rate of 5% and estimates for ten years (until 2019), as well as the historical series since 2000, are displayed. Figure 3.8 shows the simulated impact of the five scenarios on per capita cigarette consumption for price factor 0.5. Figures 3.9 and 3.10 show the simulated impacts of the five scenarios on per capita cigarette consumption for price factors of 1.0 and 1.5, respectively. Table 3.2 summarises the percentage changes in per capita consumption over the 10 year forecast and the annual percentage change in excise for each scenario.

Maintaining the current tax burden benchmark ("a") will result in an increase in per capita consumption of 35.6% over the ten years under all three pricing scenarios. Again, all three pricing scenarios result in the same outcome for per capita consumption since no real excise tax increase will be necessary in order to maintain the tax burden. Maintaining the current level of affordability ("b") will result in higher per capita consumption under all three scenarios, between 3.9% and 7.4% higher over the ten years. Decreasing affordability ("c") will result in marginally higher per capita consumption over the ten years with a price factor of 1 and 1.5, but marginally lower per capita consumption with a price factor of 0.5. Increasing the tax burden benchmark ("d") will result in an increase in per capita consumption of 6.7% and 31.2% over the ten years for all pricing scenarios. Under the final

scenario of benchmarking the tax directly ("e"), per capita consumption will increase by between 17.8% and 28.8% over the ten years.

Figure 3.8: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 5% per annum and price factor 0.5)

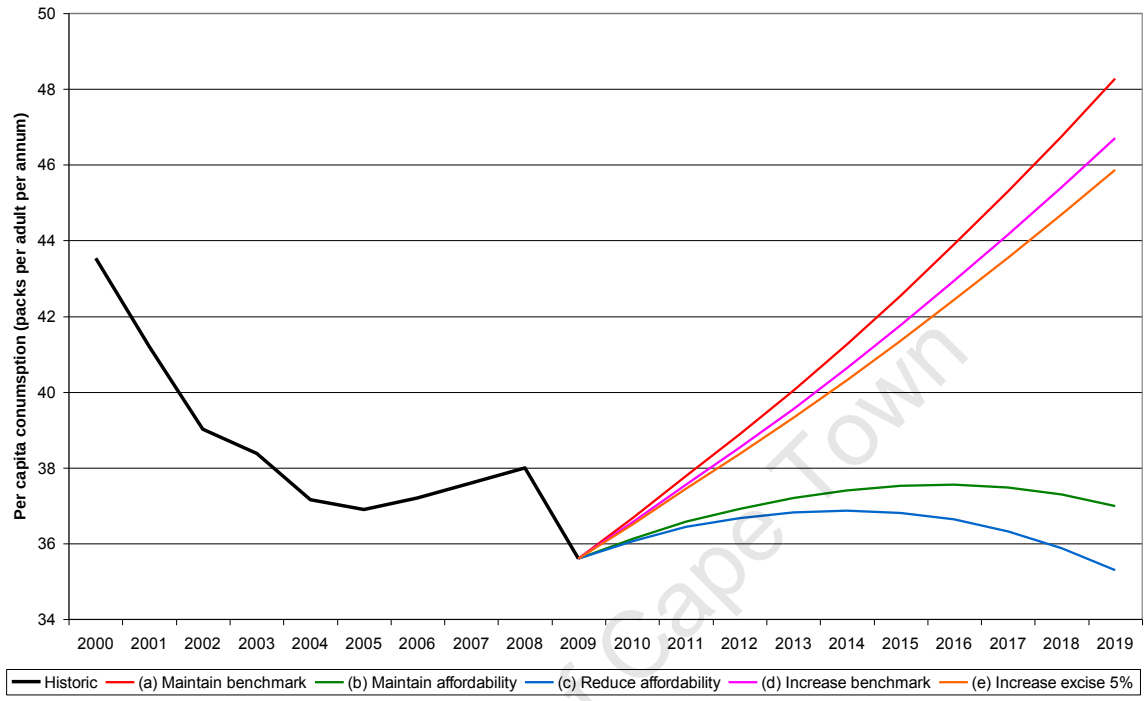


Figure 3.9: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 5% per annum and price factor 1)

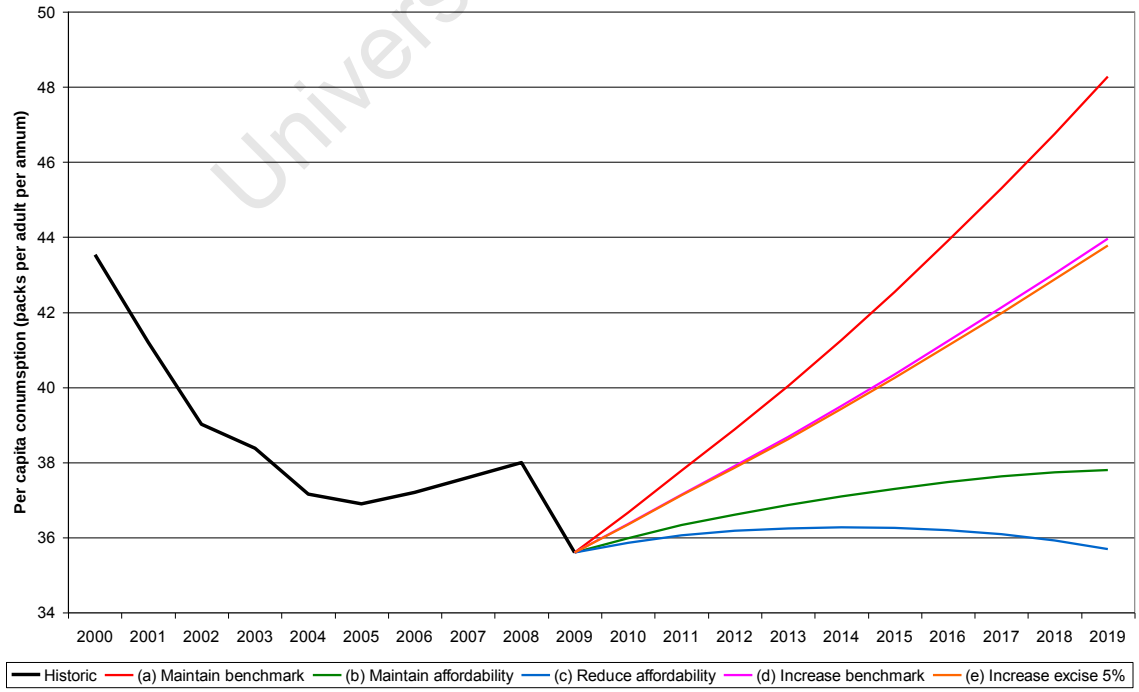
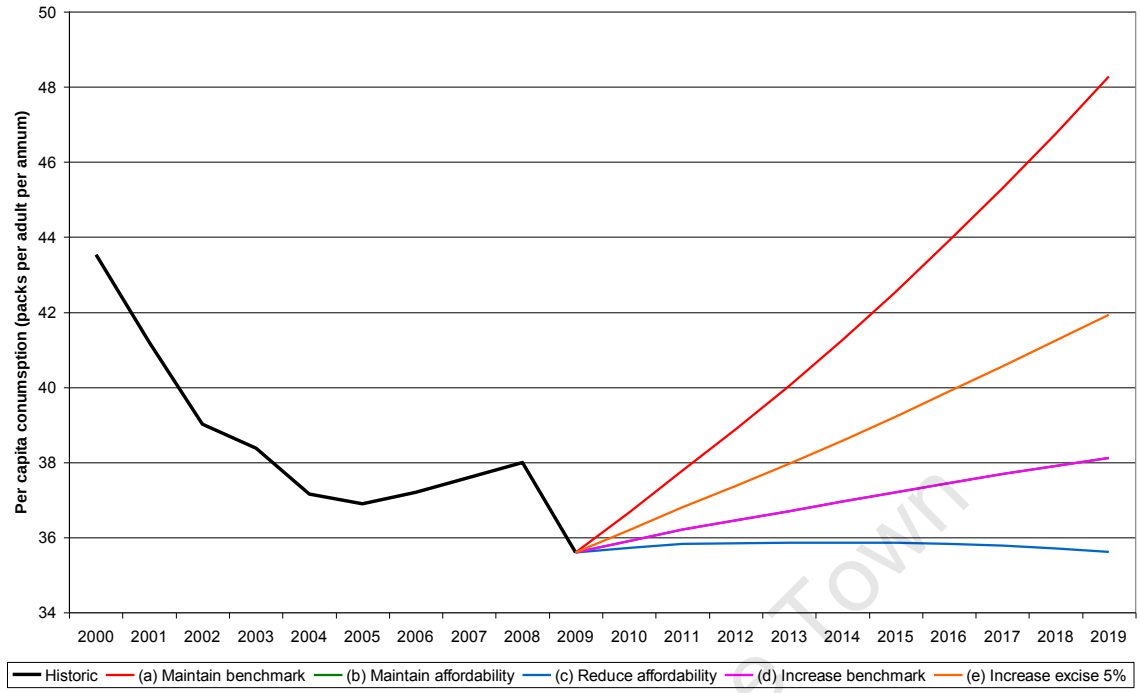


Figure 3.10: Simulated per capita consumption in South Africa, 2009-2019 (Economic growth of 5% per annum and price factor 1.5)



Note: "(b) Maintain affordability" and "(d) Increase benchmark" have the same outcomes and thus share the same line on the graph. As a result only four lines are visible.

Maintenance of the current tax burden benchmark ("a") in South Africa will clearly result in a large public health failure since per capita consumption will increase under both economic scenarios. Even maintaining the current level of affordability may not be sufficient from a tobacco control perspective. In a high economic growth environment, per capita consumption will rise, and in a low economic growth environment, the decline in per capita consumption is negligible. Reducing affordability ("c") will result in declining per capita consumption under the low economic growth scenario and no significant change in per capita consumption under the high economic growth scenario. Importantly, the two affordability-based rules are not as sensitive to the choice of price factor, meaning that under such a rule, the tobacco industry pricing decision does not significantly impact the outcome of the simulation. A new policy to upwardly adjust the current tax burden benchmark ("d") has volatile results. Under this scenario, the tobacco industry pricing strategy significantly impacts the outcome of the simulation.

Table 3.1: Summary of simulated changes in per capita consumption and excise taxes for an economic growth rate of 2.5% per annum, 2009-2019

Price factor	Maintain bemchmark (a)		Maintain affordability (b)		Decrease affordability (c)		Increase benchmark (d)		Increase excise (e)	
	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax
0.5 (under shifting)	12.2%	0.0%	-1.2%	10.2%	-4.6%	12.2%	8.5%	3.4%	6.5%	5.0%
1	12.2%	0.0%	-0.5%	5.9%	-5.3%	7.9%	2.1%	4.8%	1.6%	5.0%
1.5 (over shifting)	12.2%	0.0%	-0.4%	4.2%	-6.4%	6.2%	-12.1%	8.1%	-2.8%	5.0%

Table 3.2: Summary of simulated changes in per capita consumption and excise taxes for an economic growth rate of 5% per annum, 2009-2019

Price factor	Maintain benchmark (a)		Maintain affordability (b)		Decrease affordability (c)		Increase benchmark (d)		Increase excise (e)	
	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax	Total change in consumption	Annual change in excise tax
0.5 (under shifting)	35.6%	0.0%	3.9%	17.5%	-0.8%	19.5%	31.2%	3.4%	28.8%	5.0%
1	35.6%	0.0%	6.2%	10.9%	0.3%	12.9%	23.5%	4.8%	23.0%	5.0%
1.5 (over shifting)	35.6%	0.0%	7.4%	8.0%	0.4%	10.0%	6.7%	8.0%	17.8%	5.0%

As previously argued, tax burden benchmarks turn specific excise taxes into *ad valorem* taxes because and the tobacco industry becomes the *de facto* owner of tax policy; their pricing decision sets the specific tax. The final method of increasing the excise tax annually by 5% per year is also sensitive to the pricing strategy of the tobacco industry. Aggressive price increases (over-shifting) will water down tax increases and, although it will result in significant declines in consumption, it will nevertheless result in the tobacco industry claiming most of the "rents".

3.7 DISCUSSION AND CONCLUSION

The simulations indicate the sensitivity of tobacco consumption to economic conditions. If South Africa were to achieve strong economic growth, it is likely that consumption would rise aggressively. Clearly, maintaining the current rule is not in the interest of public health, while a rule that targets excise tax increases independent of prices allows the tobacco industry to earn most of the rents of the tax policy. Adjusting the current rule to increase the tax burden benchmark incrementally is not optimal since it provides the tobacco industry with almost all the power to set tax, and thus public health policy. Additionally, this strategy is not able to adjust to changing economic conditions.

The affordability policy rule provides policy makers with an interesting alternative. Firstly, it automatically adjusts to changing economic conditions, allowing lower tax increases in times of slower economic growth and higher taxes increases in times of faster economic growth. This is important given the role that income growth has played in influencing tobacco consumption in recent years. Secondly, it removes the strategic power from the tobacco industry to use its pricing strategy to influence tax policy by over-shifting, allowing the public to gain more of the rents of increased taxes. Critically, the simulations show that committing to a policy of decreasing affordability provides declining consumption (or at least no increase) under most scenarios. None of the alternatives simulated shows declining consumption under all economic and tobacco industry pricing decisions.

The benefits of an affordability benchmark are clear and easy to understand in this context. The affordability benchmark is promoted not because tax burden benchmarking does not work, but because the affordability benchmark provides a clear and easy to understand

dynamic benchmark. This is particularly important in many low- and middle-income countries that are experiencing rapid economic growth, where following a tax burden benchmark may result in cigarettes becoming rapidly more affordable.

The case of South Africa--where maintenance of the current tax burden benchmark will result in a public health failure--has been used to argue in favour of an affordability benchmark. An affordability benchmark may not only consolidate the public health gains made since 1994 but may also provide a lasting legacy of declining tobacco consumption. The affordability benchmark is not proposed to replace a tax burden benchmark in all cases, but rather in those cases where tax burden benchmarking is struggling in the face of rapidly growing incomes.

A further consideration is that if an affordability benchmark becomes established and the tobacco industry has significant market power, they could increase the retail price in such a way as to take all the "rents". This would occur if the tobacco industry pre-empted an excise tax increase by raising the retail price in such a way that the excise tax increase would no longer be required to meet the affordability rule. In such a case, the state's excise revenue from cigarettes would decline, since consumption would decline as a result of the price increase, and the specific excise tax would remain unchanged. Although this is not explicitly a public health concern, much of the popularity of excise tax policy comes about from its revenue generating ability, and any policy rule should ensure that excise revenue remains stable and predictable, at least in the short term.

However, as the simulations showed, alternative tax rules also allowed the tobacco industry to take significant portions of the rents. In a competitive market the ability of the tobacco industry to take the rents is undermined, since manufacturers would want to keep prices as low as possible in order to maintain market share. Also, in a monopolistic market, the threat of entry may curtail the firm's pricing power. If a government chooses to impose an affordability policy rule and wishes to remove the possibility of the tobacco industry pre-empting a tax increase, they would need a credible threat that the tax increase will occur independent of tobacco industry behaviour. Furthermore, affordability could be targeted in a backward-looking manner so that the excise tax increased relative to the prevailing price (similarly to the way in which taxes are currently set, although with a different rule); they could also be targeted in such a way that the affordability policy rule is met on an ongoing

basis, so that excise taxes are increased as and when prices rise, in addition to regular annual changes at the time of the budget.

There are however some caveats to this approach. The current global economic crisis exposes a weakness of the concept since declining incomes could require cuts in excise taxes in order to maintain affordability. This is clearly unsustainable and not in the interests of public health or fiscal policy. Cigarette excise taxes are an especially important source of revenue in times when other tax sources are declining. Evidence of this is the large number of state governments in the United States that have raised excise taxes during the current economic crisis. Thus I propose that the rule seeks only to raise excise taxes and not to allow them to decline in nominal or real terms – even if incomes are falling. Secondly, this rule is designed specifically for countries which are experiencing rapid economic growth and where growth in incomes is making cigarettes more affordable. This rule may not be relevant or appropriate in countries that have mature markets and in which income growth does not undermine tobacco control efforts.

APPENDIX B: CALIBRATION OF THE MODEL

In order to simulate future consumption several critical assumptions are required. One of the most important assumptions is the values of the price and income elasticities of demand. Equation 1 below shows the importance of the price and income elasticities of demand in computing future consumption. The formula computes future consumption as a function of past consumption and changes in price and income, which are applied to the price and income elastities of demand, respectively.

$$C_{t+1} = C_t + C_t\left(\frac{P_{t+1} - P_t}{P_t}\right)\eta_P + C_t\left(\frac{Y_{t+1} - Y_t}{Y_t} \times 100\right)\eta_Y \qquad [1]$$

Where C is consumption, P real price, Y real income, η_P the price elasticity of demand, and η_Y the income elasitcities of demand. The subscript t refers to the current time period and $t-1$ the previous time period.

Several estimates of price and income elasticities are available in the econometric literature; however, each has advantages and disadvantages. Most of the studies are not recent, and thus estimated elasticities are based on data that is not representative of recent trends and do not cover the period during which significant tax and price increases occurred (i.e. since 1993) (see Van Walbeek, 1996; Reekie, 1994; Economics of Tobacco Control in South Africa Project, 1998). The more recent estimates estimate constant elasticities (i.e. those that do not change over time) over long periods of time (Van Walbeek, 2005) while others estimate long run elasticities only (Boshoff, 2008). Rather than relying on one of these estimates or estimating models using several different elasticities, I compute a price and income elasticity of demand using a dynamic in-sample forecasting model.

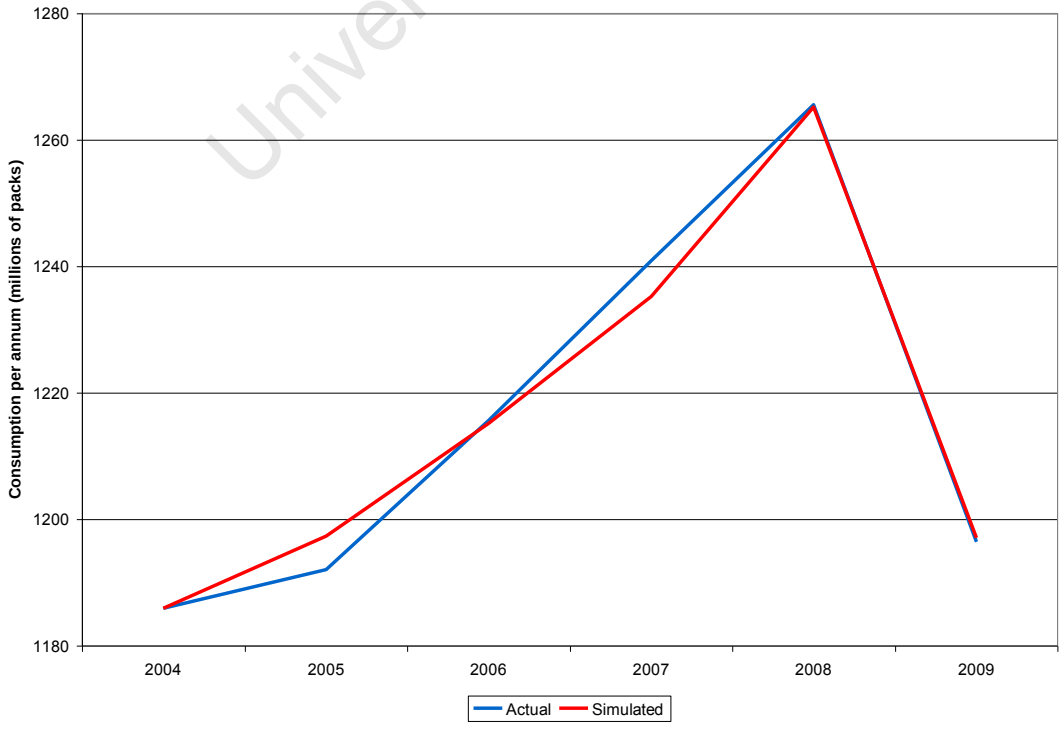
In-sample forecasting allows one to compare the forecasts of the model with the actual values. The actual and forecast values of the model are compared using the RMSE method. The combinations of price and income elasticities which result in the minimum RMSE are used to simulate future consumption in this chapter. The RMSE is the root mean square error which is estimated with the following formula:

$$RMSE(\eta_P, \eta_Y) = \sqrt{\frac{\sum_{i=1}^{n} (x_{1,i} - x_{2,i})^2}{n}} \quad [2]$$

I used a dynamic forecast in that the forecasted data point for consumption in the previous year is used to forecast the consumption data point for the next year, rather than the actual data point (static forecast). However, the actual data point is used in the first year. The primary difference between dynamic and static forecasting techniques is that under a static forecast, the errors are not cumulative and thus are a less stringent test of the performance of the model.

Using consumption, real price and real income data for the years 2004 to 2009, with a price elasticity of -0.46 and an income elasticity of 0.78, results in the lowest RMSE of 3.18. This is found through an iterative search starting with a price elasticity of -0.50 and an income elasticity of 0.70 (which resulted in a RMSE of 22.49). The starting value was based on a review of the previous literature. Figure B1 shows the actual and simulated consumption between 2004 and 2009. The simulated values are very close to the actual values and the trends are almost identical. The estimated elasticities perform well in predicting consumption in-sample. A five year forecast is used.

Figure B1: Actual and simulated consumption for η_P = -0.46 and η_Y = 0.78



APPENDIX C: DATA ISSUES

Van Walbeek (2005) has developed the most used series on consumption in South Africa, presenting data between 1961 and 2004. I follow a similar method. Consumption data is derived from data on excise taxes. Excise taxes are levied at a specific rate which allows consumption to be implied by dividing total excise revenue by the specific excise tax to find aggregate consumption data. However, South African fiscal data is presented on a fiscal year which runs from the start of March to the end of February.[49] Thus, consumption data is converted from the fiscal year to the calendar year using a weighted average of the fiscal years by taking two twelfths of the previous year and ten twelfths of the next year, the following example shows this conversion:

$$excise_{1996} = \left(\frac{2}{12}\right) \times excise_{1995/96} + \left(\frac{10}{12}\right) \times excise_{1996/97} \quad [3]$$

The data comes from various sources. The raw data is sourced from Van Walbeek (2005), although the underlying data is sourced from the Auditor-General (selected years), the Tobacco Board (selected years) and National Treasury (selected years). Data since the publication of Van Walbeek (2005) has been sourced from more recent Estimates of National Revenue (National Treasury, selected years). Table C1 describes the revenue and excise tax data for the fiscal years and the consumption data for the fiscal and calendar years.

As with consumption data, Van Walbeek (2005) provides the most complete annual time series of price data in South Africa between 1961 and 2004. Van Walbeek (2005) uses official sources from the then Central Statistical Services' Yearbook on Prices[50] and the subsequent Statistical News Release P1041.3: Retail Prices Until 1995. Between 1996 and 2001, monthly prices were purchased from Statistics South Africa, and then converted to annual data using the simple average of the months. Between 2000 and 2005, the Statistics South Africa "Report on Prices" in July of each year was used. Since 2006, prices were updated using the tobacco sub-index of the Consumer Price Index (see Blecher, 2010a for an example of this).

[49] Tax changes (specifically increases) coincide with the fiscal year.
[50] The Central Statistical Services has been renamed Statistics South Africa.

Table C1: Summary of excise revenue, tax and implied consumption in South Africa, 1961-2009

Fiscal years	Excise revenue	Excise tax	Aggregate consumption	Calendar years	Aggregate consumption
	Thousands of Rands	Cents per pack	Millions of packs		Millions of packs
1960/61	46993	9.1	516		
1961/62	47085	9.1	517	1961	517
1962/63	48717	9.1	535	1962	532
1963/64	53587	9.1	589	1963	580
1964/65	55372	9.1	608	1964	605
1965/66	55023	9.1	605	1965	605
1966/67	65312	9.1	718	1966	699
1967/68	72386	9.1	795	1967	782
1968/69	78532	9.1	863	1968	852
1969/70	85711	11.1	772	1969	787
1970/71	90573	11.1	816	1970	809
1971/72	109465	13.1	836	1971	832
1972/73	111145	13.1	848	1972	846
1973/74	136713	14.1	970	1973	949
1974/75	144642	14.1	1026	1974	1016
1975/76	178032	16.1	1106	1975	1092
1976/77	206519	18.1	1141	1976	1135
1977/78	216672	20.1	1078	1977	1088
1978/79	227218	20.1	1130	1978	1122
1979/80	252234	20.1	1255	1979	1234
1980/81	274960	20.1	1368	1980	1349
1981/82	335139	20.1	1667	1981	1617
1982/83	372183	24.1	1544	1982	1565
1983/84	378484	24.1	1570	1983	1566
1984/85	409489	26.1	1569	1984	1569
1985/86	411834	26.1	1578	1985	1576
1986/87	425301	26.1	1630	1986	1621
1987/88	468647	26.1	1796	1987	1768
1988/89	540156	30.1	1795	1988	1795
1989/90	593233	32.1	1848	1989	1839
1990/91	693965	36.1	1922	1990	1910
1991/92	816434	42.1	1939	1991	1936
1992/93	938072	52.0	1804	1992	1827
1993/94	1022176	56.9	1796	1993	1798
1994/95	1210433	71.1	1702	1994	1718
1995/96	1515268	88.0	1722	1995	1719
1996/97	1672227	104.0	1608	1996	1627
1997/98	2393286	158.0	1515	1997	1530
1998/99	2957204	204.0	1450	1998	1460
1999/00	3313841	245.0	1353	1999	1369
2000/01	3641547	283.0	1287	2000	1298
2001/02	3949575	316.8	1247	2001	1253
2002/03	4213328	350.8	1201	2002	1209
2003/04	4698781	388.5	1209	2003	1208
2004/05	5348515	452.8	1181	2004	1186
2005/06	6024031	504.4	1194	2005	1192
2006/07	6783519	556.1	1220	2006	1216
2007/08	7665368	615.7	1245	2007	1241

Fiscal years	Excise revenue	Excise tax	Aggregate consumption	Calendar years	Aggregate consumption
	Thousands of Rands	Cents per pack	Millions of packs		Millions of packs
2008/09	8659210	682.0	1270	2008	1266
2009/10	9100000	770.0	1182	2009	1196

However, a recent report for prepared for the National Council Against Smoking (Van Walbeek, 2010) has developed a more accurate method for updating price data. Van Walbeek (2010) sourced monthly prices from Statistics South Africa from December 2001 to February 2010. The data was not aggregated and included the actual data points that are used to compile the Consumer Price Index. The average monthly price of mid-priced cigarettes was calculated to represent the total market. This was deemed appropriate since mid-priced cigarettes account for about 70% of the market (Euronomonitor, 2007). Data was then annualized by taking the average monthly price.

Figure C1 below shows the real prices of cigarettes using the old and new methods. There is a noticeable difference between the methods since 2001; the results using the new method are significantly higher than the old method, and the gap between the two series is growing. This has a number of implications for the simulations in this chapter, particularly in terms of the elasticitiy assumptions. Too low a price may result in an overstatement (in absolute terms) of the price elasticity of demand. Furthermore, since the current policy rule used to set the specific excise tax is defined in terms of retail prices, the understatement of prices may be resulting in a lower excise tax than that actually desired. Figure C2 shows the total tax burden using the old and new methods. Data is also summarized in Table C2.

From the data shown it seems that the price data used to set the specific excise tax are based on a price series similar to that used in the "old method", since a total tax burden of approximately 52% has been maintained since 2004. However, if these prices are understated and the "new method" is used, the tax burden target has not been achieved and the total tax burden has remained at approximately 47% since 2000. Since the purpose of this chapter is not to test whether the target is being met, but rather to understand what policy rule is most likely to be optimal to public health, I will leave this debate open. However, I will use the new method for the price data since this data better represents the prices that smokers are paying in the market. A more thorough analysis of the implications of this discovery--by Van Walbeek--is warranted, and may have significant policy relevance.

Figure C1: Real prices of cigarettes in South Africa, 1961-2009

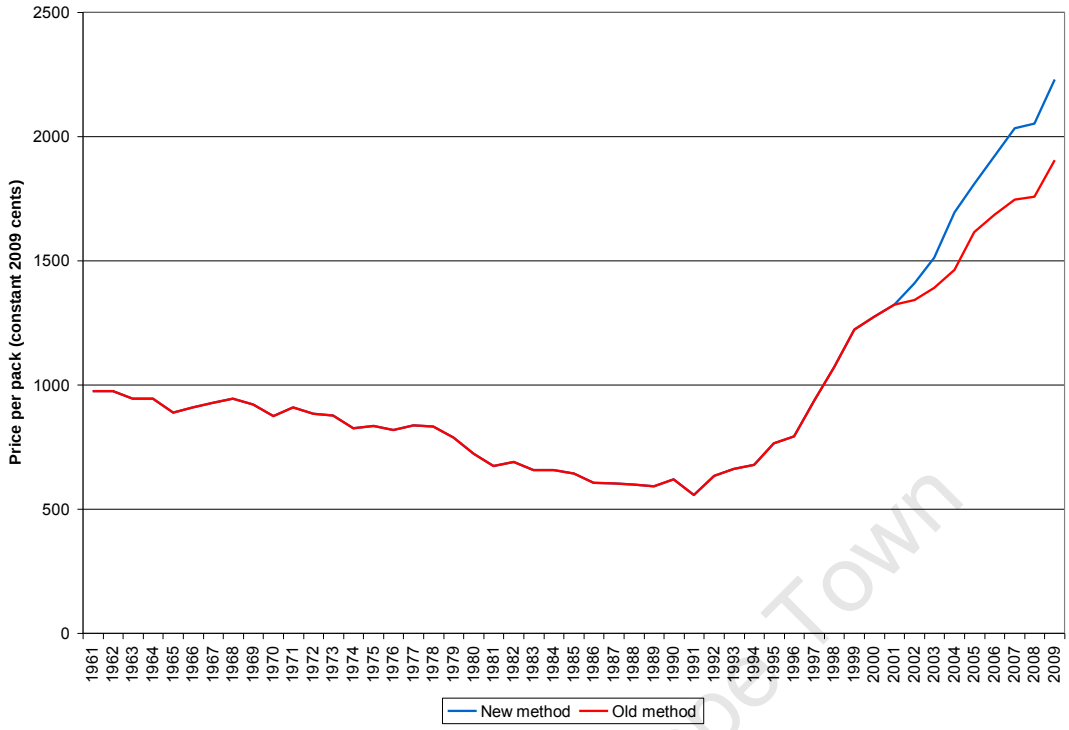


Figure C2: Total tax burden of cigarettes in South Africa, 1961-2009

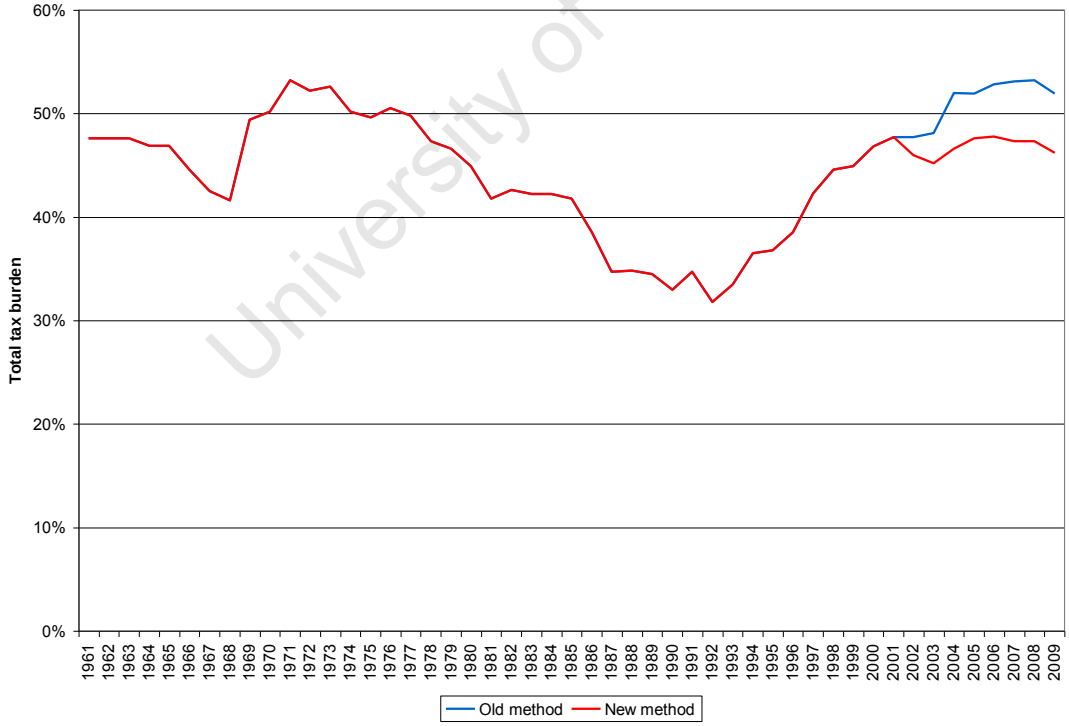


Table C2: Summary of nominal prices and tax burden in South Africa, 1961-2009

Calendar years	Price per pack	Price per pack	Excise tax burden	Excise tax burden	Total tax burden	Total tax burden
	New method	Old method	New method	Old method	New method	Old method
1961	19	19	47.6%	47.6%	47.6%	47.6%
1962	19	19	47.6%	47.6%	47.6%	47.6%
1963	19	19	47.6%	47.6%	47.6%	47.6%
1964	19	19	46.9%	46.9%	46.9%	46.9%
1965	19	19	46.9%	46.9%	46.9%	46.9%
1966	20	20	44.6%	44.6%	44.6%	44.6%
1967	21	21	42.5%	42.5%	42.5%	42.5%
1968	22	22	41.6%	41.6%	41.6%	41.6%
1969	22	22	49.4%	49.4%	49.4%	49.4%
1970	22	22	50.2%	50.2%	50.2%	50.2%
1971	24	24	53.2%	53.2%	53.2%	53.2%
1972	25	25	52.2%	52.2%	52.2%	52.2%
1973	27	27	52.6%	52.6%	52.6%	52.6%
1974	28	28	50.2%	50.2%	50.2%	50.2%
1975	32	32	49.6%	49.6%	49.6%	49.6%
1976	35	35	50.5%	50.5%	50.5%	50.5%
1977	40	40	49.8%	49.8%	49.8%	49.8%
1978	44	44	45.4%	45.4%	47.3%	47.3%
1979	47	47	42.8%	42.8%	46.6%	46.6%
1980	49	49	41.0%	41.0%	44.9%	44.9%
1981	53	53	37.9%	37.9%	41.8%	41.8%
1982	62	62	37.8%	37.8%	42.6%	42.6%
1983	66	66	36.5%	36.5%	42.2%	42.2%
1984	74	74	34.8%	34.8%	42.2%	42.2%
1985	84	84	31.1%	31.1%	41.8%	41.8%
1986	94	94	27.8%	27.8%	38.5%	38.5%
1987	109	109	23.9%	23.9%	34.7%	34.7%
1988	122	122	24.1%	24.1%	34.8%	34.8%
1989	138	138	23.0%	23.0%	34.5%	34.5%
1990	165	165	21.5%	21.5%	33.0%	33.0%
1991	171	171	24.0%	24.0%	34.7%	34.7%
1992	222	222	22.7%	22.7%	31.8%	31.8%
1993	255	255	22.0%	22.0%	33.5%	33.5%
1994	284	284	24.2%	24.2%	36.5%	36.5%
1995	348	348	24.5%	24.5%	36.8%	36.8%
1996	387	387	26.2%	26.2%	38.5%	38.5%
1997	497	497	30.0%	30.0%	42.3%	42.3%
1998	608	608	32.3%	32.3%	44.6%	44.6%
1999	730	730	32.6%	32.6%	44.9%	44.9%
2000	802	802	34.5%	34.5%	46.8%	46.8%
2001	879	879	35.4%	35.4%	47.7%	47.7%
2002	1023	974	33.7%	35.4%	46.0%	47.7%
2003	1160	1067	33.0%	35.8%	45.2%	48.1%
2004	1288	1112	34.3%	39.8%	46.6%	52.0%
2005	1405	1253	35.3%	39.6%	47.6%	51.9%
2006	1539	1350	35.6%	40.5%	47.8%	52.8%
2007	1728	1484	35.1%	40.8%	47.3%	53.1%
2008	1917	1641	35.0%	40.9%	47.3%	53.2%
2009	2229	1905	33.9%	39.6%	46.2%	51.9%

CHAPTER 4

A MOUNTAIN OR A MOLEHILL: IS THE ILLICIT TRADE IN CIGARETTES UNDERMINING TOBACCO CONTROL POLICY IN SOUTH AFRICA?[51]

4.1 INTRODUCTION

Illicit trade is a significant problem for tobacco control and potentially for the legal market for tobacco products.[52] The aim of tobacco control is to reduce smoking prevalence and cigarette consumption; illicit trade in cigarettes undermines tobacco control by allowing consumers and producers to evade tax, sometimes entirely, at other times only partially, thus lowering cigarette prices. As previous chapters have noted, prices and affordability are very important, if not the most important, determinants of the demand for cigarettes. Illicit cigarette trade is able to undermine significantly the use of taxation as a tobacco control policy tool.[53]

Higher taxes and prices create greater incentives for traders to enter the illicit market since the higher taxes and prices increase the "rents" they can achieve by avoiding or evading taxes. However, many other commodities that are not specially taxed also suffer from a large

[51] This chapter was previously published in the journal *Trends in Organized Crime* (Blecher, 2010b) and has some minor improvements in a number of areas. I would like to thank Corné van Walbeek, Hana Ross, Luk Joosens, Jonny Steinberg, Antony Altbeker, David Merrimam, Klaus von Lampe and Georgios Antonopoulos for their comments and suggestions and Claire Milne from the South African Advertising Research Foundation for providing some of the All Media and Product Survey data.

[52] The illicit trade in cigarettes can be broken down into two main categories: legally manufactured products on which excise taxes have not been paid (i.e. duty not paid) and illegally manufactured products. Smuggling is a feature of the illicit trade, as both legal and illegal products can be smuggled. Smuggling refers to the trade in illegally imported cigarettes and is often referred to as contraband. Illicit manufacturing refers to the manufacture of tobacco products which are not in compliance with local laws. Such laws may include taxation, licensing, or regulations which restrict the manufacture of tobacco products. Illicit manufacturing includes counterfeit production where products bear a trademark without the consent of the owner of the trademark. Some authors use the terms tax avoidance and evasion instead of illicit trade.

[53] Conceptually, there are different interpretations of how illicit trade undermines tobacco control. One may consider any amount of illicit trade to undermine tobacco control. However, if illicit trade occurs as a result of tobacco control policy (i.e. tax increases) one might interpret illicit trade to undermine tobacco control efforts only if the net effect of the policy is counterproductive. This would occur if tax increases result in such a large volume of illicit trade that revenue collections decline and total consumption and smoking prevalence increase. A compromise interpretation of something in between would be quite nuanced and difficult to define. Since the goal of tax policy and tobacco control is to increase revenue and reduce consumption and prevalence I consider illicit trade to undermine tobacco control if and only if the goals in terms of revenue and consumption/prevalence are not achieved.

illicit market (e.g. music, films and, to a lesser extent, clothing and medicines). Thus, factors other than taxes also contribute to the illicit trade in commodities, including cigarettes. Other factors include the value to weight/size ratio of the commodity, border and customs enforcement, the existence of organised crime syndicates and corruption. Furthermore, tax increases do not necessarily result in price increases or price increases of the same magnitude and thus it is important to consider that it is also the tobacco industry's pricing policies that influence the "rents" achieved by avoiding or evading taxes.

Generally, the focus of illicit trade has been in high-income countries, primarily because taxes and prices are considerably higher in high-income countries, relative to low- and middle-income countries, as seen in Chapter 2. Furthermore, the problem of illicit trade has been more thoroughly documented in high-income countries, most probably owing to data availability and the existence of large databases of tobacco industry documents released through litigation, particularly in the United States and United Kingdom.[54] Additionally, higher per unit taxes in high-income countries mean that government revenue losses are significantly higher, creating a greater incentive for governments to investigate and reduce illicit trade.

Upon further inspection, the more well-known cases have unique narratives. For example, in the United States, illicit trade has been made easier by state level taxation, where each of the fifty states (and the District of Columbia) apply their own, often unique, tax regimes complicated by open state borders. Additionally, some city and country authorities apply their own taxes on top of the state taxes. Thus consumers and even commercial bootleggers have incentives to cross state borders to purchase cigarettes for their own consumption or for resale. Making matters more complicated is the availability of tax free cigarettes from Native American Reservations.[55] Research by Stehr (2005), Lovenheim (2008), and Chiou and Muehlegger (2008) all consider cigarette smuggling and tax avoidance in the United States. More recently the purchasing of cigarettes across state lines via the internet has also become prevalent (see Goolsbee *et al.*, 2010).

[54] In the United States, the primary problem is individual level tax avoidance and evasion as a result of differences in tax between state and local jurisdictions. Most of the research has focused on this problem.
[55] This problem is unique to the United States and Canada.

In Canada, cross-border smuggling from the United States was common in the early 1990s. Cigarettes were legally manufactured in Canada and then exported to the United States with no Canadian taxes applied. The cigarettes were then smuggled back into Canada by organised crime syndicates with no tax paid. The Canadian cigarette manufacturers were complicit in organising the smuggling and recently paid significant fines to the Canadian government in out of court settlements and admission of guilt fines (see Joossens and Raw, 2008). The purpose of the smuggling operations was to undermine the tax regime and force the Canadian government to reconsider their tax increases, which they did.

In Europe the experience was very different. Although cross-border shopping has existed for some time, the larger problem was of untaxed smuggled cigarettes entering Western Europe from Eastern Europe. The fall of communism and the prevalence of organised crime syndicates drove the trade. Joosens and Raw (1998) attribute cigarette smuggling in Europe to fraud, while Von Lampe (2005: 226) attributes the rise of the cigarette black market in Germany to the development of "ethnically defined supply and distribution networks". However, several European countries, namely the United Kingdom, Spain and Italy, have seen a dramatic reduction in illicit trade without lowering taxes (see Joossens and Raw, 2008). Methods used to reduce illicit trade included the use of improved technology to scan shipping containers, fiscal markings (tax stamps), tracking and tracing systems, increased punishment, more customs officers, and campaigns to increase public awareness. In all cases significant tobacco industry involvement has been alleged and legal proceedings and agreements with the industry have also played a role in reducing illicit trade.

In low- and middle-income countries the illicit trade problem is different. Taxes and prices are generally lower, in both relative and absolute terms, than in high-income countries thereby creating fewer direct financial incentives to enter the illicit market (i.e. lower profit). However, the non-tax/price incentives are greater--including more corruption, fewer customs and border controls, and lower penalties--imply lower risk. Furthermore, organised crime syndicates are more prevalent. Recent evidence suggests that the prevalence of illicit cigarettes in many low- and middle-income countries is higher than the prevalence in many high-income countries (Joossens *et al.*, 2010). Thus, the expected payoff in low- and middle-income countries (with low profit but low risk) is equal to or greater than the expected payoff in high-income countries (with high profit but high risk).

The tobacco industry's role in some forms of illicit trade is often unclear.[56] Interestingly, the incentive often exists for the tobacco industry to inflate the size of the illicit market since their recommended remedy is to lower taxes. They also argue against future tax increases on the grounds that it will encourage illicit trade. In some cases the industry has been actively involved in illicit trade in order to undermine the tax system and to help promote new brands in markets in which they are not yet present. In addition to Canada and Europe there have been other cases where the tobacco industry has been directly or indirectly involved in illicit trade including in Asia (Collin *et al.*, 2004), China (Lee and Collin, 2006), Africa (LeGresley *et al.*, 2008) and Lebanon (Nakkash and Lee, 2008).

The purpose of this chapter is to consider illicit trade in a low- and middle-income country. I use the case study of South Africa since it is a middle-income country which has undertaken an ambitious program to increase the taxes on cigarettes. Between 1993 and 2009 excise taxes have increased by 372% in real terms resulting in prices rising by 163% in real terms. In the upcoming analysis I will look at whether illicit trade has undermined tobacco control and fiscal policy. Although the results will not necessarily be generalisable to other low- and middle-income countries, they will nevertheless provide an insight into what is probably the most quoted success story of taxation policy as a tobacco control tool in a low- and middle-income country.

The market for cigarettes in South African has changed remarkably over the last 20 years. Since the early 1990s South Africa has embarked upon a deliberate tobacco control program. Legislation in 1993, which became effective by 1995, allowed the restriction of smoking in public places, introduced warning labels on packaging and advertising and banned the sale of tobacco products to minors (Republic of South Africa, 1993). Further legislation in 1999--mostly implemented in 2001--banned smoking in most public places. It also banned advertising and sponsorship and the distribution of free product (Republic of South Africa, 1999). Further regulation is currently in the legislative process and is expected to become law in 2011. Consistent and large increases in excise taxes and the retail price of cigarettes have been coupled with the legislation. Van Walbeek (2005) considers these tax and price increases to be the overwhelming reason tobacco consumption and smoking prevalence fell

[56] With the exception of counterfeit cigarettes which they are often interested in reducing.

so dramatically in the late 1990s and early 2000s (see Table 4.1). The previous chapter has described these tax increases in detail.

Table 4.1: Percentage changes in smoking indicators in South Africa, 1993 to 2009

Indicator	Change
Real price per pack	162.8%
Aggregate consumption	-30.9%
Per capita consumption	-49.3%
Smoking prevalence	-27.3%
Number of smokers	-0.7%
Average consumption per smoker	-30.3%

Source: Van Walbeek (2005), National Treasury, All Media and Product Survey and Statistics South Africa

The tobacco industry has long argued that high taxes are responsible for the growth in illicit cigarettes. The Tobacco Institute of South Africa, a body which represent the majority of tobacco growers and cigarette manufacturers, claims the size of the illicit market to be 20% of the total (legal and illicit) market (Tobacco Institute of South Africa, 2008). They had previously claimed it to be between 5.5% and 11% in 2004 and 15% in 2006 (Tobacco Institute of South Africa, 2004 and 2006). However, Sahawi, a low price producer, claimed in 2007 that the illicit market was only between 5% and 10% of the total market (*Sunday Times*, 2007). No research has been published to substantiate these claims, which are used to lobby against tax increases. Tobacco industry estimates of illicit trade rely on surveys of the proportion of cigarettes that are illicit.[57] Data on the confiscation of illicit cigarettes is also presented, although there is no evidence of correlation between confiscations and illicit trade. Increases in confiscations might imply better enforcement rather than an increase in illicit trade. It is believed that almost all illicit cigarettes in South Africa are sold in the informal sector.

In order to assess whether illicit trade has undermined tobacco control and fiscal policy I will attempt to estimate the size of the illicit market to allow a more constructive and accurate debate of tobacco taxation policy in South Africa. I will then use these estimates to consider whether illicit trade is undermining tobacco control efforts in South Africa. Tobacco control efforts would be undermined if total consumption (i.e. both legal and illegal) did not decline in response to a tax/price increase. Furthermore, tax policy would be undermined if an excise

[57] Although the results of these surveys have not been made public, personal communications with senior British American Tobacco South Africa staff have confirmed this.

tax increase resulted in a decline in tax collections. This could occur if the increase in tax resulted in a significant enough decline in legal consumption.

This chapter proposes an alternative model of estimating the scale of the illicit trade market. It calculates the total consumption of cigarettes and then adjusts these data for the known "legal" market to estimate the unknown "illicit" market. It does so by using data on smoking prevalence and smoking intensity similar to that used to measure indirect tax losses in the United Kingdom (HM Revenue and Customs, 2007).

Section 4.2 describes a model which formalises the market for cigarettes and the relationship between the various smoking indicators (prevalence, intensity and consumption). Section 4.3 describes the data sources used, as well as some other estimates of illicit trade and smoking intensity. Section 4.4 provides estimates of illicit trade and analyses the results while Section 4.5 discusses these results. Section 4.6 concludes the chapter. A postscript follows the conclusion to discuss some recent developments.

4.2 THE MODEL

In order to estimate the size of the illicit market some relationships need to be formalised. The total market for cigarettes can be defined as follows:

$$Q = Q_L + Q_I \quad [1]$$

Where Q represents quantity consumed; and the subscripts L denotes legal, and I illicit. The number of people in the population who smoke, i.e. the smoking population, (P_S) can be calculated by multiplying the population (P) by smoking prevalence (R) (proportion of the population who smoke):

$$P_S = P \text{ x } R \quad [2]$$

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

$$Q = P_S \text{ x } A \quad [3]$$

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

$$Q_I = (P_S \text{ x } A) - Q_L \quad [4]$$

Thus if one knows the quantity consumed in the legal market (Q_L), the smoking population (P_S) and the smoking intensity (A) one can calculate the size of the illicit market (Q_I). I will attempt to estimate consumption in the illicit market by using available data of the three right hand side variables. I will use the usual convention of considering only the adult population.[58]

4.3 DATA

Data on legal cigarette consumption are drawn from Van Walbeek (2005) from 1993 until 2003 and directly from the author's sources for the subsequent periods (up to 2009). Van Walbeek's method calculates consumption by taking the total excise tax revenue and dividing it by the specific excise tax. Data on smoking prevalence are sourced from the "All Media and Product Survey" conducted by the South African Advertising Research Foundation and represents adult smoking prevalence.[59] Smokers are defined as those adults who smoked the day prior to the survey. Population data are sourced from mid-year estimates put out by Statistics South Africa. The number of smokers is calculated by applying smoking prevalence to the adult population. The data are shown in Table 4.2 below.

The data exhibit some interesting trends. Legal consumption declined consistently until the early 2000s; Van Walbeek (2005) attributed this decline to higher excise taxes on cigarettes. After this initial decline, consumption stabilises at about 25 billion sticks per annum. Smoking prevalence also declines consistently until 2002, after which it stabilises at about 24%. Declining smoking prevalence, combined with a growing population, has resulted in a relatively constant smoking population throughout the period under consideration.

[58] Thus smoking prevalence and intensity will only refer to the adult population. Adult population is defined as the population 15 years and older.

[59] The definition of adult in this survey is 16 years and older until 2008 and 15 years and older since 2009. Although this definition is not precisely the same as the population measure there are alternatives which are more precise. However, the difference is not considered substantial enough to undermine the results.

Table 4.2: Summary of consumption, prevalence and population data in South Africa, 1992-2009

Years	Legal consumption Sticks (billions) Q_L	Smoking Prevalence R	Population (millions) P	Smokers (millions) P_S
1993	36.04	32.6%	24.83	8.09
1994	35.38	28.8%	25.42	7.32
1995	34.16	30.2%	26.03	7.86
1996	33.80	30.3%	26.66	8.08
1997	31.54	28.4%	27.40	7.78
1998	29.90	28.5%	28.15	8.02
1999	28.44	27.9%	28.93	8.07
2000	26.68	27.1%	29.52	8.00
2001	25.52	24.5%	30.12	7.38
2002	24.68	24.8%	30.56	7.58
2003	24.06	23.8%	30.89	7.35
2004	24.04	24.1%	31.24	7.53
2005	23.70	23.2%	31.69	7.35
2006	24.02	23.3%	32.12	7.48
2007	24.56	24.3%	32.59	7.92
2008	25.02	23.4%	33.28	7.79
2009	24.92	23.7%	33.89	8.03

Source: Van Walbeek (2005), All Media and Product Survey and Statistics South Africa

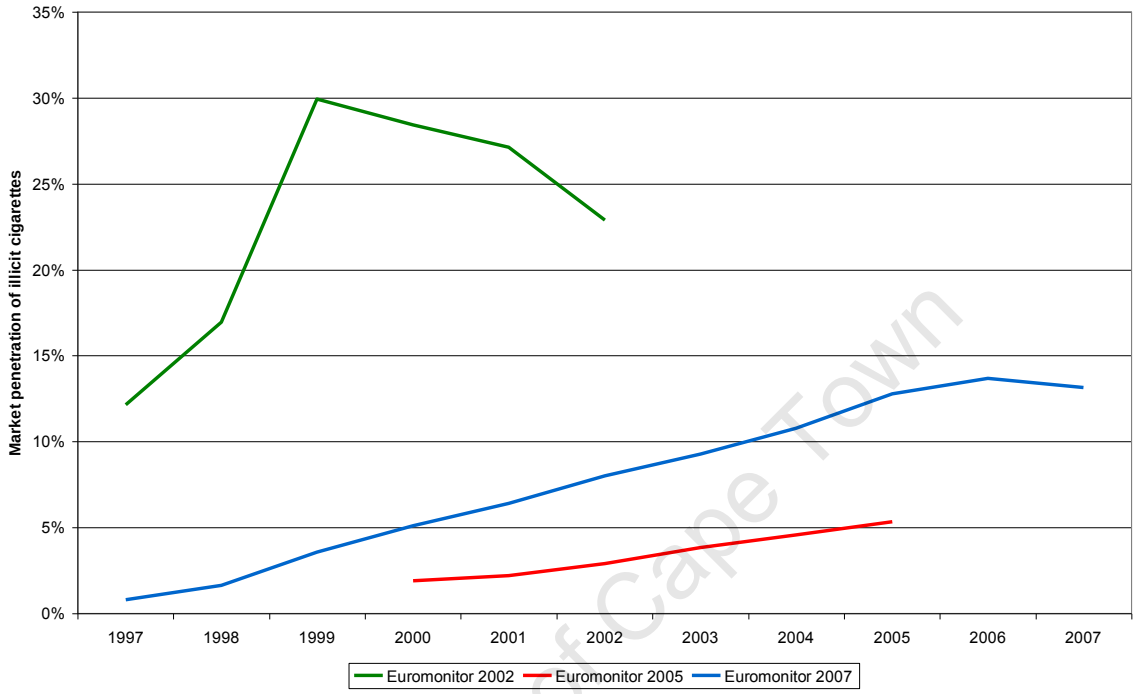
This is not the first research to consider the size of the illicit market in South Africa. Other research conducted by corporate research firms as well as by cigarette manufacturers exists.[60] Boshoff (2008) gained access to some quarterly estimates by British American Tobacco South Africa between the third quarter of 2005 and fourth quarter of 2006. Presented graphically they suggest that the illicit market may account for more than 20% of the total market.[61] Euromonitor is a private sector research firm that conducts research on various markets of consumer goods. They have conducted research on the market for cigarettes in South Africa for a number of years and have estimated the size of the illicit market. Euromonitor has declined to release the raw data and methodology used in its calculations. Its sources are listed as "official statistics, trade associations, trade press, trade interviews and Euromonitor estimates". These data are of a proprietary nature and thus not in the public domain. However, one set of estimates attributed to Euromonitor in 2002 was published in a trade publication (International Tobacco Growers Association, 2005). This provides annual estimates of the size of the illicit market, and by implication, a ratio that measures the illicit cigarette proportion, that is, the percentage of the total market which is illicit, from 1997 to

[60] The Tobacco Institute of South Africa and British American Tobacco South Africa claim that they have research on illicit trade although nothing has been published. Numerous requests for these data from them have been denied or ignored.

[61] A request was made to the author for the underlying data but the request was denied on the grounds that the data were provided by British American Tobacco South Africa, who did not want to make the data available for this study.

2001.[62] Two more recent estimates were purchased directly from Euromonitor and cover the same indicators from 2000 to 2005 and from 1997 to 2007. The three series are shown together in Figure 4.1 below.

Figure 4.1: Euromonitor estimates of illicit market in South Africa



The data in Figure 4.1 suggests that illicit trade is a significant problem in South Africa, although the three estimates differ significantly. The 2002 estimates indicate that illicit trade grew aggressively from 1997 to 1999. The penetration and absolute size of the illicit cigarette market peaked in 1999 and declined slightly thereafter. These estimates suggest that, at its peak, the illicit market may have accounted for 30% of all cigarettes consumed. The size of the total market is estimated, by Euromonitor, to have shrunk by 4.9% from 1997 to 2001. Yet, at the same time, smoking prevalence declined from 28.4% to 24.5% and the smoking population declined from 7.6 to 7.4 million. The implication is that smoking intensity remained almost unchanged between 1997 and 2001. It is possible that the construction of the total market series could have been based on this assumption. Data I will present later indicate that smoking intensity was actually declining during this period, and hence brings the reliability of these estimates into question. This would be consistent with Evans and Farrelly

[62] Euromonitor does not provide the ratio itself, but the level of illicit cigarettes and the level of the legal market; thus the ratio can be calculated. The level of the legal market it provides is similar to but not the same as the Van Walbeek estimates. The Euromonitor data are presented in tables in the appendix.

(1998), who suggest an increase in price leads to a reduction in both smoking intensity and smoking prevalence.

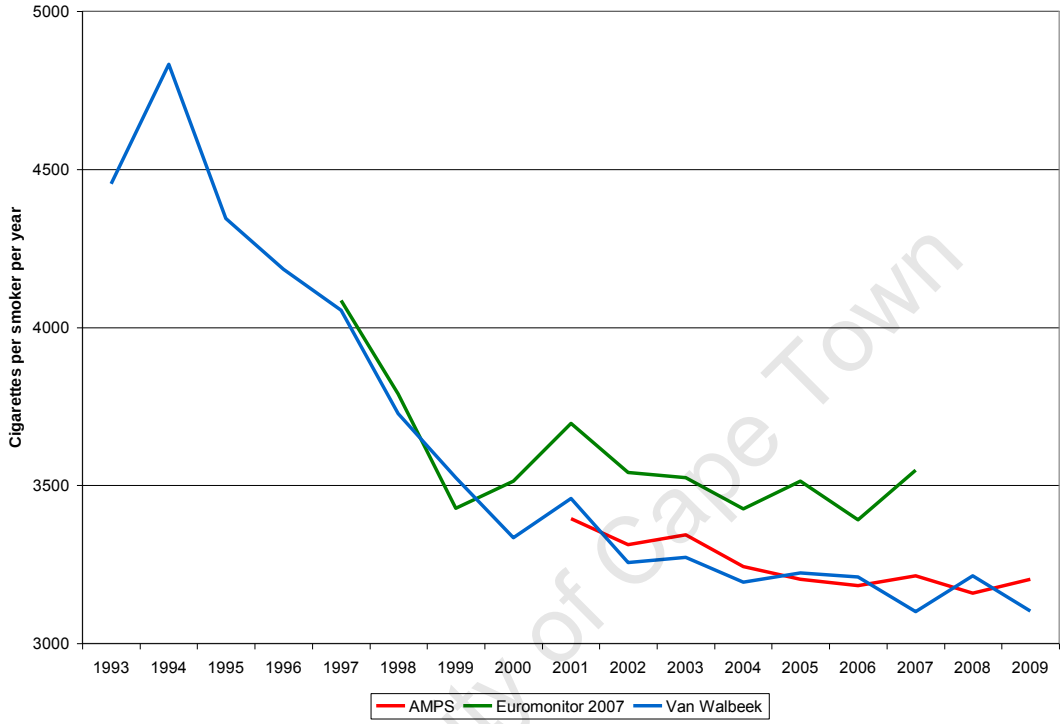
The 2005 estimates are in stark contrast to the 2002 estimates, suggesting that illicit trade occupied only 1.9% of the total market in 2000, compared to 28.4% of the 2002 estimate. However, the estimates indicate consistent growth in all years with illicit trade reaching 5.3% of the total market in 2005. The more recent 2007 estimates suggest that illicit trade was nearly non-existent in 1997 and that it has grown consistently since. The illicit market penetration peaked at 13.7% of the total market in 2006, a far cry from the 30% presented in the first estimate. The 2005 and 2007 estimates suggest that the size of the total market declined slowly between 1997 and 2007, which is consistent with our expectations from the declining smoking prevalence during this time. However, given that the size of the smoking population has remained relatively unchanged during this period (population growth has cancelled out the declining smoking prevalence), the implication is that smoking intensity declined steadily between 1997 and 2007. The credibility of all three Euromonitor estimates is questionable, due to both the lack of detail surrounding the methodology used and the variance in the estimates during overlapping years. This underscores the need for independent estimates using a transparent methodology.

Smoking intensity refers to the amount that each smoker smokes in a specific period of time (usually a day, month or year). We can calculate smoking intensity from the various data sources already discussed. From the Van Walbeek (2005) data we can calculate the smoking intensity of the legal market. The Euromonitor estimates enable us to calculate an implied smoking intensity of the total market. By construction, the Euromonitor measures are higher than those of Van Walbeek. However, if we assume that illicit trade was non-existent over the whole period, then Van Walbeek's data would also represent the total market.

The All Media and Product Survey (i.e. the source of the prevalence data in Table 4.2) also measures smoking intensity amongst smokers in South Africa. A discrete measure has been used since 1998 and a continuous measure since 2001. The continuous measure implies smoking intensity of the total market by asking smokers how many cigarettes they smoked in

the previous day.[63] The smoking intensity data for the legal market (Van Walbeek, 2005) and the total market (Euromonitor, 2007) are shown together with those of All Media Product Survey in Figure 4.2. The discrete measure asked respondents to classify their smoking behaviour as light, medium or heavy and is shown in Figure 4.3.

Figure 4.2: Continuous measures of smoking intensity in South Africa



Source: Van Walbeek (2005), Euromonitor and All Media and Product Survey

Figure 4.2 shows the distinct decline in smoking intensity of the legal and total market in South Africa since 1993 using continuous measures of smoking intensity. Van Walbeek's (2005) measure indicates that smoking intensity has declined steadily since 1993 but less aggressively since the early 2000s. The Euromonitor (2007) estimate indicates that although smoking intensity fell aggressively in the late 1990s, this decline has moderated in the 2000s.[64] The All Media Product Survey estimates suggest that smoking intensity has declined steadily since it was first reported in 2001. However, we must consider that the

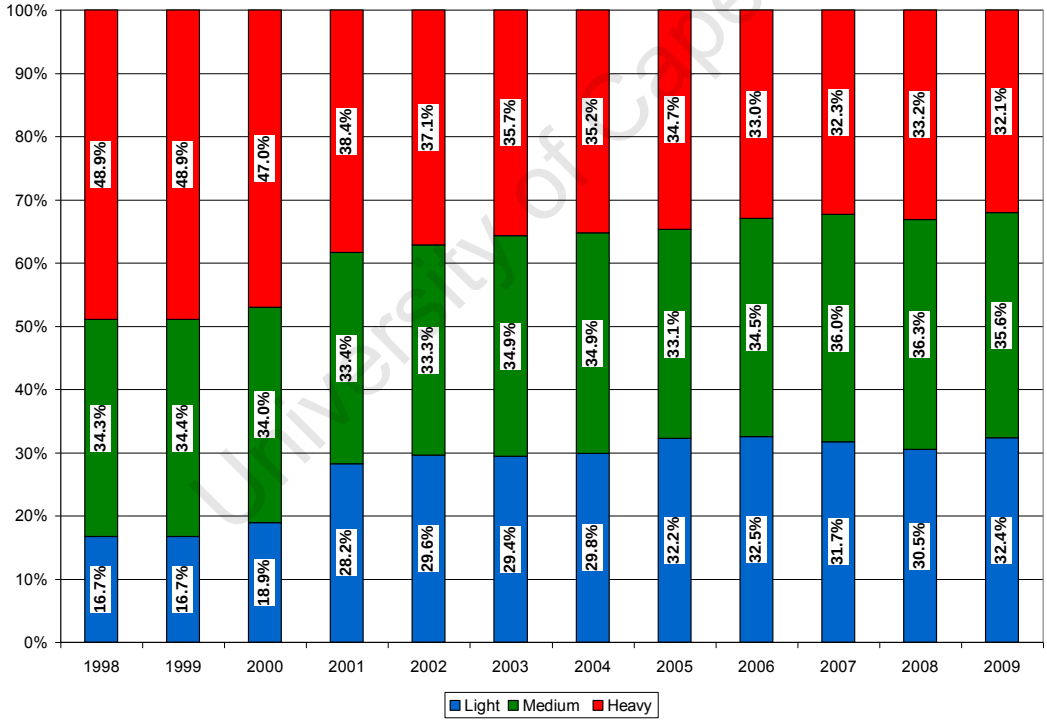
[63] This figure was then annualized to make it comparable to the other sources. It is important to recognize that this is a self-reported measure and is likely to underestimate significantly actual smoking intensity (see Warner, 1978 or Stehr, 2005). This is consistent with the underreporting of consumption of other products like alcohol (Rundle-Thiele, 2009). Under reporting of alcohol consumption may reflect social desirability reporting (Baumgartner and Steenkamp, 2005) where respondents seek to look good according to current social trends (Mick, 1996). It is impossible to know how much this measure underestimates actual smoking intensity without specific research. We will consider the implications of this later in the paper.

[64] Only the most recent Euromonitor (2007) estimate is shown here.

series only starts in 2001, by which time the most significant declines in intensity had already been seen. These three measures all tell similar stories and follow similar trends.

We are able to conclude from Figure 4.2 that smoking intensity fell aggressively during the 1990s but began to slow considerably in the early 2000s, and may have ended altogether by 2009. The Euromonitor (2007) data corroborate the Van Walbeek data in the years they overlap until 2000, where they begin to diverge; the Euromonitor (2007) data show higher rates of consumption than Van Walbeek. If the Euromonitor data are to be believed the illicit market only became a significant entity after 2000. However, the remarkable consistency between the Van Walbeek and All Media Product Survey estimates would suggest little illicit trade. On the other hand, as previously indicated the survey methodology of the All Media Product Survey estimates is subject to a downward bias.

Figure 4.3: Discrete measure of smoking intensity in South Africa



Source: All Media and Product Survey

Figure 4.3 shows similar trends to those of Figure 4.2 with a general decline in smoking intensity. This is seen by a decline in those smokers who consider themselves heavy smokers with a commensurate increase in the number of smokers who consider themselves light smokers. At the same time, the proportion that considers themselves medium smokers remained relatively the same; there is, therefore, a clear indication that there has been a trend

away from heavy smoking and towards light smoking. As a result we can anticipate that a continuous measure of smoking intensity of the same sample would show consistent declines in smoking intensity.

4.4 ESTIMATES

The estimation of the size of the illicit market in South Africa requires a multi-stage procedure. Firstly, one needs to simulate smoking intensity and then apply this to the number of smokers in the population to calculate the size of the total market.[65] Once one has an estimate of the total market, one is able to subtract the legal (and known) market from the total market to estimate the size of the illicit market. Essentially, we are solving equation 4. A and Q_L are known and P_S is being simulated.

The first assumption is that at the start of our analysis, the illicit market was non-existent. As such we set the smoking intensity of the total market equal to that of the legal market. We began the analysis in 1997, since both the tobacco industry and public health advocates acknowledge that illicit trade was insignificant at that time, and this is the start date for the Euromonitor (2007) estimate.[66] The point estimate of the legal market smoking intensity in 1997 from Van Walbeek (2005) is 4053 cigarettes per smoker per year.

The second assumption we make is on how smoking intensity changes over time. The previous section suggests that smoking intensity declined significantly since 1997. It is unlikely that intensity declines in an organised and linear fashion. Figure 4.2 suggested that smoking intensity fell aggressively at first and then fell by smaller increments. As a result it is prudent to simulate smoking intensity in such a fashion – with a function that decreases at a decreasing rate. We use a geometrically decreasing non-linear continuous function $X_{t+1} = X_t \times$

[65] Even though we have estimates of smoking intensity they refer either to the legal market (Van Walbeek, 2005) or are an implied calculation by Euromonitor. The only estimate of the total market smoking intensity, which is not implied by consumption data (like Van Walbeek, 2005) or the level of illicit trade (like Euromonitor), is from the All Media and Product Survey. However, the sample is very short and a simulated smoking intensity is used instead.

[66] The Euromonitor (2007) estimate for 1997 is 0.8%. An alternative would be to assume that the illicit market occupied 0.8% of the total market in 2007 rather than 0%, however the results would not be significantly different.

Y^z, where X represents smoking intensity, Y a decaying factor and z represents the number of years until the final year in the analysis.

This function may seem arbitrary and it is. Decaying factors are specified in order to achieve a specific outcome in the final year of the analysis. Three outcomes are assumed. We first assume smoking intensity to be that implied by the continuous All Media and Product Survey measure of 3203 cigarettes per smoker per year in 2009 (a total decline of 21.0% from 4053 in 1997). The second and third are based on this All Media and Product Survey estimate and represent a level 5% and 10% higher of 3393 and 3523 cigarettes per smoker per year in 2009 (total declines of 16.3% and 13.1% respectively), and provide slack for the likely understatement of smoking intensity.[67]

The simulated smoking intensity data are multiplied by the absolute number of smokers to get the total number of cigarettes smoked. The legal market is then subtracted from the total market and we are left with illicit market. Results for all three outcomes are shown graphically in Figure 4.4 for the available years between 2001 and 2007. Figure 4.5 compares the outcomes with the Euromonitor estimates. The percentages displayed indicate the size of the total market occupied by the illicit market.[68]

From Figure 4.4 we can make some observations about the results from our simulations. Firstly, the simulations indicate that the illicit trade market penetration grew rapidly from 1997 until peaking in 2000 at 9.1% to 12.7% of the total market. Since then, the illicit market has declined slowly, although it has remained volatile.

More important than the point estimates, however, are the underlying trends. The first Euromonitor (2002) estimate should be considered unreliable since it is not consistent with any of the other estimates. Furthermore, the shortness of the sample reduces our ability to make judgements regarding the trend. We will focus our analysis on the estimates of this chapter, although we will not discard the two subsequent Euromonitor estimates.

[67] The decaying factors used in order to achieve these outcomes are 0.996985, 0.997725 and 0.998205 respectively.
[68] The data for the steps in this process are shown in the appendix.

Figure 4.4: Simulations of the illicit market penetration in South Africa, 1997-2009

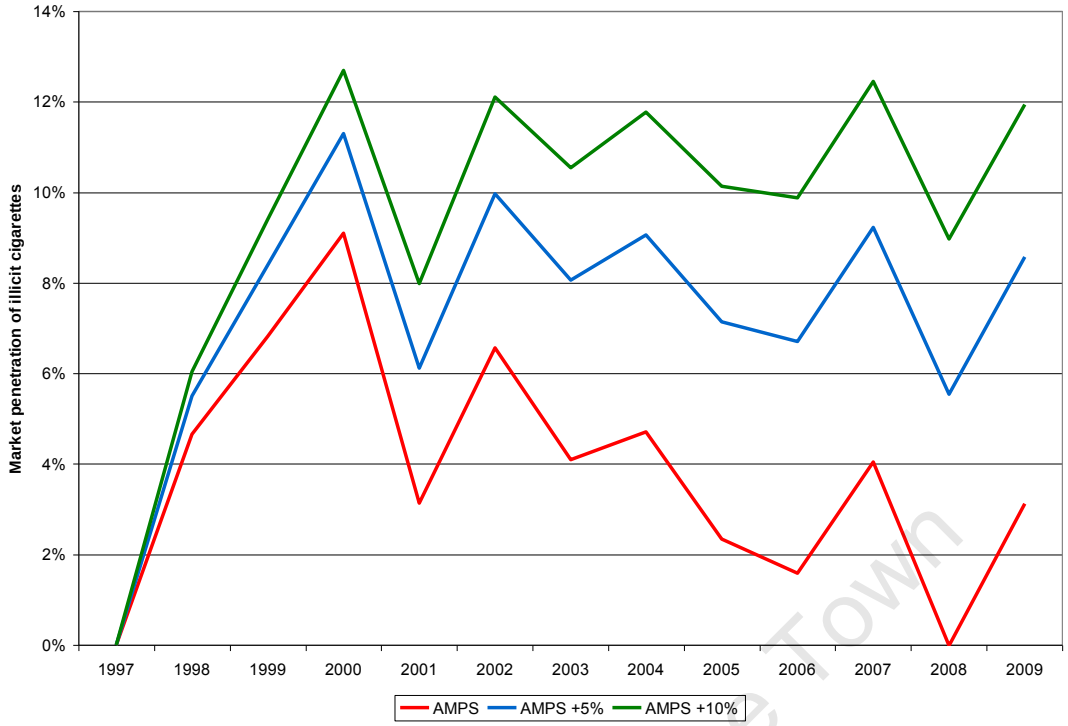
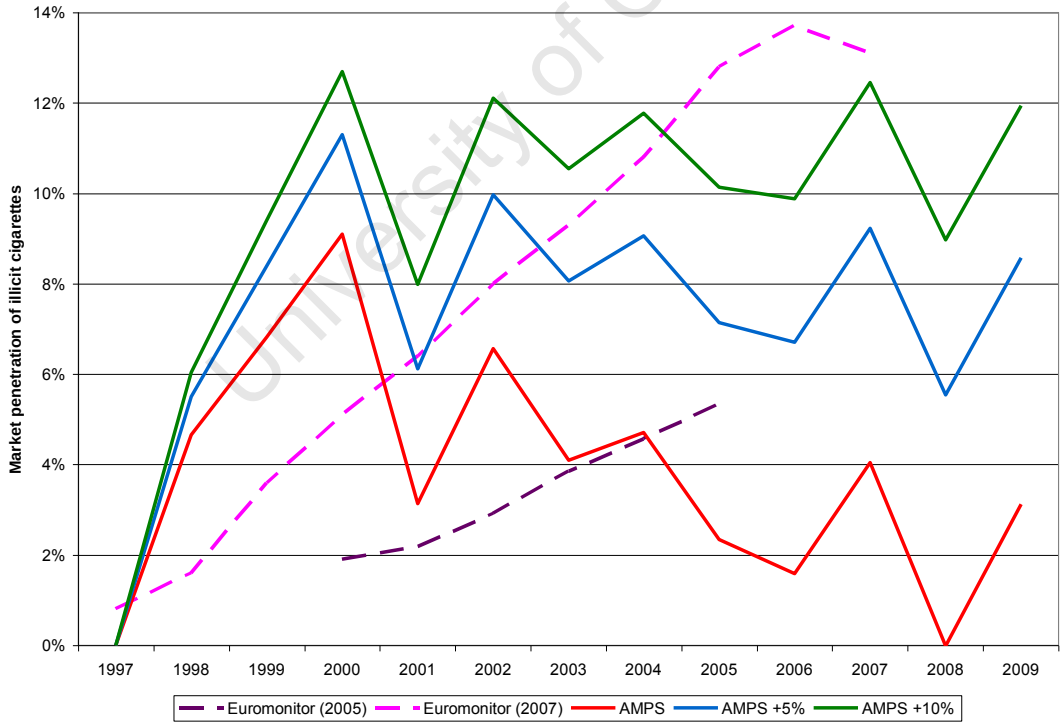


Figure 4.5: Comparison of estimates of illicit trade in South Africa, 1997-2009



4.5 DISCUSSION

This research aims to quantify the scale of illicit trade in South Africa. The research shows that, by some estimates, illicit trade is a significant problem in South Africa. The question is, how much of a problem? Estimates show that illicit trade has grown significantly, especially in the late 1990s. It shows that the illicit trade in cigarettes has most probably peaked in 2000 and that the size of the illicit market stabilised in the 2000s. I estimate that the size of the illicit market peaked at 9.1% to 12.7% of the total market in 2000. The most recent estimate suggests an illicit market penetration of 3.1% to 11.9% in 2009.

The anecdotal estimates of the size of the illicit market put forth by the Tobacco Institute of South Africa are an exaggeration. Claims of 20% of the total market are significantly higher than the estimates of this chapter and those of Euromonitor. Their previous claim of 15% market penetration in 2006 is also difficult to accept considering how, at that time, the illicit trade market penetration was most probably falling from its peak of significantly less than 15% in 2000. Other anecdotal estimates by the Tobacco Institute of South Africa in 2004 of 5.5% to 11% seem fair, and Sahawi's estimate of 5% to 10% in 2007 is corroborated by these data.

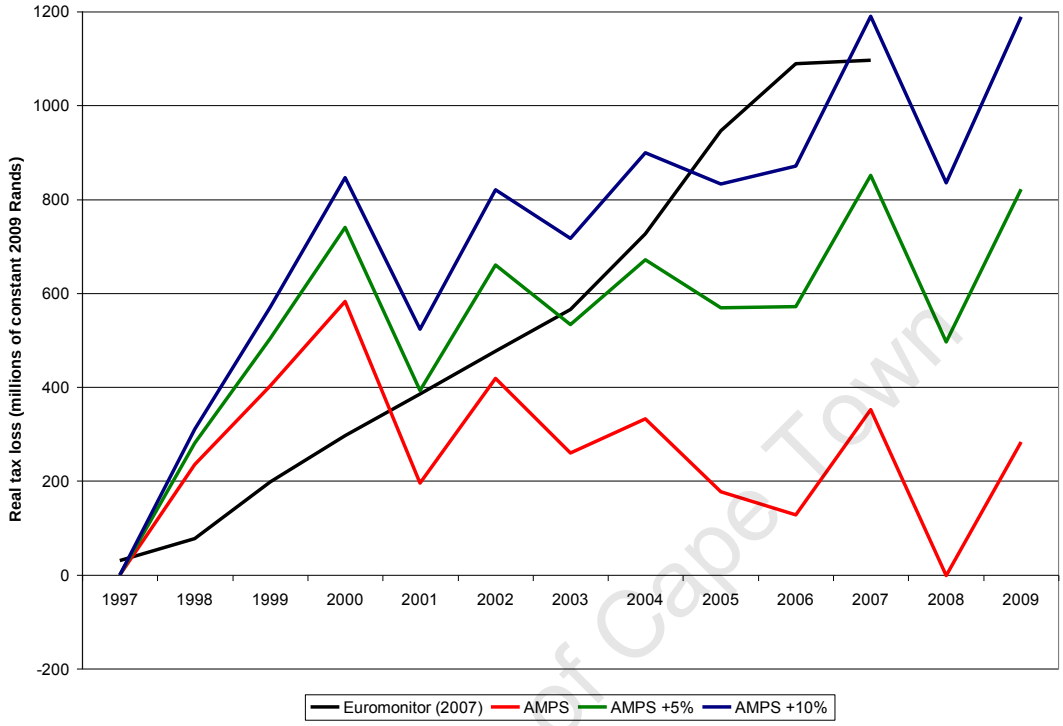
When considering whether illicit trade undermines tobacco control efforts we need to consider two specific things. Firstly, we need to consider the loss of tax revenue by the state, and secondly, the size of the total market.

There are two separate taxes that jointly comprise consumption tax in South Africa, a specific excise tax levied per packet of cigarettes, as well as Value Added Tax (often referred to as VAT), levied at a flat rate of 14% of value added.[69] Figure 4.6 below shows the estimates of real excise tax revenue (in constant 2009 prices) lost to illicit trade. Even when illicit trade decreased, the lost tax revenue remained high since the specific excise tax rose as well.[70] Yet this picture is misleading; if these cigarettes were not sold on the illicit market but on the

[69] Value Added Tax is levied on all new goods and services in South Africa with only a few exceptions and is not specific to cigarettes. Almost all substitutes in consumption to cigarettes include Value Added Tax, and as a result, we do not consider it. Even illicit cigarettes (those which have been manufactured in South Africa on which tax is not paid) include some Value Added Tax since inputs in the production process include Value Added Tax and would not reimbursed if no Value Added Tax is paid on the sale of illicit cigarettes.
[70] Essentially, the higher taxes were offsetting the declining levels of illicit trade.

legal market, the paying of the tax would raise the retail price of these cigarettes, thereby reducing their consumption.

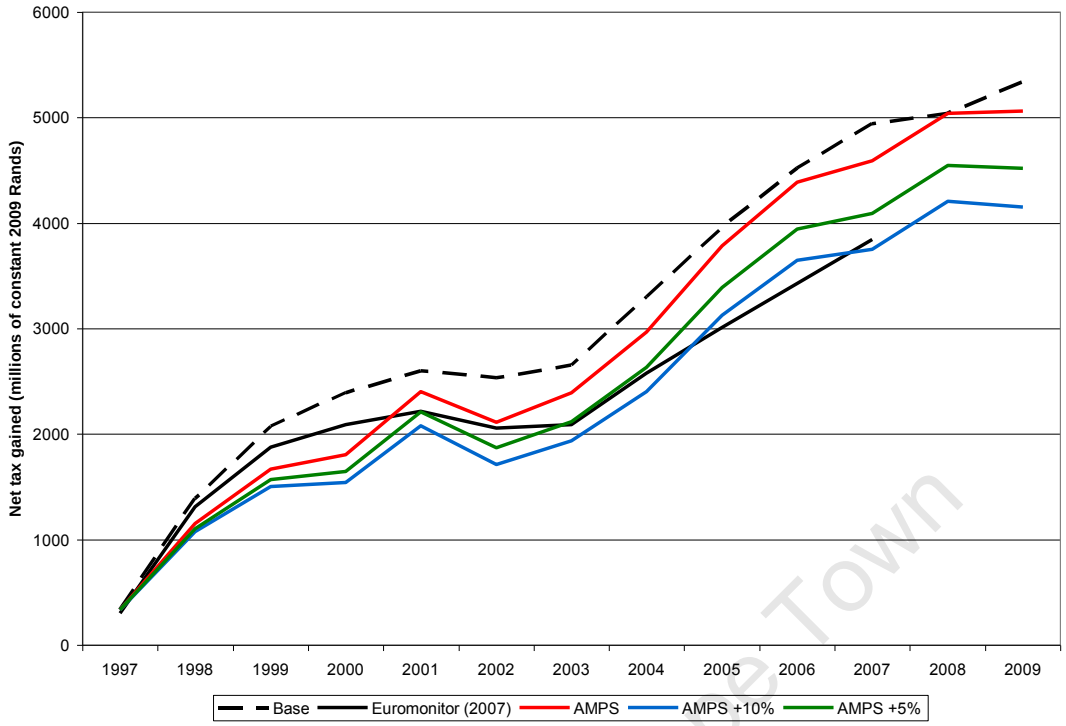
Figure 4.6: Real excise taxation lost as a result of illicit trade in South Africa, 1997-2009 (constant 2009 prices)



Furthermore, one must consider that even while lost excise taxation grew significantly as illicit trade grew, so did total excise tax collections. As Abedian and Dorrington (1994), Van Walbeek (1996) and Van Walbeek (2005) all indicate, due to the price inelastic nature of cigarettes in South Africa, the increase in the specific excise tax was greater, in percentage terms, than the decline in (legal) sales. As a result, even though legal sales were falling, excise tax collections rose significantly. Between 1997 and 2009, total excise tax collections rose by over 133% in real terms, thereby dwarfing any potential loss through illicit trade.

Figure 4.6 considers the tax lost to illicit trade while Figure 4.7 considers the net tax gain, by netting off the tax lost to illicit trade from the increase in excise tax collections that resulted from the higher specific excise. In Figure 4.7, the series labelled "base" is the increase in real excise tax collections between 1997 and 2009, without netting off illicit trade, while the other two series represent the netting off of illicit trade using the illicit trade estimates of this chapter and Euromonitor (2007) estimates. One can clearly see that the net impact of the tax increases is overwhelmingly positive.

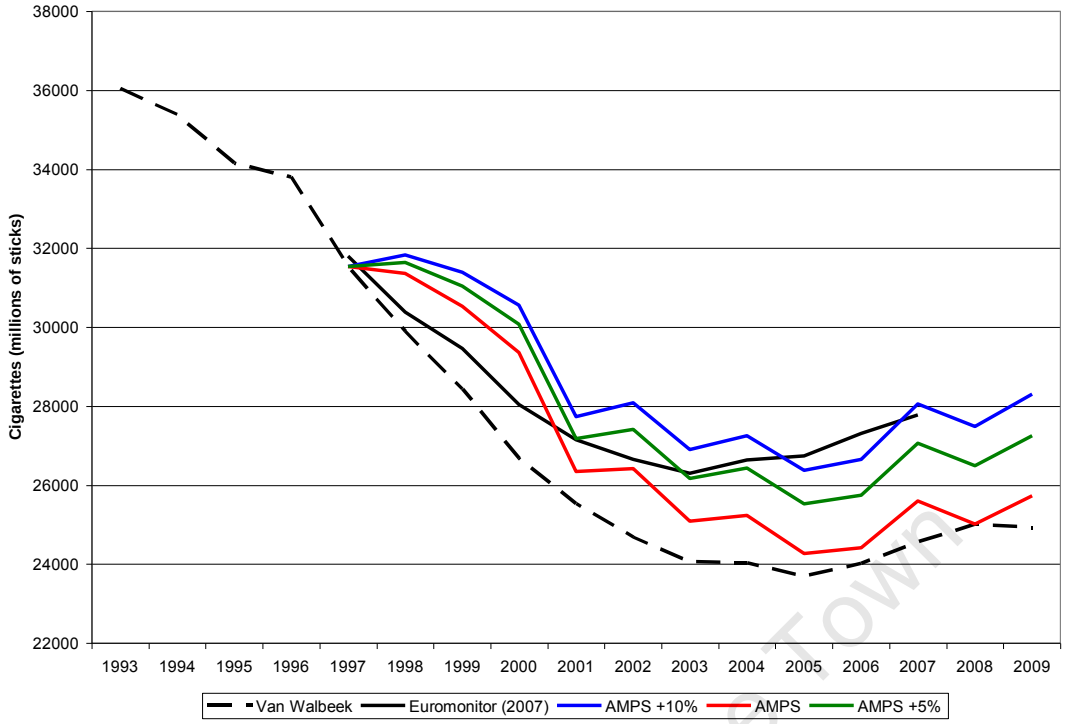
Figure 4.7: Net gain in real excise taxation collections in South Africa, 1997-2009 (constant 2009 prices)



A second consideration is the size of the total market. Previous studies have only considered the size and dynamics of the legal market, while our analysis in this chapter covers the size of the total market. Figure 4.8 combines the legal market of Van Walbeek (2005) with the illicit market estimates of this chapter, and indicates consumption in the total market. The dashed line indicates Van Walbeek's estimates of the legal market, while the solid lines indicate the total market estimates. The clearest conclusion from this is that the total market declined rapidly in the 1990s and early 2000s. Essentially, as taxes and prices have risen, total consumption has fallen. Even as illicit trade grew the total market continued to decline, albeit at a slower pace. A small number of consumers have substituted their legal consumption with illicit consumption. Predictions that higher taxes would simply drive the tobacco industry underground have not come true.[71] The total market has declined in size by 10.3% to 18.4% between 1997 and 2009, in spite of increases in illicit trade. All measures indicate a small increase in total consumption in the most recent years. This is a likely result of rapid income growth and a less aggressive tax policy, as indicated in previous chapters.

[71] The tobacco industry has used this argument to lobby against tax increases globally (see Van Walbeek, 2005).

Figure 4.8: Total consumption of cigarettes in South Africa, 1993-2009



One should also consider what drives illicit trade. The argument that higher taxes create greater incentives for criminal elements to enter into the illicit market has some strategic importance since the suggested "remedy" is to reduce taxes. Yet it must be considered that the tobacco industry has chosen to over-shift the tax and raise its profit margins in response to higher taxes (Van Walbeek, 2005) and thus should bear some, if not equal, responsibility for the rise in illicit trade. Furthermore, there is no correlation between our measure of illicit trade and real excise taxes and prices, which have been rising consistently throughout the period under consideration. All South Africa's neighbouring countries have significantly lower excise taxes, thereby creating a natural incentive to smuggle cigarettes into South Africa.[72] Yet significant quantities of illicit cigarettes confiscated by the South African Revenue Service do not come from South Africa's neighbours but from further afield. Recently, one of the largest single confiscations of illicit cigarettes was of cigarettes originating in the United Arab Emirates and Egypt (*The Times*, 2009).[73] Steinberg (2005) also notes China as a source of illicit cigarettes in South Africa.

[72] This could only account for cross border smuggling and not other forms of illicit trade.
[73] This confiscation amounts to approximately 65 million cigarettes which would amount to 3.5% of the total illicit market (using the All Media and Product Survey +5% estimate).

It is likely that there are other reasons, in addition to higher excise taxes, that have encouraged the growth in illicit trade in South Africa. Steinberg (2005: 4) argues that illegal traders in South Africa specialise in trade routes rather than commodities, and that a "trade route can host an infinite array of commodities over time, and several commodities at the same time". For instance, routes between South Africa and China include illicit trade in abalone, clothes, electronics, drugs, guns, human beings and diamonds, in addition to cigarettes. The illicit trade in a number of commodities has been able to grow in South Africa as a result of large and highly effective criminal networks. This has been compounded by weak border controls and corruption (Prinsloo and Naudé, 2009). The rise in the illicit trade in cigarettes mirrors increases in the illicit trade of many other commodities since the 1990s.

Yet the illicit trade in cigarettes has declined substantially since peaking in 2000. One may speculate that this may be a function of the spectacular decline in tobacco production in Zimbabwe where production levels have fallen by over 70% since 2000 (Kwidini, 2008). Until the early 2000s, Zimbabwe was one of the world's largest growers of tobacco and a significant producer of cigarettes.[74]

We should, however, consider the limitations of this research in light of the experimental methodology and the data used. Data on legal consumption and excise taxes in South Africa, sourced from Van Walbeek (2005), are from official sources and represent actual data. However, the data on smoking prevalence sourced from All Media and Product Survey represent just that: a survey. The survey suffers from some problems, exposed by the volatility in the series, which may arise from sampling issues. However, the limitations of the survey are compensated for by the use of a consistent series throughout the analysis. Furthermore, the lack of a long times series of smoking intensity data has necessitated a reliance on simulating smoking intensity based on evidence of declining smoking intensity during the period of analysis. One must also keep in mind the potential understatement of smoking intensity in the All Media and Product Survey data. We have provided for this in the model by assuming a higher smoking intensity than that suggested by the All Media and Product Survey data. Even though it is expected that the All Media Product Survey smoking

[74] It has been anecdotally stated that Zimbabwe might have been the source of many cigarettes smuggled into South Africa given the large price differentials between the two neighbors. In 2006 the most affordable cigarettes in Zimbabwe cost $1.44 per pack of 20 while they cost $2.56 in South Africa (Blecher and Van Walbeek, 2009). Although the large majority of tobacco is exported, more than half of the cigarettes produced between 1996 and 2000 were exported, indicating a surplus in manufactured cigarettes (ERC, 2001). Furthermore, the ample supply of leaf would make counterfeit manufacturing possible.

intensity is understated the remarkable likeness between the All Media Product Survey and Van Walbeek's implied smoking intensity measures could suggest very little, if any, understatement. This, together with the volatility of the Euronomintor estimates creates serious doubt about whether illicit trade occupies a significant portion of the market. As such, the estimates of this chapter should be considered to be at the upper end of estimates. Furthermore, more accurate data on smoking intensity would improve the accuracy of estimates of the size of the illicit market.

Much research has been conducted on the illicit trade in cigarettes in North America and Europe, but South Africa is a unique case. Data limitations and the different nature of the illicit trade problem--that is, cross-border smuggling and contraband in South Africa versus cross-border smuggling from neighbouring states and domestic tax avoidance in North America and Europe--require innovative methods. This chapter is a first step to overcome the unique challenges regarding illicit trade research in South Africa.

4.6 CONCLUSION

It is clear that increased taxes and retail prices have resulted in very large declines in total cigarette consumption in South Africa, which are even more pronounced when considered in per capita terms. Thus, the strategy of increasing excise taxes to reduce cigarette consumption and increase government revenue has worked with dramatic effect, even in the face of the growth in illicit trade. Even though South Africa may have experienced a significant increase in illicit trade, it has not undermined tobacco control efforts, since total consumption has fallen and the net impact on tax revenue was positive.

This research supports the strategy of increased cigarette taxation in South Africa. Although it identifies a significant illicit trade problem, it also finds that this problem has most likely peaked and has probably declined substantially since. At its current levels, illicit trade probably accounts for no more than 12% of the total market. It is likely that if the government pursues a more aggressive taxation strategy in the future, total consumption--not just legal consumption--will fall, and government revenue will rise, even if there is some growth in illicit trade.

4.7 POSTSCRIPT

On the occasion of his appointment as Chief Executive Officer of British American Tobacco South Africa, Brian Finch gave an interview with the *Sunday Times* newspaper (Barron, 2010). The *Sunday Times* is the largest and one of the most influential weekend newspapers in South Africa. Finch indicated that illicit cigarettes are British American Tobacco South Africa's "biggest challenge". The most recently available data indicates that British American Tobacco South Africa held 90% of the legal cigarette market in South Africa (ERC, 2007) – thereby operating with considerable market power which would, no doubt, result in significant pricing power.

Finch stated that "company research suggests that one out of every five cigarettes smoked in South Africa is illicit"; this implies a total market penetration of 20%, significantly higher than the 2009 estimates of this chapter as well as those of Euromonitor (although the final Euromonitor estimate is from 2007). However, this is in line with the most recent claims of the Tobacco Institute of South Africa. The Tobacco Institute of South Africa is a trade group with very close links to British American Tobacco South Africa; some tobacco control advocates would simply consider the institute to be a mouthpiece for British American Tobacco South Africa. However, Finch takes this claim one step further by indicating that the illicit market had doubled in the last year.

There are several inconsistencies which raise more questions than answers and bring serious doubt about the credibility of British American Tobacco South Africa on the issue of illicit trade. Firstly, if the market for illicit cigarettes has doubled in the last year, then the prior Euromonitor and Tobacco Institute of South Africa estimates of the size of the illicit market are greatly troubling. Since both the Tobacco Institute of South Africa and British American Tobacco South Africa have previously relied on these estimates in both the media and Parliamentary hearings, one would believe that they felt confident in them; however, Finch's statement casts doubt on the credibility of the previous estimates. Since the generic recommendation from the tobacco industry to reduce illicit trade is to lower taxes, there is a clear incentive for the industry to argue constantly that *recent* tax increases have given rise to *recent* increases in illicit trade. There is no clear evidence that the levels of illicit trade have changed significantly in the last year or two, or even since the early 2000s.

Finch clearly identifies taxation and price as the drivers of illicit trade: "We can't compete on price. If 52% of your price is tax that's a hell of an incentive to offer any trader to sell your stuff…the opportunity to anyone wanting to indulge in illicit gains (sic) is huge".[75] Yet, as the previous chapter described, the use of the 52% benchmark has essentially turned the specific tax into an *ad valorem* tax. As a result, it is the tobacco industry itself which sets the tax via its pricing decisions. In 2009, cigarette prices rose by 15.2% in nominal terms and 7.6% in real terms, requiring an increase in the specific excise tax to maintain the benchmark. However, in 2009, the excise tax increased by only 11.3% in nominal terms and 3.9% in real terms resulting in the total tax burden falling to 49.7%. This is well below the target, and was most likely a result of National Treasury underestimating the tobacco industry's price increases, as well as a secondary price increase later in the year. What is clear is that the increase in tax was more modest than the increase in price. In fact the excise tax increase in 2009 was one of the smallest increases, in real terms, since excise taxes began to increase in 1993. Essentially, Finch claims that illicit trade has doubled as a result of tax increases in a year which saw the smallest tax increases in recent memory.

Furthermore, Finch claims that government's response to declining tax revenues from legal producers has been to increase tax on cigarettes. This statement is false for two reasons. As this chapter has indicated, tax revenues are rising and not falling, even in the existence of significant illicit volumes. Secondly, it is not the government which has been increasing the excise tax, but rather the tobacco industry, through their pricing strategy. The benchmark was met several years ago, and any increase in the excise tax, in real terms, is simply a reaction to the pricing decisions of the tobacco industry. It is a very weak argument to blame taxes for the supposed and unproven increase in illicit trade if you yourself are the driver of the taxes.

However, it is possible to reconsider this question in a different light by asking: how much illicit trade would be required to undermine tobacco control and taxation policy? In other words, how much illicit trade would need to exist in the market for taxation revenues to actually fall, as Finch suggested? Calculations suggest that the number of illicit cigarettes in the market would need to be 4 or 5 times larger—an illicit market penetration of nearly 40%

[75] 52% refers to the policy that 52% of the retail price should be occupied by excise taxes and Value Added Tax. As the previous chapter notes this is a target, which is met in a backward looking manner resulting in actual tax burden falling below the 52% target.

of the total market—in order for tax revenues to start declining.[76] Thus, even under the tobacco industry's "worst case scenario" tobacco control and tax policy efforts would not be undermined. The illicit cigarette market would need to be significantly larger than even the "worst case scenario" for this to occur.

[76] This is not to suggest that such a level of illicit trade would be acceptable but rather to indicate that the current levels of illicit trade are significantly lower than the position which would clearly undermine the policy objectives.

APPENDIX D: ADDITIONAL DATA

Table D1: Euromonitor estimates of illicit market (2002)

	1997	1998	1999	2000	2001
Legal sales*	32.6	30.4	25.3	25.7	25.7
Contraband*	4.5	6.2	10.8	10.2	9.6
Total*	37.1	36.6	35.5	35.9	35.3
Penetration	12.1%	16.9%	29.9%	28.4%	27.1%

Notes: * billions of sticks

Table D2: Euromonitor estimates of illicit market (2005)

	2000	2001	2002	2003	2004	2005
Legal sales*	26.7	25.5	24.7	23.5	23.0	22.5
Contraband*	0.5	0.6	0.7	0.9	1.1	1.3
Total*	27.2	26.1	25.4	24.4	24.1	23.8
Penetration	1.9%	2.2%	2.9%	3.8%	4.6%	5.3%

Notes: * billions of sticks

Table D3: Euromonitor estimates of illicit market (2007)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Legal sales*	31.5	29.9	26.7	26.7	25.5	24.7	23.5	23.0	22.5	21.9	24.4
Contraband*	0.3	0.5	1.0	1.4	1.8	2.2	2.4	2.8	3.3	3.5	3.7
Total*	31.8	30.4	27.7	28.1	27.3	26.8	25.9	25.8	25.8	25.4	28.1
Penetration	0.8%	1.6%	3.6%	5.1%	6.4%	8.0%	9.3%	10.8%	12.8%	13.7%	13.1%

Notes: * billions of sticks

Figure D1: Simulated smoking intensity 1997-2009

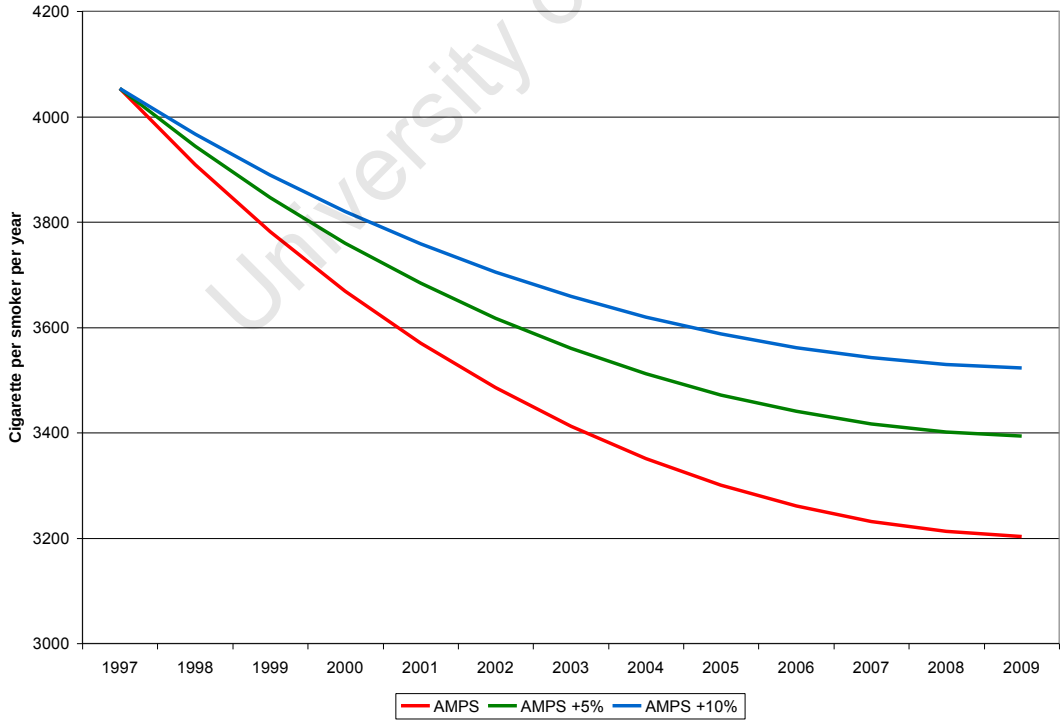


Table D4: Summary of simulations

Years	Simulated smoking intensity			Number of smokers	Total market			Legal market	Absolute level of illicit trade			Illicit market penetration		
	Cigarette per smoker per year				Millions of cigarettes			Millions of cigarettes	Millions of cigarettes			Percentage of total market		
	AMPS	AMPS +5%	AMPS +10%		AMPS	AMPS +5%	AMPS +10%		AMPS	AMPS +5%	AMPS +10%	AMPS	AMPS +5%	AMPS +10%
1997	4053	4053	4053	7781600	31540	31540	31540	31540	0	0	0	0.0%	0.0%	0.0%
1998	3909	3944	3967	8022750	31360	31641	31824	29900	1460	1741	1924	4.7%	5.5%	6.0%
1999	3781	3846	3889	8071470	30520	31045	31391	28440	2080	2605	2951	6.8%	8.4%	9.4%
2000	3669	3760	3820	7999920	29350	30077	30558	26680	2670	3397	3878	9.1%	11.3%	12.7%
2001	3570	3683	3759	7379400	26347	27181	27736	25520	827	1661	2216	3.1%	6.1%	8.0%
2002	3485	3617	3705	7578880	26414	27412	28079	24680	1734	2732	3399	6.6%	10.0%	12.1%
2003	3412	3560	3659	7351820	25086	26170	26898	24060	1026	2110	2838	4.1%	8.1%	10.5%
2004	3351	3511	3619	7528840	25229	26437	27250	24040	1189	2397	3210	4.7%	9.1%	11.8%
2005	3301	3472	3587	7352080	24268	25524	26372	23700	568	1824	2672	2.3%	7.1%	10.1%
2006	3261	3440	3561	7483960	24406	25746	26653	24020	386	1726	2633	1.6%	6.7%	9.9%
2007	3232	3417	3542	7919370	25594	27058	28052	24560	1034	2498	3492	4.0%	9.2%	12.4%
2008	3212	3401	3529	7787520	25016	26487	27486	25020	-4	1467	2466	0.0%	5.5%	9.0%
2009	3203	3393	3523	8031930	25723	27256	28298	24920	803	2336	3378	3.1%	8.6%	11.9%

Note: The simulated smoking intensity is applied to the number of smokers which results in the total market. The legal (known) market is subtracted from the total market which yields the absolute level of illicit trade. The absolute level of illicit trade is divided by the total market to calculate the illicit market penetration.

CHAPTER 5

THE IMPACT OF TOBACCO ADVERTISING BANS ON CONSUMPTION IN LOW- AND MIDDLE-INCOME COUNTRIES[77]

5.1 INTRODUCTION

The question of whether or not advertising of tobacco products affects the consumption of tobacco products is controversial.[78] Tobacco control advocates and practitioners argue that tobacco advertising has a positive impact on aggregate consumption, and that restricting or even banning tobacco advertising altogether can reduce aggregate consumption. The tobacco industry argues that advertising has no positive impact on aggregate consumption but rather that it influences the relative market shares of individual brands, and is therefore not a public health issue. Economists have added empirical value to this debate by regressing cigarette consumption on advertising, controlling for other determinants of demand (i.e. price and income). Many studies have found that advertising has had a positive impact on aggregate consumption while, at the same time, many studies have shown no significant impact. Table 5.1 details all studies published in peer reviewed journals that investigate the relationship between tobacco consumption and advertising expenditure.

Saffer (2000) argues that the high level of aggregation of advertising expenditure data used in time series studies leaves little variation to correlate with consumption data. Since the marginal impact of advertising is very low—possibly even zero—it is possible that we would not find any relationship between advertising expenditure and consumption. Although this would not be true at all levels of expenditure, the marginal impact is likely to be low since cigarettes are one of the most heavily advertised products (where permitted). To support this,

[77] This chapter is an updated and extended version of work previously published as a working paper by *Economic Research South Africa* (Blecher, 2008a) and in the *Journal of Health Economics* (Blecher, 2008b). I would like to thank Corné van Walbeek, Paul Dunne, Sam Perlo-Freeman, Reza Daniels, Prabhat Jha, Frank Chaloupka and referees for *Economic Research South Africa* and the *Journal of Health Economics* for useful comments and suggestions and Angela McClean and Omar Shafey for providing data for this and prior versions. I would like to acknowledge the financial support of *Economic Research Southern Africa*. I would like to thank the American Cancer Society for allowing me to use proprietary datasets to which they subscribe.

[78] The term advertising refers to advertising, promotion and sponsorship but not marketing.

Saffer (2000) quotes *Advertising Age* which reports that Philip Morris was the ninth largest advertiser in the world in 1996. Furthermore, since the marginal impact of advertising is likely to be high at low levels of advertising and fall progressively as advertising increases, it is likely to have a non-linear impact on consumption. Few if any of the studies that investigate the relationship between tobacco consumption and advertising expenditure take this potential non-linear relationship into account.

Chapman (1989) also criticised the use of aggregate data, and in particular noted the inability of studies to examine all methods of promotion (including non-advertising) used by the tobacco industry. Econometric analysis only examines the effects of advertising on aggregate data, while advertising also has an influence on smoking related cognition and beliefs. In most cases they are unable to examine effects on specific population groups, like youth, women or the poor. He argued that it would be more relevant to analyse the industry's use of marketing, deploying qualitative and quantitative techniques.

In more recent times economists have begun to focus less on advertising expenditure and more on the impact of various advertising restrictions and bans on aggregate consumption. In the simplest context, Smee (1992) and Perkurinen (1989) compared what happened before and after an advertising ban was imposed in Norway and Finland, respectively, and found that the ban had a negative impact on per capita consumption. Subsequently, a significant body of literature has developed using cross-sectional time series data to test the impact of advertising restrictions and bans, mostly in high-income countries

This chapter considers the impact that advertising bans have on tobacco consumption, paying particular attention to low- and middle-income countries. In order to do this I will model the demand for tobacco consumption at the aggregate country level in seventy-six countries. Section 5.2 considers the prior literature while section 5.3 focuses on the methodology and data. This is followed by an analysis of the data in section 5.4 and the estimation of the cross-country demand models in section 5.5. Section 5.6 discusses the results and concludes the chapter.

This chapter aims to improve the prior literature in several ways. Firstly, it includes a significant number of low- and middle-income countries in the sample, whereas the previous

literature included only high-income countries. Secondly, it makes some methodological improvements with respect to the manner in which advertising bans are modelled.

Table 5.1: Studies investigating the impact of advertising expenditure on tobacco consumption

Study	Country	Time Period
No significant effect of advertising		
Grabowski (1976)	United States	1956-1972
Schneider *et al.* (1981)	United States	1930-1978
Yuclet and Kaynak (1984)	United States	1955-1979
Baltagi and Levin (1986)	United States	1963-1980
Johnson (1986)	Australia	1961-1986
Godfrey (1986)	United Kingdom	1956-1984
Hoffman (1987)	West Germany	1969-1979
McAuliffe (1988)	United States	1957-1985
Baltagi and Levin (1992)	United States	1963-1988
Wilcox and Vacker (1992)	United States	1991-1990
Duffy (1991)	United Kingdom	1971-1987
Franke (1994)	United States	1961-1990
Wilcox *et al.* (1994)	South Korea	1988-1992
Reekie (1994)	South Africa	1970-1989
Duffy (1995)	United Kingdom	1963-1988
Goel and Morey (1995)	United States	1959-1982
Duffy (1996)	United Kingdom	1963-1992
Gallet (1999)	United States	1958-1991
Duffy (2003)	United Kingdom	1963-1996
Duffy (2006)	United Kingdom	1964-2002
Significant positive effect of advertising		
Fujii (1980)	United States	1929-1973
Witt and Pass (1981)	United Kingdom	1955-1975
Young (1983)	United States	1929-1973
Bishop and Yoo (1985)	United States	1954-1980
Radfar (1985)	United Kingdom	1965-1980
Leefland and Reuijl (1985)	West Germany	1960-1975
Abernethy and Teel (1986)	United States	1949-1981
Porter (1986)	United States	1947-1982
Chetwynd *et al.* (1988)	New Zealand	1973-1985
Kao and Tremblay (1988)	United States	1953-1980
Harrison *et al.* (1989)	New Zealand	1973-1985
Seldon and Doroodian (1989)	United States	1952-1984
Tegene (1991)	United States	1953-1985
Smee (1992)	United Kingdom	1960-1987
Valdes (1993)	Spain	1964-1988
Tremblay and Tremblay (1995)	United States	1955-1990
Bardsley and Olekalns (1999)	Australia	1963-1996
Keeler *et al*. (2004)	United States	1990-2000
Peng and Ross (2009)	Ukraine	1997-2006

Source: Smee (1992), Saffer and Chaloupka (2000), Nelson (2006) and Blecher and Hastings (2011)
Note: Many of the studies included would include marketing expenditures in addition to advertising expenditures.

5.2 LITERATURE REVIEW

Since a number of countries now impose significant restrictions and even bans on tobacco advertising it is possible to estimate the impact that these policies have had on tobacco consumption using aggregate data. The first study to do this was Laugesen and Meads (1991) using data from twenty-two Organisation for Economic Co-operation and Development (OECD) countries for the period 1960 to 1986 to examine the impact of increasing advertising restrictions on per capita consumption. They construct a demand model in which they specify per capita consumption as a function of price, income, a number of demographic factors and an advertising restrictions score. The advertising restrictions score was bound by 0 and 10, 0 implying no restrictions whatsoever and 10 implying a total ban on all advertising and sponsorship, along with strong and varied warnings on cigarette packaging.[79] Laugesen and Meads found that increasing advertising restrictions had, since 1973, been associated with declining tobacco consumption.

At this time advertising bans were still a relatively new phenomenon and the tobacco industry fought aggressively against them. In order to do so, the tobacco industry attempted to show that restrictions and bans did not result in their intended outcome of reducing tobacco consumption and as a result should not be implemented or should even be repealed where they already existed. At the time the tobacco industry did all it could to discredit research which showed that advertising bans reduced consumption; they commissioned their own studies, where necessary, to show that advertising bans had no impact on consumption. This was a full frontal war; Laugesen and Meads (1991), as well as subsequent studies (like Stewart, 1993b) were on the front line.

Laugesen and Meads' (1991) paper was written as an improvement on the report of the New Zealand Toxic Substances Board (1989) which was used as evidence in various Canadian court cases (High, 1999). Even though it was an improvement, High (1999: 27) indicates that it still "suffers from basic flaws in methodology and data that renders it unintelligible and of no probative value" while Stewart's (1992) critique was described by High (1999: 37) as

[79] A point was awarded each for bans on (1) television, (2) radio, (3) cinema, (4) outdoor posters, (5) point of sale (shops), (6) press, (7) magazines and (8) sponsorship while restrictions earned half a point. A further point was scored if package warnings were the same on all packets and a second if the warnings were varied.

"devastating". Stewart's concerns included the quality of the data[80], the use of the estimation techniques and the failure to control for country specific influences, such as different tastes, culture and attitudes. Furthermore, High (1999) raises a major concern with the use of the advertising restriction score since it implies that a ban in one particular media has the same impact as a ban in another media, and a restriction half that of a ban. The method implies that a score of two has double the impact of a score of one, and a score of three triples the impact.

Stewart[81] (1993b) attempts to correct the flaws of the Report of the New Zealand Toxic Substance Board (1989) and Laugesen and Meads (1991), using annual data from 22 OECD countries for 27 years from 1964 to 1990. High (1999: 37) indicates that "Stewart has produced among the best studies of advertising and consumption" in the tobacco control literature. However, the criticism of Laugesen and Meads' (1991) pooling technique remains valid for Stewart (1993), since he does not control for differences across countries, either.

Interestingly, Stewart (1993b) concludes that advertising bans had a positive impact on per capita tobacco consumption. Duffy (1996: 15 in High, 1999) explained the result as an artefact of the reduction in health warnings associated with reduced cigarette advertising. This could only be based on the assumption that people are therefore less aware of the health implications of smoking as a result of less advertising. This theory is flawed since health warnings have become more prevalent on packaging and at points of sale since advertising bans have been imposed.

High (1999: 28) argues that Laugesen and Meads (1991) take an incorrect approach to estimate the effect of advertising bans on tobacco consumption by using the advertising restriction score. This same criticism stands for Stewart (1993b) in that he uses a single dummy variable to indicate a ban, making no allowance for a partial ban in one media and a complete ban in another. Saffer and Chaloupka (2000) correct this problem by categorising advertising regulations as weak, limited or comprehensive. They consider a total of seven

[80] However, Laugesen and Meads (1993) indicate that Stewart's critique did not analyse the dataset used in the Laugesen and Meads (1991) paper, but rather an earlier version.

[81] It is important to note that Stewart is/was a private consultant who worked for the Confederation of European Community Cigarette Manufacturers (Abbey Management Service, 1996). It is not known whether Stewart's part in this debate was funded by the Confederation of European Community Cigarette Manufacturers, but the result of his study would be consistent with other tobacco industry funded research. Scollo *et al.* (2003) show that studies funded by the tobacco industry that attempted to estimate the impact of clean air legislation on hospitality industries consistently found that regulation had negative effects, while studies that did not receive tobacco industry funding found otherwise.

media: television, radio, outdoor, print, cinema, point-of-sale and sponsorship. They classify the regulation in a country and year as weak if bans existed in 0, 1 or 2 media, limited if bans existed in 3 or 4 media, or comprehensive if bans existed in 5, 6 or 7 media. They indicate the importance of investigating how bans in a number of media work together in influencing consumption since a greater number of countries have implemented more comprehensive bans and restrictions on tobacco advertising since the 1980s. Saffer and Chaloupka (2000) conclude that limited advertising bans have little or no effect on tobacco consumption while comprehensive bans reduce tobacco consumption.

In Saffer and Chaloupka's (2000) paper, regressions are estimated using per capita consumption as the dependent variable, including price, income, the unemployment rate and the percentage of filtered cigarettes as controls over the period 1970 to 1992. These variables are in addition to dummy variables for limited and comprehensive bans. The regressions are conducted using a two-way fixed effects model with fixed effects for countries and time periods. The coefficients of the limited and comprehensive ban dummies were generally found to be insignificant. Saffer and Chaloupka (2000) indicate that the inconsistent results may reflect a lack of variation in the ban variables in the years prior to 1983. They altered the specification of their model to include only years from 1984 onwards and found that the coefficients of both the limited and comprehensive ban dummies were negative. The limited ban coefficients remain insignificant, while the comprehensive ban coefficients are statistically significant. Furthermore, the magnitudes of the comprehensive ban coefficients were consistently greater than the coefficients of the limited bans. They conclude that comprehensive advertising bans resulted in a 7.4% decline in cigarette use in OECD countries.

Saffer and Chaloupka (2000) draw some important conclusions, indicating that limited bans are not effective in reducing tobacco consumption since they ultimately will result in a substitution of advertising from the banned media to those that are still allowed. They conclude that only comprehensive bans are effective in reducing consumption. This study also includes significant methodological improvements, particularly the treatment of the advertising bans as weak, limited or comprehensive bans, along with the use of fixed effects to control for differences between countries and time periods.

Nelson (2003) points out two specific problems in the prior literature (Laugesen and Meads, 1991; Stewart, 1993b; Saffer and Chaloupka, 2000).[82] He indicates that the early cross-country studies ignored the possibility that advertising bans are endogenously determined together with consumption. He also indicates the possibility of a structural break in the data noting that Saffer and Chaloupka (2000) find that comprehensive bans only become a significant determinant of tobacco consumption post-1984.

Nelson (2003) limits his sample to 20 OECD countries for the period 1970 to 1995. The first sets of regressions are estimated to replicate and improve the prior literature. He includes dummy variables for (1) requirements for warnings on packaging and advertising material, (2) television and radio advertising bans, (3) moderate bans (if three or four specific media bans existed)[83] and (4) strong bans (if five or more specific media were banned) as well as country and time dummies. Nelson (2003) diversifies his use of ban dummies to include some bans that he regards as important and intentionally looks at the difference between broadcast bans and other media bans. Nelson's initial conclusions were that none of the bans play a role in the determination of cigarette consumption.

The decision to use the shortened sample from 1985 to 1995 was based on testing for a structural break, which was done by using a recursive technique, successively estimating regressions with one less year, indicating a structural break in 1985. Nelson (2003) also tested the individual country autocorrelation in some of the regressions and found that the majority of countries have strong positive autocorrelation. He indicates that this may also account for a downward bias in standard errors, and hence may have led previous studies to accept that advertising bans had a negative effect on consumption, when in fact they had not. Nelson (2003) essentially rejects the previous attempts to measure the effectiveness of advertising bans on consumption in cross-country studies on the grounds of poor econometric techniques.

Based on his conclusion—that advertising bans do not play a role in determining consumption—Nelson (2003) hypothesises a public choice model, arguing that advertising restriction should only be implemented once smoking prevalence has fallen so that smokers

[82] It is important to note that Nelson has ties to the tobacco industry and has worked as a consultant to industry bodies; he appeared for them as an expert witness in various legal proceedings.
[83] Nelson (2003) considers a total of nine media, namely: television, radio, cinema, outdoor, newspapers, magazines, shop advertising, sponsorships, and indirect advertising such as brand names on non-tobacco products.

no longer constitute an "effective economic or political interest group" (Nelson 2003: 20). The rationale behind this hypothesis is that tobacco consumption has fallen since the mid-1960s due to the public's knowledge of the health risks associated with smoking; the decline is influenced by, amongst others, government reports, public education programs, health warnings and counter-advertising campaigns. Because of greater understanding of these risks, combined with higher taxation and direct measures such as age controls, tobacco consumption and prevalence fell, resulting in a swing in public opinion that allowed advertising bans to be legislated without much political cost. Nelson (2003) indicates that most comprehensive advertising bans were only legislated once large-scale falls in consumption had already taken place.[84] To test this hypothesis that advertising bans are a result of a reduction in tobacco consumption, Nelson (2003) estimates a two-stage model treating advertising restriction endogenously.[85]

Nelson (2003) finds that income and prices are statistically significant in predicting demand, that warnings are only statistically significant in the first sample period (1971 to 1995)[86], and that the advertising restriction score is not statistically significant in any of the samples. Although not statistically significant, the coefficients are negative in all samples, which is inconsistent with the results Nelson (2003) found in the single equation models. The t-statistics also decrease over the three samples, indicating that advertising restrictions have become less important in determining consumption. Nelson (2003) was unable to reject the null hypothesis that advertising bans were exogenous, meaning that advertising bans are endogenously determined together with consumption. He concluded that advertising bans and restrictions have had no effect on consumption.

The literature described all considered advertising and advertising bans as an influence on tobacco consumption through the demand side. However, an alternative theory, developed by Tremblay and Tremblay (1999), states that advertising bans have an impact on consumption through the supply side, in addition to the demand side. They theorize that advertising bans reduce the extent of price competition, thereby increasing prices and reducing consumption. They indicate that this hypothesis is supported by empirical investigations in other industries.

[84] This may be the case in high-income countries but it is not the case in most, although not all, low- and middle-income countries where consumption is rising.
[85] Instruments used are male smoking prevalence, female smoking prevalence, healthcare costs, legged tax revenue, population older than 65 years and an openness index.
[86] The other samples used are 1977 to 1995 and 1985 to 1995.

Tan (2006) draws the same conclusions using a game theoretic dynamic oligopoly model, where firms compete on price and advertising. Declines in advertising, which would result from a policy intervention, reduce smoking rates because of higher industry concentration. Tan notes that between 1990 and 2000 the concentration in the tobacco industry in the United States has increased significantly.[87] A number of empirical investigations of this hypothesis have been performed in the United States. Farr *et al*. (2001) show that the Fairness Doctrine and the Broadcast Advertising Ban reduced consumption and led to increased prices. The Fairness Doctrine (1968-1970) required one anti-smoking advertisement to be aired for every four pro-smoking advertisements on television and radio, while the Broadcast Advertising Ban (since 1971) has banned all cigarette advertisements from television and radio (Tremblay and Tremblay, 1999). Farr *et al.'s* method involves estimating a demand equation and a supply relation simultaneously, using aggregate data. Advertising enters both the demand and supply sides with advertising expenditure interacting with the various policy dummy variables. Iwasaki *et al*. (2006) shows that, in addition the Fairness Doctrine and the Broadcast Advertising Ban, the Master Settlement Agreement in 1998 restricted advertising and reduced consumption through price competition. In addition to damages paid, the agreement prohibited outdoor advertising, banned the use of cartoon characters to promote tobacco and provided funding for antismoking advertising. Iwasaki *et al*. (2006) follow a similar methodology to Farr *et al*. (2001), estimating demand and supply equations simultaneously.

Yet none of this work has been conducted in low- and middle-income countries.[88] Since a large amount of the work relating to the impact of economic interventions on tobacco consumption (particularly taxation and price elasticities) has shown significantly different results in low- and middle-income countries as opposed to high-income countries, there is no reason to suggest that the results of the literature with respect to advertising in high-income countries can be generically fitted to low- and middle-income countries. Thus the purpose of this study is to quantify the impact of advertising bans on tobacco consumption, paying particular attention to low- and middle-income countries. The aim of this chapter is not to test the impact of advertising, but rather the impact of advertising *bans* on aggregate consumptions with respect to low- and middle-income countries.

[87] However, market concentration has declined following the Master Settlement Agreement in 1998.
[88] Blecher (2008a and 2008b) does consider low- and middle-income countries but since this chapter is an extension and improvement of Blecher (2008a and 2008b) we do not consider it as part of this review.

5.3 METHODS AND DATA

A pooled model regresses the variables of all groups in all periods and implies that the estimated coefficients are the same for each group.[89] Baltagi and Levin (1986) indicate that pure cross-sectional studies cannot control for country or group-specific effects, and pure time series models cannot control for unobservable (taste) changes over time. Thus they argue for pooling, since with this method we can control for both country or group-specific effects and changes over time. The pooled model ignores factors specific to each individual group and the time series effects are likely to be overpowered by the cross-sectional variation (Dunne and Perlo-Freeman, 2003). The pooled model is unable to capture the unobserved or immeasurable heterogeneity that may exist between groups (Baltagi *et al.*, 2000), which is then observed in the error term. If such heterogeneity exists, the pooled estimator will be inconsistent, which is likely, given the vast differences between countries. The pooled regression can be formalised by equation 1 below:

$$y_{it} = \alpha + \beta x_{it} + u_{it} \qquad [1]$$

Where y is the dependent variable, x the independent variable, α and β the estimated coefficients, and u the error term, where $i=1,\ldots,N$ represents the groups and $t=1,\ldots,T$ the time periods.

Panel models attempt to control for unobserved or immeasurable heterogeneity between different groups. Since pooled models are inconsistent where differences between groups exist, panel models allow one to estimate consistent coefficients. The most common technique is the fixed effects model, which allows the intercept to differ across groups, while the parameters of the independent variables remain global estimates. The model is formalised, as in Dunne and Perlo-Freeman (2003), in equation 2 below:

$$y_{it} = \alpha_i + \beta x_{it} + u_{it} \qquad [2]$$

[89] In a cross-country study each group is a single country but the term can make reference to any categorical grouping in a panel model. I will use the term group and country interchangeably.

The intercept term α_i now represents the group-specific effects and removes the unobserved heterogeneity from the error term. A two-way fixed effect model, which also controls for unobserved heterogeneity between different time periods, is also possible (equation 3). In practice, fixed effects panel models are estimated using deviations from the group mean rather than the addition of dummy variables for each fixed effect (at the cost of degrees of freedom). Only within-group variation is considered, and the between-group variation is factored out by the imposition of the fixed effects (Dunne and Perlo-Freeman, 2003).

$$y_{it} = \alpha_i + \alpha_t + \beta x_{it} + u_{it} \quad [3]$$

An alternative to the fixed effect model is the random effects model which treats the group-specific effect as random. The estimated coefficients are often found to lie between the simple pooled and fixed effects model, and are sometimes not that dissimilar to the fixed effects estimates. Dunne and Perlo-Freeman (2003) indicate that the random effects model can be rendered inconsistent due to correlation between the fixed effects and the regressors.[90]

The dataset has been drawn from a number of sources. Price data are sourced from the Economist Intelligence Unit's World Cost of Living Survey. This is the largest dataset that includes a significant number of low- and middle-income countries, and that collects annual data on the retail prices of cigarettes. Data are collected on a city-wide basis for two different brands, an international or imported brand (usually Marlboro) and a locally produced popular brand, in two different types of retail stores. I define three price measures, the *international price* (Marlboro), *local price* and *minimum price* (the minimum of the international and local price). Within each category I also use the cheapest price available in each year and city. The suggestion for using the lowest price when using the same dataset is made by Blecher and Van Walbeek (2004); they suggest that, in most countries, the cheaper brand would be the most popular brand. In many high-income countries there is little difference between the prices of the two brands. Where more than one city is surveyed in a particular country, the average (unweighted) price is used. Prices are captured in a common currency, United States

[90] The fixed effects and random effects models can be easily compared using a Hausman test. Both fixed effects and random effects models were estimated in this chapter, however, Hausman test results consistently indicated that the fixed effects models were statistically preferable and thus the random effects results are not presented.

dollars, and converted into real terms (constant 2000 prices) using the United States Consumer Price Index City Average for All Items (United States Department of Labour).[91]

Consumption data are sourced from the ERC Group and is converted into per capita terms using the adult population (aged 15 and older).[92] The ERC Group, formerly known as the European Research Group, is an independent market research organisation that compiles annual country level reports on a number of markets, including cigarettes. Population data are sourced from the World Bank's World Development Indicators Database. Income data are also sourced from the World Bank's World Development Indicators Database. Per capita Gross Domestic Product in constant 2000 US dollars are used as a proxy of income rather than some measure of personal income, since it places a value on free state services and transfers (Laugesen and Meads, 1993). Furthermore, GDP is available for a far broader cross–section of countries (almost all countries, including low- and middle-income countries) than any other measure.[93]

Data on advertising regulations in each country are captured from a number of sources. For European nations, the regional office of the World Health Organisation provides an online Tobacco Control Database which includes detailed information on each member country (26 countries). A similar set of data exists for some members of the Pan American Health Organisation through the Pan American Tobacco Information Online System. This provided data for six countries. This was supplemented by data from the *Tobacco Control Country Profiles* (Shafey *et al.*, 2003) since the Pan American Tobacco Information Online System only indicates the current policy and does not indicate the policy that existed previously. Fourteen countries that were not included in either of the aforementioned databases were surveyed using an online survey of eminent persons in each country. In other countries that were not surveyed due to language barriers or other logistical problems a search of both editions of *Tobacco Control Country Profiles* (Shafey *et al.*, 2003; Corrao *et al.*, 2000), the *Tobacco Atlas* (Shafey *et al.*, 2009), *MPOWER* (World Health Organisation, 2008), the

[91] This is the same data source that was used in Chapter 2. The data are treated and used in the same manner as it was in Chapter 2.

[92] Previous versions of this chapter including that published in the *Journal of Health Economics* used *Tobacco Control Country Profiles* (Shafey *et al.*, 2003) for the consumption data. However, this source is not complete with many missing observations, especially in low-and-middle income countries. Furthermore, the *Tobacco Control Country Profiles* data has not been updated since it was published.

[93] See Chapter 2 for a thorough discussion of different measures of income and a more detailed justification of the use of GDP as a measure of income.

Centre for Disease Control's National Tobacco Information Online System and original source documents were employed. In total, data were collected for 68 countries.[94] A detailed appendix of all sources in each country is included. A time series indicating the number of media in which advertising was banned in each particular year was constructed for each country., Following Saffer and Chaloupka (2000), seven media were considered television: radio, outdoor, print, cinema, point-of-sale and sponsorship.

There are a number of methods available for including advertising bans and restrictions in the model. The first would simply be to create a discrete and bounded score, similar to Laugesen and Meads (1991), where 10 might represent a total ban on all advertising in all media and 0 an unrestricted market. Alternatively the score would be bounded by 0 and 7 if the seven media that Saffer and Chaloupka (2000) classify are used. The Laugesen and Meads (1991) method has a distinct disadvantage in that it implies that a point scored for any reason implies the same generalised impact as any other. An alternative method is to create dummy variables for weak, limited and comprehensive bans as used by Saffer and Chaloupka (2000) where 0, 1 or 2 bans are considered a weak policy; 3 or 4 bans a limited policy and 5, 6 or 7 bans a comprehensive policy. The weakness of this methodology would be the subjective nature of the application of a weak, limited or comprehensive ban to a particular country in a particular year. A third method would be to include dummy variables for bans and restrictions in different categories or media (e.g. television, radio, outdoor, print, cinema, point-of-sale and sponsorship) as suggested by High (1999). This solves the problems of the first two methods, however, the inclusion of so many dummy variables would require large dimensions of the dataset to ensure sufficient degrees of freedom. Furthermore, the use of individual dummies for each particular media also removes the ability to examine the interaction between bans in different media, or the cumulative effect of a number of bans that the Saffer and Chaoupka method allows by measuring the overall impact.

Each method described has particular strengths and weaknesses. Rather than rely on the strengths of a single method, I propose the analysis of a number of methods. Firstly, I will replicate the Saffer and Chaloupka method. Secondly, I will employ a variation of the Saffer and Chaloupka method by conducting a sensitivity analysis on the subjective boundaries to

[94] Data on a further eight countries were collected since price or consumption data were available for them. However, for these eight countries, either price or consumption data were not available, thus making formal modelling for these countries in a demand framework impossible. However, in the next section I conduct a descriptive analysis for which the whole sample is used.

ensure that the boundaries themselves do not drive the result. This is done by making the Saffer and Chaloupka definition more restrictive and then less restrictive. Under the restricted definition, a weak policy includes 0, 1, 2 or 3 bans, a limited policy 4 or 5 bans and a comprehensive policy 6 or 7 bans. Under the relaxed definition, a weak policy includes 0 or 1 bans, a limited policy 2 or 3 bans and a comprehensive policy 4, 5, 6 or 7 bans. Table 5.2 provides a summary of the categorisation of the regulations based on the number of advertising ban dummy variables included in the model. Thirdly, I will follow the suggestion of High (1999) but instead of including a separate dummy variable for each media, I will include a separate dummy for 1 ban, 2 bans, 3 bans, 4 bans, 5 bans, 6 bans and 7 bans, irrespective of which media the bans occur in. In the regressions the base case will be one ban and thus this dummy variable will be excluded. Although some information is lost by not using the dummies to locate bans in specific media, this *graduated bans* method will allow bans to augment each other and remove the problem of the subjective nature of the weak, limited and comprehensive classifications.

Table 5.2: Summary of advertising ban dummies

	Weak	**Limited**	**Comprehensive**
Restricted alternative	0, 1, 2, 3	4, 5	6, 7
Saffer and Chaloupka (2000)	0, 1, 2	3, 4	5, 6, 7
Relaxed alternative	0, 1	2, 3	4, 5, 6, 7

5.4 DATA ANALYSIS

Data on advertising regulations were collected for 76 countries, of which 26 are classified as high-income countries according the World Bank in July of 2006 (World Bank, 2006); the remaining 50 are classified as low- and middle-income countries.[95] The analysis of advertising regulations covers the period 1990 to 2005. During this period there has been a strong trend towards the strengthening of advertising regulations, with many countries moving from weak policies to limited and comprehensive policies as defined by Saffer and Chaloupka (2000).[96] In high-income countries this trend has been stable over the entire period, while in low- and middle-income countries it has been only been seen in the most recent years.

[95] The previous version of this analysis (Blecher, 2008b) included only 51 countries, 21 high-income and 30 low- and middle-income countries. 68 countries are included in the regression analysis later in the chapter.
[96] This part of the analysis uses the standard Saffer and Chaloupka (2000) definitions of weak, limited and comprehensive policies.

In 1990, 65% (17/26) of high-income countries and 90% (45/50) of low- and middle-income countries in the sample had weak policies in place and this number has declined to 26% and 52% (13/50 and 26/50) respectively by 2005. Limited policies are generally not popular and could be found in only 8% (2/26) of high-incomes countries in 1990 and in only 2% (1/50) of low- and middle-income countries. Countries with limited bans tend to be scarce since they are usually countries in transition from a weak to a comprehensive policy. By 2005, the number of countries with limited policies had grown to 15% (4/26) of high-income countries and 6% (3/50) of low- and middle-income countries. Comprehensive bans were in place in 27% (7/26) of high-income countries and in only 6% (3/50) of low- and middle-income countries in 1990. The number of countries implementing comprehensive advertising bans grew considerably to 62% (16/26) of high-income countries and 42% (21/50) of low- and middle-income countries by 2005. Figures 5.1 and 5.2 indicate the percentage of countries choosing weak, limited and comprehensive advertising bans in high-income and low- and middle-income countries, respectively.

Figure 5.1: Advertising bans in high-income countries (n=26)

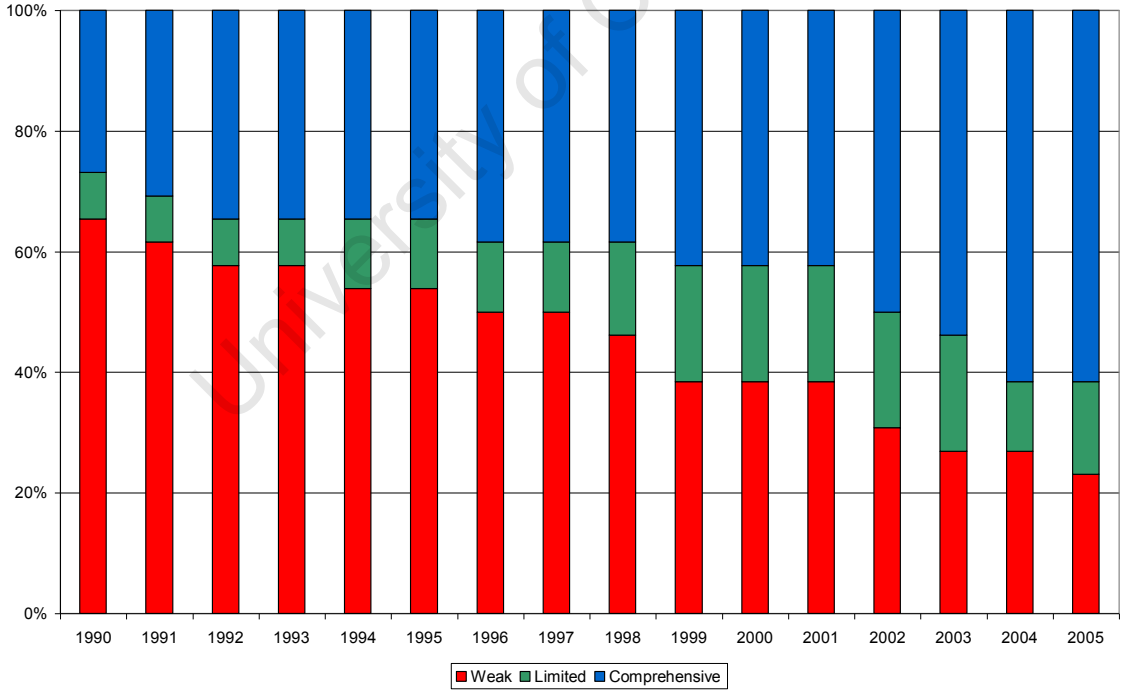
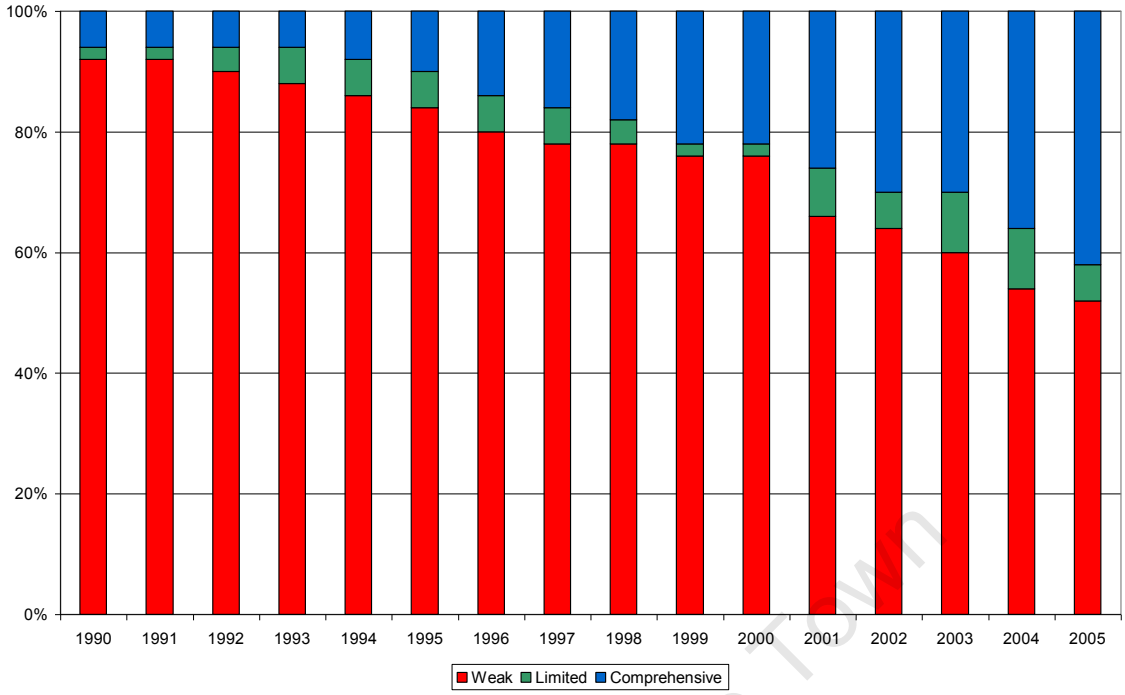


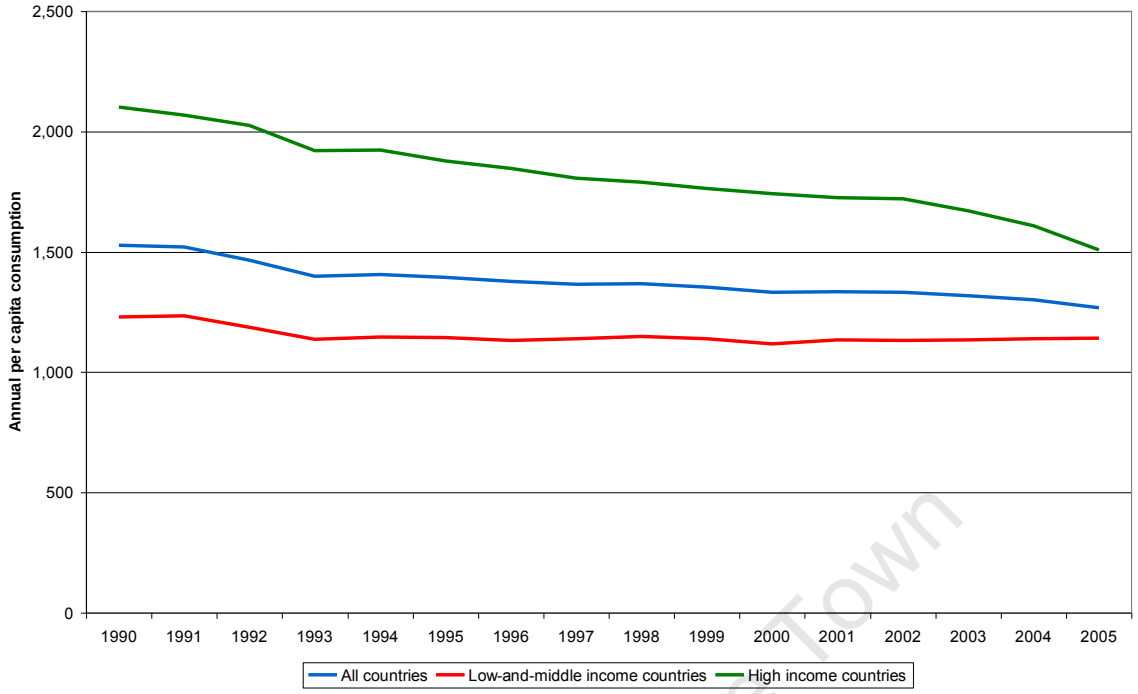
Figure 5.2: Advertising bans in low- and middle-income countries (n=50)



Low- and middle-income countries have been slower in taking up more rigorous policies. The majority of low- and middle-income countries still have little or even no regulation of advertising, while the majority of high-income countries have had comprehensive policies in place since 2003. Advertising bans are considered part and parcel of a comprehensive tobacco control strategy. Such strategies are not yet as popular in low- and middle-income countries as they are in high-income countries.

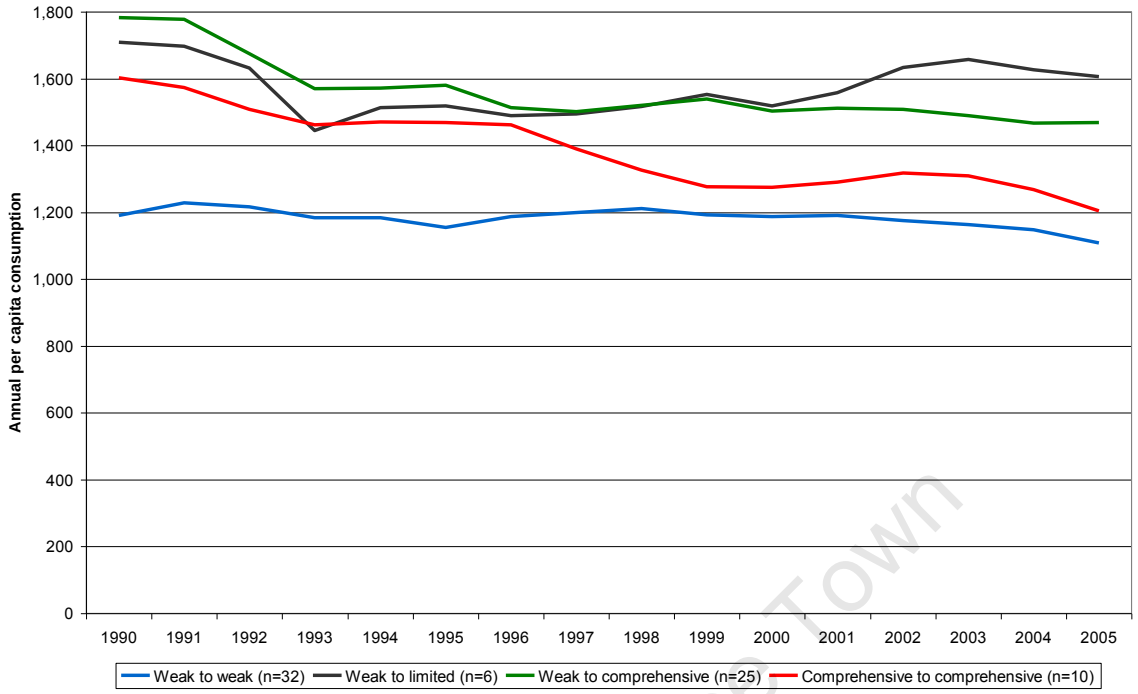
Consumption varies across countries. High-income countries tend to have significantly higher levels of per capita consumption than low- and middle-income countries. Figure 5.3 describes the trends in per capita consumption in low- and middle-income and high-income countries and shows that there has been a consistent decline in per capita consumption in high-income countries between 1990 and 2005. Per capita consumption in low- and middle-income countries declined between 1991 and 1993 and has remained flat since.

Figure 5.3: Average annual per capita consumption



The important question is: what happens to consumption when a country implements a stricter policy? Figure 5.4 shows the average annual per capita consumption for countries that had weak policies in place in 1990. It indicates three different series for those countries that, by 2005, had implemented limited bans, and for those that had implemented comprehensive bans. It also includes those that kept weak policies in place over the 1990-2005 period. What is immediately noticeable is how countries that changed from weak bans to limited and comprehensive bans had higher per capita consumption to begin with relative to those that did not change. Countries that implemented limited and comprehensive strategies were most often high-income countries and those that kept weak policies in place were typically low- and middle-income countries. Furthermore, countries that implemented comprehensive bans had consistently declining per capita consumption over the period while countries that kept weak bans in place found that per capita consumption remained relatively flat and even experienced increases in tobacco consumption. Countries that implemented limited bans between 1990 and 2005 saw per capita consumption decline in the early years of the sample but rise in the later years (however, this is a small sample of only six countries). It is important to consider that countries which implemented more restrictive advertising regimes were more likely to have other policies in place that discouraged smoking, such has higher taxation and prices, which may affect the results.

Figure 5.4: Average annual per capita consumption for countries which in 1990 had weak policies

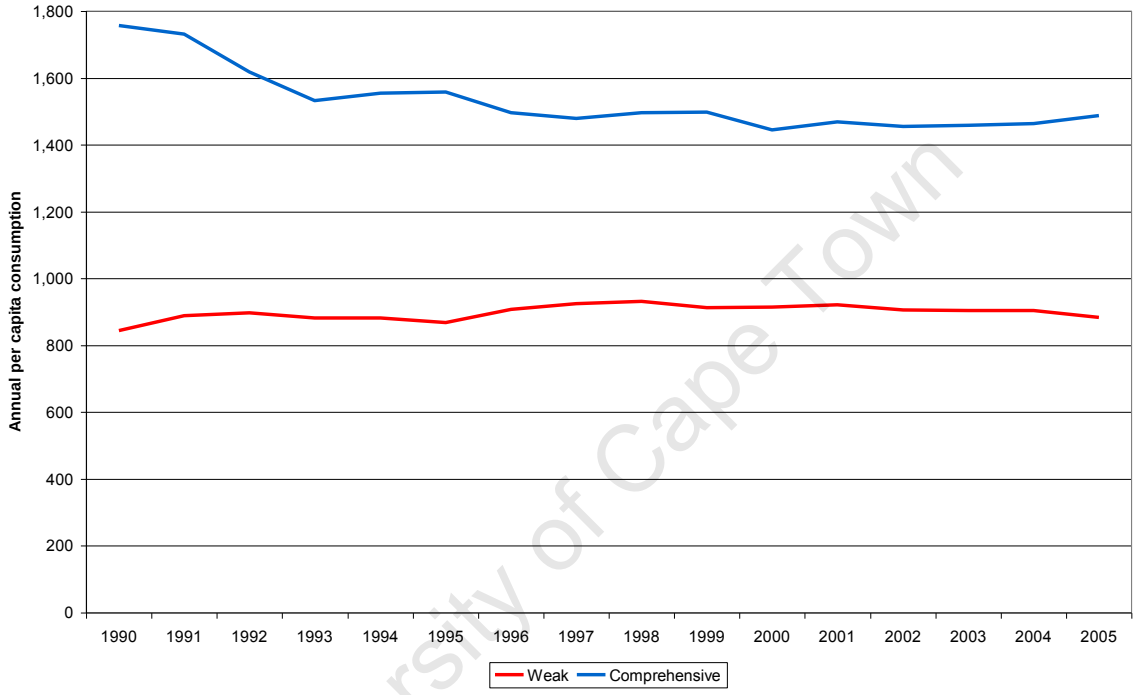


This analysis is suggestive of a link between advertising bans and tobacco consumption. Countries which implemented comprehensive advertising bans have seen tobacco consumption decline, while countries that have maintained weaker policies have seen consumption remain stable and in some cases increase. It must be remembered that countries that implemented comprehensive bans were also likely to have seen increases in the real prices of cigarettes, since both are components of a broader tobacco control strategy. The increases in the average real (minimum) prices for those countries in the sample which moved from weak or limited in 1990 to comprehensive bans by 2005 was 32.9% between 1990 and 2005, while those that implemented limited bans from weak bans increased by only 16.3%. Those that maintained weak policies saw prices increase by 18.4%. This analysis suggests a correlation between consumption and advertising bans without any suggestions of causation.

Low- and middle-income countries are less likely to implement limited and comprehensive bans. Figure 5.5 breaks down low- and middle-income countries into two groups based on the status of their policies in the last year of the analysis in 2005 (weak or comprehensive). The data indicate declines in per capita consumption in those countries that chose to implement comprehensive bans between 1990 and 2005 with the most robust declines occurring between

1990 and 2000. At the same time, it shows that per capita consumption in countries that maintained weak policies remained flat or even rose slightly during the same period. This indicates that, although most low- and middle-income countries maintained weak policy regimes, comprehensive bans may play a role in reducing consumption in low- and middle-income countries as they have in high-income countries.

Figure 5.5: Average annual per capita consumption for low- and middle-income countries with weak and comprehensive policies in 2005



The figures presented show that high-income countries are more likely to implement comprehensive strategies than low- and middle-income countries. Furthermore, per capita consumption is declining in high-income countries and this trend has not been shared in low- and middle-income countries. It is easy to mistake the trend of declining consumption in the high-income countries with increased advertising bans. Yet at the same time there is some evidence to suggest that increasing advertising bans occur in countries with declining consumption. A more rigorous econometric analysis will now be undertaken.

5.5 ECONOMETRIC MODEL

This section estimates the demand for tobacco in order to test the impact of advertising bans on consumption. Firstly, a fixed effects model is estimated employing only country-fixed effects (one-way model) and then employing both country- and time-fixed effects (two-way model). In each case I formally test to see whether the one-way or two-way model is the statistically preferred model using a *Likelihood Ratio Test*. The Likelihood Ratio Test, approximated by the Chi-squared distribution, is able to compare two models where one is nested in the other – in this case the one-way model is nested in the two-way model. The test statistic is calculated as follows:

$$D = -2\left[\ln(likelihood_{null}) - \ln(likelihood_{alternative})\right] \quad [4]$$

The degrees of freedom are calculated by difference in the degrees of freedom between the null and alternative models. Furthermore, the fixed effects models are also compared to random effects models using a Hausman (1978) test. In all cases in this chapter the Hausman test indicates that the fixed effects models are always preferred to the random effects models. The conventional Likelihood Ratio Test is not appropriate here since the random effects model is estimated using *generalised least squares* and the fixed effects model using *ordinary least squares*. The Hausman test statistic is the ratio of the squared differences between the fixed effects and random effects results and the differences between their variances; it is formalised by Johnston and Dinardo (1997: 404) below:

$$H = (\beta_{RE} - \hat{\beta}_{FE})'(\Sigma_{FE} - \Sigma_{RE})^{-1}(\beta_{RE} - \hat{\beta}_{FE}) \quad [5]$$

Where *RE* denotes random effects while *FE* denotes fixed effects; *beta hat* is the vector of estimated coefficients of the underlying model and *sigma* the variance. *H* will be distributed asymptotically as Chi-squared. The null hypothesis is that the random effects model is consistent and efficient and the alternative that the random effects model is inconsistent (and thus that the fixed effect model is consistent).

Sixty-seven countries are included in the model over 16 years (1990 to 2005). The panel is not balanced since observations are missing for some countries in some years due to

unavailable data.[97] The model is estimated in natural logarithms to allow for interpretation of the coefficients as elasticities and is formalised by equation 6 below:

$$\ln C_{it} = \alpha_i + \alpha_t + \beta_1 \ln P_{it} + \beta_2 \ln Y_{it} + \beta_3 D(Lim)_{it} + \beta_4 D(Comp)_{it} + \mu_{it} \quad [6]$$

Where *C* represents per capita consumption, *P* real prices, *Y* real per capita income, *D(Lim)* and *D(Comp)* represent the dummy variables for limited and comprehensive bans, respectively; weak bans are the base case; the subscript *it* refers to country *i* and time period *t*. The fixed effects are denoted by α_i and α_t.

I estimate the model in equation 6 using the three price measures (minimum, local and international) and three measures of weak, limited and comprehensive advertising ban variations (the base as well as the restricted and relaxed alternatives). The results are shown for all countries in Table 5.3 and for low- and middle-income countries only in Table 5.4.

When considering the models including all countries, the one-way fixed effects models are preferred to the pooled models with no fixed effects for all variations of price and advertising bans. I used a Likelihood Ratio Test to compare the models; the test statistics are shown in Table 5.5. Subsequently, I also compared the two-way fixed effects to the one-way fixed effects model, also using a Chi-squared statistic, and found that the two-way fixed effects models are preferred to the one-way model for all variations of price and advertising bans. These tests are also shown in Table 5.5. Thus the results in Table 5.3 only refer to the two-way fixed effects model, which is the preferred model. For completeness, I also compare the two-way fixed effects model to the pooled model and confirm that the two-way fixed effects models are preferred.

When considering the models including only low- and middle-income countries, I find that the one-way fixed effects models are also preferred to the basic pooled model. The test results are also shown in Table 5.5. However, when I compare the two-way model to the one-way model, I find that the two-way model is not preferred for all variations. Thus Table 5.4 includes only the results from the one-way fixed effects models and not the two-way fixed effects model, as in Table 5.3.

[97] The missing data occurs in the price series since not all countries were included in the Economist Intelligence Unit series in 1990. There are also some individual observations missing from seemingly random years.

Table 5.3: Regression results for all countries including group and time fixed effects

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Minimum price	-0.159*** (0.020) -8.180	-0.163*** (0.019) -8.370	-0.160*** (0.019) -8.234						
Local price				-0.204*** (0.022) -9.411	-0.209*** (0.022) -9.642	-0.205*** (0.022) -9.441			
International price							-0.139*** (0.023) -6.135	-0.138*** (0.023) -6.073	-0.139*** (0.023) -6.135
Income	0.435*** (0.063) 6.865	0.447*** (0.063) 7.067	0.441*** (0.064) 6.929	0.421*** (0.064) 6.554	0.436*** (0.064) 6.801	0.430*** (0.066) 6.664	0.444*** (0.065) 6.885	0.448*** (0.064) 6.943	0.447*** (0.065) 6.901
Limited ban Restricted definition	-0.081*** (0.031) -2.655			-0.082*** (0.030) -2.732			-0.085*** (0.031) -2.752		
Limited ban Standard definition		-0.090*** (0.033) -2.708			-0.096*** (0.032) -2.959			-0.062* (0.034) -1.853	
Limited ban Relaxed definition			0.032 (0.030) 1.076			0.023 (0.030) 0.775			0.038 (0.030) 1.260
Comprehensive ban Restricted definition	-0.074*** (0.028) -2.599			-0.068** (0.028) -2.424			-0.078*** (0.027) -2.714		
Comprehensive ban Standard definition		-0.090*** (0.026) -3.414			-0.088*** (0.026) -3.407			-0.089*** (0.027) -3.316	
Comprehensive ban Relaxed definition			-0.067** (0.027) -2.519			0.069*** (0.026) -2.631			-0.065** (0.027) 6.254
Constant	3.449*** (0.530) 6.541	3.360*** (0.528) 6.361	3.393*** (0.531) 6.389	3.576*** (0.536) 6.674	3.467*** (0.534) 6.495	3.500*** (0.538) 6.510	3.411*** (0.538) 6.341	3.387*** (0.538) 6.298	3.377*** (0.540) 6.254
n R^2	1031 0.96	1031 0.96	1031 0.96	985 0.96	985 0.96	985 0.96	1029 0.94	1029 0.95	1029 0.95

Note: standard errors in parenthesis, t-statistics below parenthesis.

Table 5.4: Regression results for low- and middle-income countries including only group fixed effects

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Minimum price	-0.112*** (0.024) -4.660	-0.116*** (0.024) -4.753	-0.115*** (0.024) -4.765						
Local price				-0.140*** (0.027) -5.219	-0.146*** (0.027) -5.346	-0.143*** (0.027) -5.320			
International price							-0.018 (0.029) -0.620	-0.017 (0.029) -0.598	-0.016 (0.029) -0.546
Income	0.243*** (0.066) 3.684	0.226*** (0.065) 3.482	0.247*** (0.066) 3.712	0.236*** (0.067) 3.533	0.221*** (0.066) 3.364	0.243*** (0.068) 3.598	0.245*** (0.068) 3.616	0.219*** (0.067) 3.285	0.242*** (0.068) 3.536
Limited ban Restricted definition	-0.170*** (0.044) -3.865			-0.168*** (0.044) -3.827			-0.180*** (0.045) -4.002		
Limited ban Standard definition		-0.092* (0.056) -1.644			-0.104* (0.056) -1.858			-0.054 (0.057) -0.947	
Limited ban Relaxed definition			0.030 (0.050) 0.590			0.025 (0.054) 0.463			0.051 (0.052) 0.982
Comprehensive ban Restricted definition	-0.207*** (0.042) -4.880			-0.205*** (0.043) -4.770			-0.224*** (0.043) -5.200		
Comprehensive ban Standard definition		-0.201*** (0.037) -5.407			-0.200*** (0.037) -5.341			-0.210*** (0.038) -5.544	
Comprehensive ban Relaxed definition			-0.186*** (0.037) -5.020			-0.186*** (0.038) -4.949			-0.190*** (0.038) -5.016
Constant									
n R^2	620 0.953	620 0.953	620 0.953	602 0.954	602 0.954	602 0.954	618 0.951	618 0.951	618 0.951

Note: standard errors in parenthesis, t-statistics below parenthesis.

Table 5.5: Model selection test results

Countries	Price variable	Advertising bans	Table	Model	One-way fixed effects versus pooled			Two-way fixed effects versus pooled			Two-way fixed effects versus one-way fixed effects		
					χ^2	df	P-stat	χ^2	df	P-stat	χ^2	df	P-stat
All	Minimum	Restricted	5.3	1	3046.442	66	0.000	3138.570	82	0.000	92.128	15	0.000
All	Minimum	Standard	5.3	2	3042.336	66	0.000	3125.028	82	0.000	82.692	15	0.000
All	Minimum	Relaxed	5.3	3	2949.512	66	0.000	3040.450	82	0.000	90.938	15	0.000
All	Local	Restricted	5.3	4	2999.993	66	0.000	3087.020	82	0.000	87.027	15	0.000
All	Local	Standard	5.3	5	2998.658	66	0.000	3075.080	82	0.000	76.422	15	0.000
All	Local	Relaxed	5.3	6	2906.192	66	0.000	2989.429	82	0.000	83.237	15	0.000
All	International	Restricted	5.3	7	2992.013	66	0.000	3100.394	82	0.000	108.381	15	0.000
All	International	Standard	5.3	8	2987.788	66	0.000	3088.005	82	0.000	100.217	15	0.000
All	International	Relaxed	5.3	9	2893.879	66	0.000	3003.068	82	0.000	109.189	15	0.000
LMIC	Minimum	Restricted	5.4	1	1913.907	40	0.000	1928.614	56	0.000	14.707	15	0.473
LMIC	Minimum	Standard	5.4	2	1889.309	40	0.000	1903.833	56	0.000	14.524	15	0.486
LMIC	Minimum	Relaxed	5.4	3	1881.016	40	0.000	1895.511	56	0.000	14.495	15	0.488
LMIC	Local	Restricted	5.4	4	1872.631	40	0.000	1892.269	56	0.000	19.637	15	0.186
LMIC	Local	Standard	5.4	5	1848.098	40	0.000	1867.479	56	0.000	19.381	15	0.197
LMIC	Local	Relaxed	5.4	6	1842.644	40	0.000	1861.693	56	0.000	19.049	15	0.212
LMIC	International	Restricted	5.4	7	1881.064	40	0.000	1897.949	56	0.000	16.884	15	0.326
LMIC	International	Standard	5.4	8	1857.347	40	0.000	1874.249	56	0.000	16.902	15	0.325
LMIC	International	Relaxed	5.4	9	1850.271	40	0.000	1867.087	56	0.000	16.817	15	0.330

When considering the models including all countries (Table 5.3), I find negative and statistically significant price elasticities of demand for all specifications of equation 6. The price elasticities differ between the three price specifications, but not between the different specifications of the advertising bans. The price elasticities are -0.16 for the minimum price (models 1, 2 and 3), range between -0.20 and -0.21 for the local price (models 4, 5 and 6) and are -0.14 for the international (Marlboro) price (models 7, 8 and 9). The magnitudes of the income elasticities are positive and statistically significant in all specifications and range between 0.42 and 0.45 without significant variation between price and advertising ban measures. When using the standard definitions of the advertising bans, i.e. those defined by Saffer and Chaloupka (2001) for models 2, 5 and 8, I find that the effect of both the limited and comprehensive advertising bans are negative and statistically significant in all specifications of price.

The magnitudes of the limited advertising bans range between -0.06 and -0.10 and comprehensive advertising bans are -0.09; the three are not significantly different from each other. The advertising ban coefficients are interpreted as autonomous shift elasticities, meaning that the application of the ban results in a 6% to 10% decline in per capita consumption in a country and year when a limited ban is implemented, and a 9% decline when a comprehensive advertising ban is implemented. The stricter application of the advertising bans in models 1, 4 and 7 makes it more difficult to be considered comprehensive; I again find that both the limited and comprehensive advertising bans are negative and statistically significant in all specifications of price. The magnitudes of the limited advertising bans' range between -0.08 and -0.09 and the comprehensive advertising bans' range between -0.07 and -0.08 and are not significantly different from each other. When considering the weaker application of the advertising bans for models 3, 6 and 9 (i.e. making it easier to be considered comprehensive), I find that the comprehensive advertising bans remain negative and statistically significant at -0.07; however, the limited advertising bans are no longer statistically significant. With the exception of the limited advertising ban, in the weaker application of the bans, the models are relatively robust to variations in the price variable and the definition of the advertising bans.

The model is then re-estimated, this time including only low- and middle-income countries. Forty-one countries are included in the model over 16 years (1990 to 2005). The panel is not balanced since observations are missing for some countries in some years due to unavailable data. Again three models were estimated, a pooled model including no fixed effects, and one- and two-way fixed effects models. As indicated previously, the one-way fixed effects models are preferred and are shown in Table 5.4.

Negative and statistically significant price elasticities of demand are estimated for the minimum and local prices, but not the international (Marlboro) price, which is negative but not statistically significant. The price elasticities differ between the three price specifications, but not between the different specifications of the advertising bans. The price elasticities range between -0.11 and -0.12 for the minimum price (models 1, 2 and 3), -0.14 and -0.15 for the local price (models 4, 5 and 6) and are -0.02 for the international (Marlboro) price (models 7, 8 and 9).

The magnitudes of the income elasticities are positive and statistically significant in all specifications and range between 0.22 and 0.25 without significant variation between price and advertising ban measures. When using the standard definitions of the advertising bans in models 2, 5 and 8, I find that the comprehensive advertising ban is negative and statistically significant in all specifications of price. The limited advertising bans are negative in all specifications of price but only statistically significant using the minimum and local prices (models 2 and 5).

The magnitudes of the comprehensive advertising bans range between -0.20 and -0.21 and are significantly higher (in absolute terms) than the magnitudes of the limited advertising bans, which range between -0.09 and -0.10 where statistically significant. When considering the stricter application of the advertising bans in models 1, 4 and 7 (i.e. making it more difficult to be considered comprehensive), I find that both the limited and comprehensive advertising bans are negative and statistically significant in all specifications of price. The absolute magnitudes of the comprehensive advertising bans range between -0.21 and -0.22 and are greater (in absolute terms) than the magnitudes of

the limited advertising bans, ranging between -0.17 and -0.18, in all specifications of price (although this difference is not statistically significant).

When considering the application of the relaxed advertising bans in models 3, 6 and 9 (i.e. making it easier to be considered comprehensive), I find that the comprehensive advertising bans are negative (-0.19 in magnitude) and statistically significant in all specifications of price; however, the limited advertising bans are no longer statistically significant in any specifications. Again, with the exception of the limited advertising ban in the weaker application of the bans and, additionally, with the exception of the lack of statistical significance of the international (Marlboro) price measure, the models are relatively robust to variations in the price variable and the definition of the advertising bans.

The third method of accounting for advertising bans allows for easy interpretation by presenting the coefficients of the graduated ban dummy variables graphically. Regressions similar to the ones above are performed and include price and income as independent variables, along with the dummy variables for 1 ban, 2 bans, 3 bans, 4 bans, 5 bans, 6 bans and 7 bans (no bans is the base case). The two-way fixed effects model that includes country and time-period fixed effects is used for the model including all countries (Figure 5.6) and the one-way fixed effects model (including only country-level fixed effects) is used for the model including only low- and middle-income countries (Figure 5.7) in order to remain consistent with the estimates presented in Tables 5.3 and 5.4.

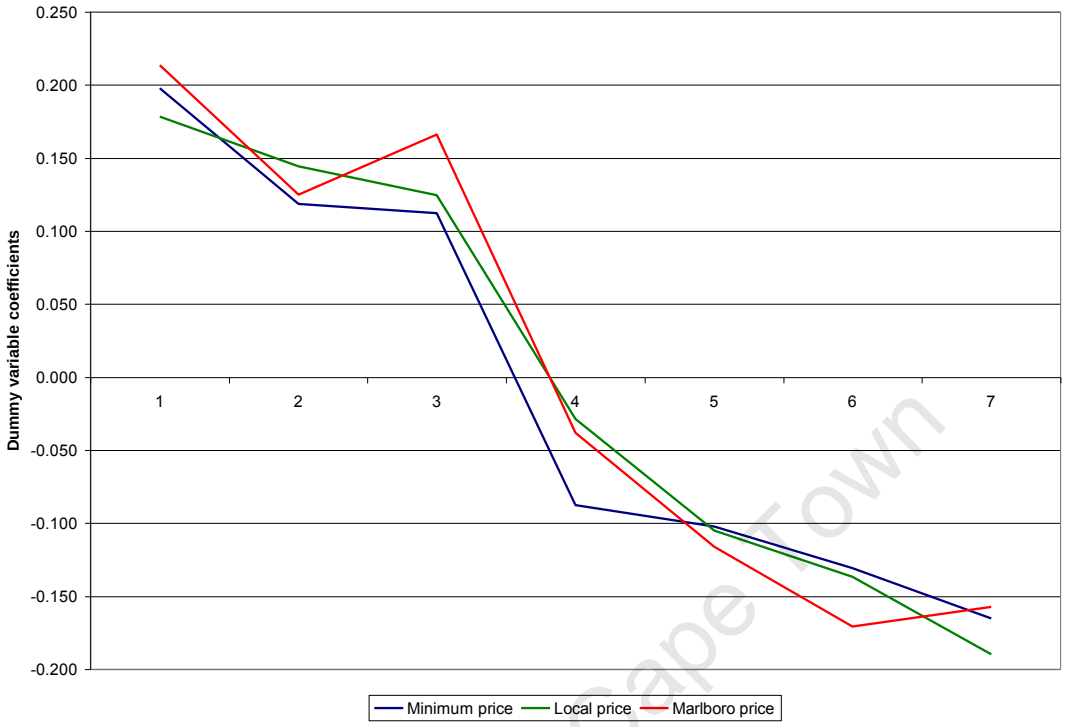
When considering all countries, only the dummy variables on the 3rd, 4th, 5th and 7th bans are negative. Furthermore, only the coefficients on the 1st, 2nd and 7th dummy variables are statistically significant. These results are consistent across all three price measures. The most important result is the trend: generally as one adds more advertising bans consumption falls as indicated by the declining trend in the magnitudes of the dummy variables. This trend is even more evident and pronounced when considering only low- and middle-income countries (see Figure 5.7). Although the dummy variables for 1st, 2nd

and 3rd bans are positive (only the first two are statistically significant, and the third is only statistically significant when using the international price), the coefficients of the dummy variables for the fourth, fifth, sixth and seventh ban are negative (the 5th, 6th and 7th bans and also statically significant). Furthermore, the magnitudes become greater, in absolute terms, as more bans are added, indicating that successively more bans have a greater impact in reducing consumption. Furthermore, the results support the results of the models in Tables 5.3 and 5.4 indicating that advertising bans have a greater impact on reducing consumption in low- and middle-income countries relative to high-income countries, since the absolute magnitude of the coefficients in Figure 5.7 is greater than those in Figure 5.6. Furthermore, they support the results in Tables 5.3 and 5.4 by reducing the reliance on the subjective categorisation of the advertising bans.

Figure 5.6: Coefficients of graduated advertising ban dummy variables for all countries

Note: Includes country and time-period fixed effects. The horizontal axis shows the number of bans out of a total of seven.

Figure 5.7: Coefficients of graduated advertising ban dummy variables for low- and middle-income countries



Note: Includes only country-fixed effects. The horizontal axis shows the number of bans out of a total of seven.

5.6 DISCUSSION AND CONCLUSION

This chapter attempts to estimate the impact of advertising bans on tobacco consumption by estimating a number of cross-sectional time series models. Generally it was found that cigarettes are price inelastic and normal goods with mostly statistically significant coefficients on price and statistically significant coefficients on income. This is consistent with our expectations. Advertising bans were generally found to have negative and statistically significant impact on consumption, especially for low- and middle-income countries.

The models estimated in this chapter have provided a number of innovations. Firstly, the chapter includes a significant number of low- and middle-income countries in the sample and is the first study to focus attention on the impact of advertising bans in this context.

Secondly, a number of improvements are made to the manner in which advertising bans are accounted for in the model. The Saffer and Chaloupka (2001) method of classifying bans as either weak, limited or comprehensive is used as a base, but a sensitivity analysis of this method is also employed. In addition to the Saffer and Chaloupka method a "graduated ban" method is used to remove the subjectivity of weak, limited and comprehensive bans but to still allow bans in different media to augment each other. Thirdly, three measures of price are included in the model.

The different definitions of price have little impact on the results of the advertising bans. However, the sensitivity analysis of the advertising bans does provide some interesting results. The standard Saffer and Chaloupka definitions show that limited and comprehensive advertising bans are negative and significant—but the magnitudes of the limited and comprehensive advertising bans are not statistically different from each other in the model including all countries. However, the magnitude of the comprehensive advertising ban is similar to that of Saffer and Chaloupka's (2001) findings (-9% in this chapter versus -7%). When looking only at low- and middle-income countries using the Saffer and Chaloupka definitions, we find that comprehensive bans are significantly stronger than limited bans in reducing consumption; this is consistent with the findings of Saffer and Chaloupka (2001). When the definitions of the advertising bans are restricted, the results of the models including all-countries remain similar. However, this is not the case for low- and middle-income countries, where the limited and comprehensive advertising ban dummies are now of a similar magnitude. Many countries which were previously classified as having limited or comprehensive advertising bans are now classified as having weak or limited advertising bans. The coefficients of the limited advertising bans have higher t-statistics in absolute terms, whereas the coefficients of the comprehensive bans have lower t-statistics in absolute terms relative to the base scenario.

When the definitions of the advertising bans are relaxed, many countries which were previously classified as having weak or limited advertising bans are now classified as having limited or comprehensive advertising bans. Results for both the all-countries model and the low- and middle-income country models are now consistent with the

results of Saffer and Chaloupka (2001), where only comprehensive advertising bans play a role in reducing consumption. The results indicate that the boundaries make a difference to the results. However, the boundaries chosen by Saffer and Chaloupka (2001) were, to some extent, endogenous.

The graduated bans remove the subjectivity while still supporting the conclusions of the other methods by indicating that adding more advertising bans reduces consumption. Furthermore, a small number of advertising bans does little to reduce consumption. It also supports the notion that advertising bans are more effective in reducing consumption in low- and middle-income countries.

The results are consistent with those found in the literature. They are supportive of the results of Saffer and Chaloupka (2000) in particular since we find that comprehensive advertising bans are more effective in reducing consumption than are limited advertising bans (although in only one definition in the all-countries models and two definitions in the low- and middle-income countries models). When including all countries in the model, I find that comprehensive advertising bans result in a 6.5% to 9.0% reduction in per capita consumption while in low- and middle-income countries I find that comprehensive advertising bans result in a 18.6% to 22.4% reduction in per capita consumption (depending on the specification used). The graduated bans models indicate that a complete advertising ban (a ban in all seven media) reduces consumption by 11.1% to 14.2% in all countries and 15.7% to 19.0% in low- and middle-income countries (relative to advertising bans in no media).

An interesting question arises: why should advertising bans have such a large impact on consumption in low- and middle-income countries relative to the entire sample? The literature indicates that the impact of price changes has a larger impact on consumption in low- and middle-income countries *vis-à-vis* high-income countries. Van Walbeek (2005: 80) indicates that "the consensus view is that the price elasticity of demand is around -0.4 for developed countries and between -0.4 and -0.8 for developing countries". Furthermore, changes in income may also have a greater impact on consumption in low-

and middle-income countries than high-income countries (see IARC, 2011). It seems that the demand for tobacco is more sensitive to its determinants in low- and middle-income countries relative to high-income countries. Thus, consumers are possibly more sensitive to demand-side interventions, whether it be price or non-price measures including advertising bans, public smoking bans and social factors.

There are a number of reasons for this greater sensitivity; firstly, the price of cigarettes takes up a greater portion of a consumer's income in low- and middle-income countries than it does in high-income countries (Blecher and Van Walbeek, 2004). As a result, an increase in price has a relatively greater impact on a person's budget. Furthermore, consumers in poorer countries are likely to have lower levels of education and would have a poorer understanding of the health consequences of smoking. Thus the impact of advertising may be stronger in low- and middle-income countries since a greater number of smokers are enticed by advertising due to the poorer understanding of the health consequences.

A second hypothesis surrounds the age profile of low- and middle-income countries relative to high-income countries. The population of low- and middle-income countries is, on average, younger than that of high-income countries, and advertising might have a greater impact on encouraging younger people to initiate smoking (see US Department of Health and Human Services, 1994; National Cancer Institute, 2001). Thus, banning advertising may reduce initiation rates more significantly in low- and middle-income countries relative to high-income countries.

This study provides an important ratification of prior literature as well as extending the validity of its conclusions to include a larger set of countries, particularly low- and middle-income countries. The study has used several innovations and thus makes considerable improvements on the prior literature. Yet the study does suffer from some limitations and drawbacks. Firstly, the dataset is not as robust as one would wish it to be. Data on prices, consumption and advertising bans all suffer from one weakness or another. The price data is of a specific price rather than the average price paid, although I

attempt to mitigate this risk by using three specifications of price. The results of the advertising ban variables are not sensitive to the choice of price specification. The dataset on advertising bans is complete, although it is not necessarily as consistent as one might like since it is compiled from a number of different sources. Finally, the sample covers a period 1990-2006 and as a result does not include the implementation of advertising bans in a number of countries which implemented comprehensive bans on advertising prior to 1990.

Furthermore, the chapter, along with the prior literature, only considers static models. Static models—which specify an econometric model where consumption is a function of price and income—are unable to account for the addictive nature of tobacco use. Most studies which use aggregate data make use of an econometric specification that accounts for the addictive nature of tobacco use, using either the myopic addiction model or the rational addiction model. These models include past consumption or both past and future consumption in the econometric specification to account for addiction. However, as Hsiao (2003) indicates, the fixed and random effects estimators are not always appropriate when considering dynamics within a panel model.[98] A number of dynamic panel estimators exist, but the complexity of them has not made them popular tools.

[98] He also indicates that the implications of the estimation are also different to those considered when a static model is used. Hsiao (2003) says that when a static model is considered, the primary focus on whether or not to choose a fixed or random effects model relates to the efficiency of the estimates and the independence between the regressors and the effects. When the independent variables are strictly exogenous, the fixed-effects assumption gives us a best linear unbiased estimate and a consistent and unbiased estimate under the random-effects assumption, even though not an efficient one if the time period is fixed. The *ordinary least squares* estimator of the fixed effects model does not suffer any bias due to the omission of individual attributes that are correlated with the exogenous independent variables, since their effects have been differenced out. Yet, when a random effects model is estimated using *generalised least squares* it will be biased if the same occurs. In a static model, if the independent variables are correlated with the effects, a random effects model that is correctly formulated will lead to the same estimates as the fixed effects model. Hsiao (2003) indicates that this is why the fixed effects model has assumed so much importance in the literature.
However, when a lagged dependent variable is included as an independent variable, strict exogeneity of the regressors no longer holds. Thus the *ordinary least squares* estimate of the fixed effects model is no longer consistent in a panel with a large number of groups and short time-series. The *generalised least squares estimate* of the random effects model also poses some problems and the consistency depends on the way that the number of groups and time periods tend to infinity. Thus the use of either the fixed or random effects is not appropriate, and other techniques, such as instrumental variable techniques, which can treat the lagged dependent variable as endogenous, have been proposed. It has also been argued that as the time period grows the bias in the lagged dependent variable shrinks, and that as the time period under consideration grows to infinity, the fixed and random effects estimators become consistent.

Not only is the decision whether or not to pool of importance, but how to deal with pooling is also an essential question. Baltagi and Levin (2000: 117) indicate that there is controversy about which pooled estimator "yields the most plausible estimator". In this chapter, models estimated using the fixed effects estimator assume homogeneity, since the intercept varies by group (country), but the estimated parameters are global estimates. The prior literature (Laugesen and Meads, 1991; Stewart, 1993b; Saffer and Chaloupka, 2000; and Nelson, 2003) also assumes homogeneity. A growing literature now prefers a heterogeneous estimator (see Robertson and Symonds, 1992; Pesaran and Smith, 1995; and Maddala *et al.*, 1994 for examples). However, Baltagi *et al.* (2000) prefer the homogenous estimators, although this is for state level data in the United States. Individual states surely have more in common than individual countries, especially a very diverse group of countries. In simple terms, South Africa and Nigeria are very different to the United States and the United Kingdom. While it was recognised that pooling provided better estimates than cross-sections or time series models by themselves, the most appropriate method of pooling is not always clear. Smith and Fuertes (2004), Baltagi (2008) and Hsiao and Pesaran (2007) provide more comprehensive reviews of the heterogeneity issues. Furthermore, heterogonous estimators, like the random coefficients model, do not suffer from the same problems as the traditional pooled estimators when considering dynamic specifications.

A final consideration is that of the endogeneity of advertising bans. Nelson (2003) proposes that advertising bans are only implemented once tobacco consumption and smoking prevalence have fallen enough to provide the political space for policy to be implemented. Although he finds empirical support for this, his sample is exclusively in high-income countries. As Figure 5.3 shows, consumption is not falling in low- and middle-income countries. In fact consumption and prevalence is rising in many low- and middle-income countries (see Chapter 1). Even if advertising bans are endogenous in high-income countries there is no reason to believe that this is the case in low- and middle-income countries. However, I am unable to test this empirically. The empirical

test for endogeneity is to employ a two-stage model where advertising bans are instrumented by smoking prevalence in the first stage. Nelson (2003) uses male smoking prevalence, female smoking prevalence, healthcare costs, lagged tax revenue, the population older than 65 years and an openness index. If advertising bans are endogenous we should find that smoking prevalence (at least amongst males) has a negative and statistically significant effect on advertising bans in the first stage. In low- and middle-income countries this technique creates an insurmountable challenge since smoking prevalence data are not widely available and time series on smoking prevalence in individual countries is almost non-existent. Generally, the driver for implementation of advertising bans in low- and middle-income countries has been the "exogenous" policy recommendations of international institutions, especially Article 13 of the Framework Convention on Tobacco Control.

Future literature will, it is hoped, address both these econometric issues: estimating models that take into account the addictive nature of cigarettes, as well as the potential heterogeneity in a diverse sample of countries.

APPENDIX E: DATA SOURCES

Table E1: Sources of information on advertising bans in individual countries

Country	Source
Argentina	Survey
Australia	TCCP; Acts of parliament
Austria	WHO Regional Office for Europe Tobacco Control Database
Azerbaijan	WHO Regional Office for Europe Tobacco Control Database
Bangladesh	Survey
Belgium	WHO Regional Office for Europe Tobacco Control Database
Brazil	Survey; MPOWER; TCCP
Bulgaria	WHO Regional Office for Europe Tobacco Control Database
Canada	Survey
Chile	Pan American Health Organisation PATIOS Database; TCCP
China	Survey
Colombia	Pan American Health Organisation PATIOS Database; TCCP
Costa Rica	Pan American Health Organisation PATIOS Database
Croatia	WHO Regional Office for Europe Tobacco Control Database
Czech Republic	WHO Regional Office for Europe Tobacco Control Database
Denmark	WHO Regional Office for Europe Tobacco Control Database
Ecuador	Pan American Health Organisation PATIOS Database; TCCP
Egypt	Survey
Finland	WHO Regional Office for Europe Tobacco Control Database
France	WHO Regional Office for Europe Tobacco Control Database
Germany	WHO Regional Office for Europe Tobacco Control Database
Greece	WHO Regional Office for Europe Tobacco Control Database
Guatemala	Pan American Health Organisation PATIOS Database; TCCP
Holland	WHO Regional Office for Europe Tobacco Control Database
Hungary	WHO Regional Office for Europe Tobacco Control Database
India	Survey
Indonesia	TCCP; NATIONS
Iran	TCCP; NATIONS; World Health Organisation (Undated)
Ireland	WHO Regional Office for Europe Tobacco Control Database
Israel	WHO Regional Office for Europe Tobacco Control Database
Italy	WHO Regional Office for Europe Tobacco Control Database
Ivory Coast	TCCP
Japan	MPOWER; TCCP
Jordan	TCCP
Kenya	TCCP; Acts of parliament
Kuwait	MPOWER; TCCP
Malaysia	Survey
Mexico	Survey
Morocco	MPOWER; TCCP
New Zealand	Survey
Nigeria	TCCP; NATIONS
Norway	WHO Regional Office for Europe Tobacco Control Database
Pakistan	TCCP; NATIONS
Panama	Pan American Health Organisation PATIOS Database; TCCP
Paraguay	TCCP; Acts of parliament

Country	Source
Peru	Pan American Health Organisation PATIOS Database; TCCP
Philippines	TCCP
Poland	WHO Regional Office for Europe Tobacco Control Database
Portugal	WHO Regional Office for Europe Tobacco Control Database
Romania	TCCP
Russia	WHO Regional Office for Europe Tobacco Control Database
Saudi Arabia	Tobacco Atlas; TCCP
Senegal	TCCP; NATIONS; Acts of parliament
Serbia and Montenegro	WHO Regional Office for Europe Tobacco Control Database
Singapore	TCCP
South Africa	Survey
Spain	WHO Regional Office for Europe Tobacco Control Database
Sweden	WHO Regional Office for Europe Tobacco Control Database
Switzerland	WHO Regional Office for Europe Tobacco Control Database
Thailand	Survey
Tunisia	TCCP; Survey
Turkey	WHO Regional Office for Europe Tobacco Control Database
United Arab Emirates	TCCP
United Kingdom	WHO Regional Office for Europe Tobacco Control Database
United States	TCCP; NATIONS; Nelson (2003)
Uruguay	Survey
Vietnam	Tobacco Atlas; TCCP
Zimbabwe	Survey; TCCP

Note: The names and details of the persons surveyed are available on request from the author.

CHAPTER 6

CONCLUSION

This thesis has provided an analysis of three important issues in tobacco control in low- and middle-income countries, namely: (1) affordability, (2) the illicit trade in cigarettes and (3) the impact of advertising bans on tobacco consumption. Two chapters have provided a global view, while two chapters have used the case study of South Africa to provide the analysis. In this context, South Africa is an important country, since it is a middle-income country that has embarked on a tobacco control strategy that is well-known and well-documented. Tobacco consumption and smoking prevalence are rising rapidly in low- and middle-income countries, and interventions are required to arrest and reverse this trend. These interventions tend to be economic in nature and global best practices have been developed in order to assist policy makers in implementing effective tobacco control policies. The Framework Convention on Tobacco Control and the World Health Organisation's "MPOWER Strategy" have provided formal frameworks, while the World Bank publication, *Curbing the Epidemic*, provided an earlier framework. This is in addition to many other formal and informal frameworks on regional and global levels.

Chapter 2 provided a thorough review of previous attempts to develop methods to examine the affordability of cigarettes across countries and over time. Affordability has emerged as an important metric to asses tax and price policies, since many low- and middle-income countries are experiencing rapid economic growth that is making cigarettes more affordable to consumers. Furthermore, the chapter considers which measures are the most appropriate in different contexts and explores the advantages and disadvantages of the various methods. It concludes that although the minutes of labour method, developed by Guindon *et al.* (2002), does provide an easy-to-understand metric, it is unable to provide estimates for a large cross section of countries, particularly low- and middle-income countries. Furthermore, it is only able to estimate affordability at

discrete points in time. The relative income price method, first proposed by Blecher and Van Walbeek (2004), is able to provide long and consistent time-series estimates for the largest group of countries, including a considerable number of low- and middle-income countries. However, this metric is more difficult to understand and interpret.

The chapter also examines the trends in affordability over time and concludes that, since 1990, cigarettes have become less affordable in high-income countries and more affordable in low- and middle-income counties, at an increasing rate in the 2000s. What drives these changes in affordability is especially important from a tobacco control perspective since it is a deliberate policy intervention (i.e. raising taxes) that is most likely to result in declining affordability. In those countries where affordability has declined, it was shown that increases in prices outweighed increases in incomes. In a very small number of countries economic shocks resulted in declining incomes which made cigarettes less affordable. Of those countries where cigarettes became more affordable incomes generally outgrew prices. This is of concern as an outcome since many low- and middle-income countries will continue to experience rapid economic growth which will make cigarettes more affordable in the future, unless governments take deliberate action to make cigarettes less affordable through increases in taxation.

Until recently, tax policy prescriptions and guidelines said little about affordability. The World Bank's seminal publication *Curbing the Epidemic* (Jha and Chaloupka, 1999) said nothing about affordability. Instead it suggested that "[the] strategy, tailored to individual country needs, would include: (1) raising taxes, using as a yardstick the rates adopted by countries with comprehensive tobacco control policies where consumption has fallen. In these counties, tax accounts for two-thirds to four-fifths of the retail price of cigarettes". The World Health Organization's "MPOWER Strategy" in 2008 (World Health Organisation, 2008) argued that "[increasing] the price of tobacco through higher taxes is the single most effective way to decrease consumption and encourage tobacco users to quit", again paying no attention to rising incomes as a threat to tobacco control and public health. Article 6 of the Framework Convention on Tobacco Control also ignores the issue: "The Parties recognize that price and tax measures are an effective and important

means of reducing tobacco consumption". The tobacco control community's view was no different. The declaration of the 14th World Conference on Tobacco or Health in 2009 said nothing about affordability instead declaring that "[by] 2012, 80% of the countries would have raised tobacco taxes to over 60% of the retail price".

More recently, most likely as a result of the growing literature focusing on the affordability of cigarettes, international best practices have begun to focus less on price as the explicit metric, but rather on affordability. The updated 2009 version of the World Health Organisation's "MPOWER Strategy" (World Health Organization, 2009: 56) indicates that "[cigarettes] should become less affordable over time to reduce consumption". In addition to this strategy, the recent World Health Organisation *Technical Manual on Tobacco Tax Administration* (World Health Organisation, 2010: 99) also focuses on affordability as an explicit policy measure, especially in low- and middle-income countries, indicating that countries should "[increase] tobacco taxes by enough to reduce the affordability of tobacco products. In order to maximize the public health impact of higher tobacco taxes, while at the same time generating higher revenues, governments should raise taxes so as to raise prices and reduce the affordability of tobacco products. In many low- and middle-income countries, tobacco use increases with incomes and incomes are rising faster than tobacco product prices so that these products are becoming more affordable. In order to reduce affordability, tax increases need to result in real price increases that are higher than the increases in real incomes." These statements are very encouraging from a tobacco control perspective, and indicate the impact that this growing literature has had and is having on tobacco control policies. The *Technical Manual on Tobacco Tax Administration* is one of the most important additions to the list of international policy documents. It is a comprehensive guide not only to tax policy but also to tax administration and is less reliant on a "one size fits all" approach than any of its predecessors. Even though it advocates a tax burden benchmark (excise taxes should account for at least 70% of price) it also suggests that tax increases should also account for growing incomes, thereby creating a "compromise" policy rule.

Chapter 3 builds on Chapter 2 by conducting a case study on tax policy in South Africa. South Africa follows the World Bank's suggestion by targeting the percentage of the

price of cigarettes occupied by taxes. The chapter begins by reviewing the rationale for such a policy and also the problems associated with it. It shows that high taxes, as measured by the percentage of price comprised of taxes, does not necessarily result in high prices in absolute terms. It then proposes a new policy rule that links tax and price policy to affordability. The affordability policy rule is shown to adjust taxes dynamically and prices in such a manner that, at a minimum, keeps pace with inflation and economic growth. Low- and middle-income countries are growing at the most rapid and robust rate in recent history and maintenance of an affordability policy rule will ensure that cigarettes become less affordable, reversing the trend found in Chapter 2, where cigarettes have been found to be becoming more affordable since the 1990s, and more aggressively so in the 2000s.

Chapter 4 also conducts a case study on tax policy in South Africa, although it does so by focussing the lens on the illicit trade in cigarettes. Economic theory suggests that higher taxes on cigarettes will create greater incentives for illegal traders to engage in the evasion and avoidance of taxes on cigarettes. The tobacco industry has used this argument to lobby against tax increases in South Africa and many other countries. Furthermore, they state that higher taxes in South Africa have resulted in dramatic increases in the volumes of illicit cigarettes and that such volumes are growing. However, little to no evidence has been presented to support these claims.

This chapter used an innovative method to measure the volumes of illicit cigarettes over time. The results indicate that the volume of illicit cigarettes has grown significantly in South Africa and that the illicit market now occupies a considerable portion of the general market. However, the estimates of this chapter indicate that these levels are also significantly less than is claimed by the tobacco industry.

This chapter also considers whether the growth in illicit trade has undermined tobacco control and fiscal policy in South Africa. The purpose of such an analysis is to see whether the net benefit of tax policy is positive, that is, whether the fiscal gains of higher taxation and the health gains of lower consumption/prevalence outweigh the lost revenue

of higher consumption/prevalence resulting from illicit trade. The chapter finds that the net fiscal and public health benefits of increasing excise taxes are overwhelming. Furthermore, it shows that the levels of illicit trade required to undermine fiscal policy and tobacco control policy are significantly higher than claims made by the industry. The chapter concludes that, even in the face of illicit trade, increasing tobacco taxes are an effective fiscal and public health policy and that reducing illicit trade through non-tax measures will likely result in even greater benefits.

The interaction between Chapter 3 and 4 is also interesting. Chapter 3 uses estimates of the price and income elasticities of demand to forecast the impact of tax changes on consumption. However, the estimated elasticities may be overestimates since they are calibrated using only legal consumption data and since the size of the illicit market is significant and the total market is significantly larger than the legal market. How to improve the estimates of the elasticies to take this into account is unclear; however, the estimates using only legal consumption are still appropriate for a number of reasons. First, previous estimates of price and income elasticities using only legal consumption have proven to be appropriate tools in forecasting future consumption. Secondly, the percentage of the market occupied by illicit trade has remained relatively constant in the last few years and thus changes in the total market have been similar to changes in the legal market. Thirdly, an overstatement of the elasticies impacts all simulations in the same manner and thus the implications for choosing a policy rule are not serious. In other words, the conclusion in Chapter 4 of an affordability policy rule resulting in the largest decline in consumption remains unaffected if smaller price and income elasticites (in absolute terms) are used.

Chapter 5 moves back into the realm of the cross-country aggregate level analysis to consider the impact of advertising bans on tobacco consumption, paying particular attention to low- and middle-income countries. Restriction and bans on advertising were popular tobacco control interventions in high-income countries in the 1960s, 1970s and 1980s. As the focus of tobacco control has moved to low- and middle-income countries more and more advocates are calling for restrictions and bans on advertising. However,

just as with any other tobacco control intervention, there is a need for relevant research to provide an evidence base for this intervention. This chapter attempts to provide the evidence base for advertising bans in low- and middle-income countries. It follows a similar methodology to an existing literature, heretofore exclusive to high-income countries, that models the demand for tobacco over time for a cross-section of countries.

This chapter provides two important innovations, firstly, by including a significant number of low- and middle-income countries in the sample, and secondly, by improving the methodology by which advertising bans are included in the model. The chapter finds that comprehensive advertising bans are able to help reduce tobacco consumption; this finding is particularly strong in low- and middle-income countries. Importantly, the chapter also finds that comprehensive advertising bans are significantly more effective in reducing consumption in low- and middle-income countries than they are in high-income countries. Furthermore, these results are consistent using a variety of methods.

Considering these chapters together, this thesis has provided a number of important policy implications. Firstly, affordability is an important and appropriate metric in the analysis of taxation policy in low- and middle-income countries. Rapid and robust economic growth requires that tax increases not only account for inflation, but also for rapidly growing incomes in order to, at a minimum, maintain affordability. Making cigarettes and tobacco products less affordable is an important tobacco control policy goal in order to ensure that consumption and smoking prevalence decline, or at least do not increase. Secondly, countries which are experiencing rapid economic growth are advised to follow tax policy rules which take into account rapidly growing incomes. Thirdly, the experience of South Africa indicates that illicit trade in tobacco products should not be a reason to decrease excise taxes. Even though illicit trade may increase as a result of tax increases, illicit trade is unlikely to undermine tobacco control policy; net tax revenues will increase and net consumption will decline as a result of tax increases. Furthermore, governments should focus on reducing illicit trade through non-tax measures in order to see the largest benefits from tax increases in terms of revenue gains and consumption declines. The generalisability of this result to other low- and middle-

income countries has not been analysed; however it is an important result given the attention that has been paid to South Africa as an example of a successful tax policy. Finally, comprehensive advertising bans are an appropriate measure in reducing tobacco consumption, especially in the context of low- and middle-income countries, where comprehensive advertising bans have a greater impact on reducing consumption than they do in high-income countries. This research clearly supports the measures adopted by the World Health Organisation and the Framework Convention on Tobacco Control as global best practice in tobacco control.

This research is a starting point for further research in these areas. More measures are required to continue supporting tobacco control policies and interventions. Improved research methods will provide stronger evidence while more targeted research will assist policy makers in implementing polices that target vulnerable populations and regions. Avenues for future research include:

- The continued surveillance of the affordability of cigarettes in the broadest sample of countries over time. This will enable policy makers to benchmark tax policy to peer countries and to ensure that cigarettes become less affordable over time.
- Locating improved sources of price data to ensure accuracy of affordability measures and to include the largest cross-section of countries, particularly low- and middle-income countries, where price data are scarce. A specific improvement may be the use of price data that are a true average of the country rather than that of one city (or in some cases several cities).
- Locating improved sources of income data to develop appropriate measures of affordability. Although GDP data are an acceptable source of income data, narrower measures of income allow for easier interpretation of affordability metrics. Narrow measures of income that are available in a time-series format for a large number of low- and middle-income countries will be useful to tobacco control advocates and policy makers in those countries.

- Furthermore, the tracking of affordability could be linked to consumption and prevalence data. This will enable policy makers to identify better the link between affordability and the usage of tobacco products.
- Analysis of tobacco industry price reactions to tax increases in South Africa is required. As Chapter 4 has shown, recent price increases in South Africa have far outweighed excise tax increases (over-shifting of the tax by the tobacco industry). Ultimately, this has allowed the tobacco industry to take most of the rents of the increases in tax. From a pure tobacco control perspective this has resulted in lower consumption than expected for the given tax increases. Specifically, research into understanding market structures and pricing power is necessary. Even though the incumbent dominant manufacturer has a very large market share and is a *de facto* monopoly there is no imminent risk of losing this monopoly position. Either there is no credible threat of new entrants, no credible threat of price competition or some other mechanism that allows them to over-shift tax increases so aggressively. The implications of such research are significant in that it will allow us to understand industry behaviour better but also to make more accurate forecasts of how tax changes will impact on tobacco consumption, smoking prevalence and tax revenue.
- Conduct more detailed county-level analysis of illicit trade in order to understand the magnitudes of illicit trade. This will allow for a more accurate and constructive debate surrounding the impact of illicit trade on tax policy. Furthermore, more accurate measures will allow a more detailed assessment of the drivers behind illicit trade and a more accurate assessment of which interventions work in reducing illicit trade. The methods employed in this thesis are innovative, although their accuracy is dependent on the accuracy of the underlying data and thus improved data on, particularly, smoking intensity will be of benefit.
- The cross-country demand modelling employed in Chapter 5 has weaknesses in methodology, since it does not account for addiction in the econometric specification. Furthermore, it also assumes homogeneity of cross-sections in the models. Future research should adequately address both addiction in the

specifications and the use of heterogeneous modelling techniques. Heterogeneous modelling techniques may be particularly useful in low- and middle-income countries, where cross-country differences are more explicit.

BIBLIOGRAPHY

Abbey Management Services, *Clients whose sales effects we've measured*. Available at: www.mikestrt.dircon.co.uk/mclients.htm [Accessed May 12, 2005].

Abedian, I. & Dorrington, R., 1994. An evaluation of a recent attempt to assess the social benefits of cigarette smoking. *Studies in Economics and Econometrics*, 18(1), 59-72.

Abernethy, A. & Teel, J., 1986. Advertising for cigarettes. *Journal of Advertising*, 15, 51-55.

Auditor-General, Various years. *Report of the Auditor-General on the appropriation and miscellaneous accounts in respect of general affairs*, Pretoria: Government Printer.

Baltagi, B., 2008. *Econometric Analysis of Panel Data* 4th ed., Chichester: Wiley.

Baltagi, B., Griffin, J. & Xiong, W., 2000. To pool or not to pool: homogeneous versus heterogeneous estimators applied to cigarette demand. *The Review of Economics and Statistics*, 82(1), 117-126.

Baltagi, B. & Levin, D., 1986. Estimating dynamic demand for cigarettes using panel data: the effects of bootlegging, taxation and advertising reconsidered. *The Review of Economics and Statistics*, 68(1), 148-155.

Bardsley, P. & Olekalns, N., 1999. Cigarette and tobacco consumption: Have anti-smoking policies made a difference? *The Economic Record*, 75(230), 225-240.

Barron, C., 2010. Newsmaker: Smoke coming out of his ears. *Sunday Times*, 11 July 2010.

Baumgartner, H. & Steenkamp, J., 2005. Response biases in marketing research. In: *The handbook of market research: do's and don'ts*. Newbury Park, CA: Sage Publications, pp 204–37.

Bishop, J. & Yoo, J., 1985. Health scare, excise taxes and advertising ban in the cigarette demand and supply. *Southern Journal of Economics*, 52, 402-411.

Blecher, E.H., 2008a. The impact of tobacco advertising bans on consumption in developing countries. *Policy Paper No. 13*. Cape Town: Economic Research Southern Africa.

Blecher, E.H., 2008b. The impact of tobacco advertising bans on consumption in developing countries. *Journal of Health Economics*, 27, 930-942.

Blecher, E.H., 2010a. Targeting the affordability of cigarettes: a new benchmark for taxation policy in low-income and middle-income countries. *Tobacco Control*, 19, 325-330.

Blecher, E.H., 2010b. A mountain or a molehill: is the illicit trade in cigarettes undermining tobacco control policy in South Africa? *Trends in Organised Crime*, 13, 299-315.

Blecher, E.H., 2010c. *A call to action on tobacco control in Africa*. Working paper. Atlanta: American Cancer Society.

Blecher, E.H. & Hastings, G., 2011 (forthcoming). *Impact of Tobacco Industry Marketing Communications on Tobacco Use*. In: Chaloupka, F.J., Fong, G. & Yurekli, A. (eds.) NCI Tobacco Control Monograph 21: *The Economics of Tobacco and Tobacco Control*. Bethesda: National Cancer Institute.

Blecher, E.H. & van Walbeek, C.P., 2004. An international analysis of cigarette affordability. *Tobacco Control*, 13, 339-346.

Blecher, E.H. & van Walbeek, C.P., 2008. *An analysis of cigarette affordability*. Paris: International Union Against Tuberculosis and Lung Disease.

Blecher, E.H. & van Walbeek, C.P., 2009. Cigarette affordability trends: an update and some methodological comments. *Tobacco Control*, 18, 167-175.

Boshoff, W., 2008. Cigarette demand in South Africa over 1996-2006: the role of price, income and health awareness. *South African Journal of Economics*, 76(1), 118-131.

Campaign for Tobacco Free Kids, 2001. *Immorality and innaccuracy of the death benefit argument*. Washington DC: Campaign for Tobacco Free Kids.

Chaloupka, F., Hu, T-W., Warner, K.E., Jacobs, R. & Yurekli, A., 2000. *The taxation of tobacco products*. In: Jha, P. & Chaloupka, F.J. (eds.) *Tobacco control in developing countries.* New York: Oxford University Press, pp 237-272.

Chaloupka, F. & Warner, K., 2000. The Economics of Smoking. In: *The Handbook of Health Economics*. New York: North-Holland/Elsevier Science, pp 1539-1627.

Chapman, S., 1989. The limitations of econometric analysis in cigarette advertising studies. *British Journal of Addiction*, 84(11), 1267-1274.

Chetwynd, J., Coope, P., Brodie, R.J. & Wells, E., 1988. Impact of cigarette advertising on aggregate demand for cigarettes in New Zealand. *British Journal of Addiction*, 83, 409-414.

Chiou, L. & Muehlegger, E., 2008. Crossing the line; direct estimation of cross-border cigarette sales and the effect on tax revenue. *The B.E. Journal of Economic Analysis and Policy*, 8(1).

Collin, J., LeGresley, E., MacKenzie, R., Lawrence, S. & Lee, K., 2004. Complicity in contraband: British American Tobacco and cigarette smuggling in Asia. *Tobacco Control*, 13, ii.104-ii.111.

Corrao, M.A., Guindon, G.E., Sharma, N. & Shokoohi, D.F., 2000. *Tobacco Control Country Profiles*. Atlanta: American Cancer Society.

Duffy, M., 2003. Advertising and food, drink and tobacco consumption in the UK. *Agricultural Economics*, 28, 51-70.

Duffy, M., 1991. Advertising and the consumption of tobacco and alcoholic drink: A system-wide analysis. *Scottish Journal of Political Economy*, 38(4), 369-385.

Duffy, M., 1995. Advertising in demand systems for alcoholic drinks and tobacco: a comparative study. *Journal of Policy Modeling*, 17, 557-577.

Duffy, M., 1996. Econometric studies of advertising, advertising restrictions and cigarette demand: a survey. *International Journal of Advertising*, 15, 1-23.

Duffy, M., 2006. Tobacco consumption and policy in the United Kingdom. *Applied Economics*, 38, 383-393.

Dunne, J. & Perlo-Freeman, S., 2003. The demand for military spending in developing countries: a dynamic panel analysis. *Defence and Peace Economics*, 14(6), 461-474.

Economics of Tobacco Control in South Africa Project, 1998. *The economics of tobacco control in South Africa*. Cape Town: Applied Fiscal Research Centre, School of Economics, University of Cape Town.

Economist Intelligence Unit, 1990. *Worldwide cost of living survey*. Available at: http://store.eiu.com/product/130000213.html.

ERC Group, 2001. *World Cigarettes*. Newmarket: ERC Group.

ERC Group, 2007. *World Cigarettes*. Newmarket: ERC Group.

Euromonitor, 2005. *Euromonitor International: Country Sector Briefing*. London: Euromonitor International.

Farr, S., Tremblay, C. & Tremblay, V., 2001. The Welfare Effect of Advertising Restriction in the U.S. Cigarette Industry. *Review of Industrial Organization*, 18, 147-160.

Franke, G., 1994. US cigarettes demand, 1961-1990: economic issues, evidence and implications. *Journal of Business Research*, 30, 33-41.

Fujii, E., 1980. The demand for cigarettes: Further empirical evidence and its implications for public policy. *Applied Economics*, 12, 479-489.

Gajalakshmi, C.K., Jha, P., Ranson, K. & Nguyen, S., 2000. Global patterns of smoking and smoking-attributable mortality. In: Jha, P. & Chaloupka, F.J. (eds.) *Tobacco control in developing countries*. New York: Oxford University Press.

Gallet, C., 1999. The effects of the 1971 advertising ban on behaviour in the cigarette industry. *Managerial and Decision Economics*, 20, 299-303.

Gilmore, A.B., Branston, J.R. & Sweanor, D, 2000. The case for OFSMOKE: how tobacco price regulation is needed to promote the health of markets, government revenue and the public. *Tobacco Control*, 19, 423-430.

Godfrey, C., 1986. *Price and Advertising Elasticities of Demand for Tobacco*. Working paper. York: ESRC Addiction Research Centre, University of York.

Goel, R. & Morey, M., 1995. The interdependence of cigarette and liquor demand. *Southern Journal of Economics*, 62, 451-459.

Goolsbee, A., Lovenheim, M. & Slemrod, J., 2010. Playing with Fire: cigarettes, taxes and competition from the internet. *American Economic Journal: Economic Policy*.

Grabowski, H., 1976. The effects of advertising on the inter-industry distribution of demand. *Explorations in Economic Research*, 3, 21-75.

Guindon, G.E., Hien, N.T.T., Kinh, H.V., McGirr, E., Trung, D.V. & Lam, N.T., 2010. *Tobacco Taxation in Vietnam*, Paris: International Union Against Tuberculosis and Lung Disease.

Guindon, G., Perucic, A. & Boisclair, D., 2003. *Higher tobacco prices and taxes in South-East Asia*. Washington DC: World Bank.

Guindon, G., Tobin, S. & Yach, D., 2002. Trends and affordability of cigarette prices: ample room for tax increases and related health gains. *Tobacco Control*, 11, 35-43.

Gujarati, D., 2003. *Basic Econometrics*. 4th ed., New York: McGraw-Hill.

Harrison, R., Chetwynd, J. & Brodie, R., 1989. The influence of advertising on tobacco consumption: a reply to Jackson and Ekelund. *British Journal of Addiction*, 84, 1251-1254.

Hausman, J., 1978. Specification Tests in Econometrics. *Econometrica*, 46(6), 1251-1271.

High, H., 1999. *Does advertising increase smoking? Economics, free speech and advertising bans.* Occasional Paper 107. London: Institute for Economic Affairs.

Hill, M., 1986. Female Labor Force Participation in Developing and Developed Countries – Consideration of the Informal Sector. *Review of Economics and Statistics*, 65, 459-468.

HM Revenue and Customs, 2007. *Measuring Indirect Tax Loses – 2007*. London: HM Revenue and Customs.

Hoffman, V., The effect of advertising on cigarette consumption in the Federal Republic of Germany. *Jahrbucher fur Nationalokonomie und Statistik*, 203, 257-273.

Hsiao, C., 2003. *Analysis of panel data*. 2nd ed. Cambridge: Cambridge University Press.

Hsiao, C. & Pesaran, H., 2007. Random Coefficient Panel Data Models. In: *The Econometrics of Panel Data: Fundamentals and recent developments*. 3rd ed. Springer.

IARC, 2011. *IARC Handbooks of Cancer Prevention, Tobacco Control, Vol. 14: Effectiveness of Tax and Price Policies for Tobacco Control*. Lyon: International Agency for Research on Cancer.

International Tobacco Growers Association, 2005. *Illicit Trade in Tobacco*. Tobacco Courier.

Iwasaki, N., Tremblay, C. & Tremblay, V., 2006. Advertising restrictions and cigarette smoking: evidence from myopic and rational addiction models. *Contemporary Economic Policy*, 24(3), 370-381.

Jha, P. & Chaloupka, F., 1999. *Curbing the Epidemic*. Washington DC: World Bank.

Jha, P. & Chaloupka, F., 2000. *Tobacco control in developing countries*. New York: Oxford University Press.

Johnson, L., 1986. Advertising expenditure and aggregate demand for cigarettes in Australia. *International Journal of Advertising*, 5, 45-58.

Johnston, J. & DiNardo, J., 1997. *Econometric methods*. Singapore: McGraw-Hill.

Joossens, L., Merriman, D., Ross, H. & Raw, M., 2010. The impact of eliminating the global illicit cigarette trade on health and revenue. *Addiction*, 105, 1640-9.

Joossens, L. & Raw, M., 1998. Cigarette smuggling in Europe: who really benefits? *Tobacco Control*, 7, 66-71.

Kan, M., 2007. Investigating cigarette affordability in 60 cities using the cigarette price-daily income ratio. *Tobacco Control*, 16, 429-432.

Kao, K. & Tremblay, V., 1988. Cigarette 'health scare', excise taxes, and advertising ban: Comment. *Southern Economic Journal*, 54(3), 770-776.

Keeler, T.E., Hu, T-W., Barnett, P.G. & Manning, W.G., 1996. Do cigarette producers price-discriminate by state? An empirical analysis of local cigarette pricing and taxation. *Journal of Health Economics*, 15, 499-512.

Keeler, T.E., Hu, T-W., Ong, M. & Sung, H-Y., 2004. The US national tobacco settlement: the effects of advertising and price changes on cigarette consumption. *Applied Economics*, 36, 1623-9.

Kwidini, T., 2008. Zimbabwe's tobacco sector fizzles out. *Mail and Guardian*. Available at: www.mg.co.za/article/2008-07-02-zimbabwes-tobacco-sector-fizzles-out.

Lal, A. & Scollo, M., 2002. Big Mac index of cigarette affordability. *Tobacco Control*, 11, 280-2.

Laugesen, M. & Meads, C., 1991. Tobacco advertising restriction, price, income and tobacco consumption in OECD countries, 1960-1986. *British Journal of Addiction*, 86, 1343-1354.

Laugesen, M. & Meads, C., 1993. The authors' reply to 'Tobacco consumption and advertising restrictions: a critique of Laugesen and Meads (1991)' by M.J. Stewart. *International Journal of Advertising*, 12(1).

Lee, K. & Collin, J., 'Key to the future': British American Tobacco and cigarette smuggling in China. *PLoS Medicine*, 3, 228–37.

Leeflang, P. & Reuijl, J., 1985. Advertising and industry sales: An empirical study of the West German cigarette market. *Journal of Marketing*, 49, 92-98.

LeGresley, E., Lee, K., Muggli, M.E., Patel, P., Collin, J. & Hurt, R.D., 2008. British American Tobacco and the "insidious impact of illicit trade" in cigarettes across Africa. *Tobacco Control*, 17, 339-346.

Levine, R. & Kinder, M., 2004. *Millions saved: proven success in global health*. Washington DC: Center for Global Development.

Lopez, A., Collishaw, N. & Piha, T., 1994. A descriptive model of the cigarette epidemic in developed countries. *Tobacco Control*, 3(3), 242-247.

Lovenheim, M., 2008. How far to the border?: The extent and impact of cross-border casual cigarette smuggling. *National Tax Journal*, 61(1), 7-33.

Mackay, J., Eriksen, M. & Shafey, O., 2006. *The Tobacco Atlas*. 2nd ed. Atlanta: American Cancer Society.

Mackay, J., Jemal, A., Lee, N.C. & Parkin, D.M., 2006. *The Cancer Atlas*. Atlanta: American Cancer Society.

Maddala, G., Srivastava, V. & Li, H., 1994. *Shrinkage estimators for the estimation of short-run and long-run parameters from panel data models*. Working paper. Ohio: Ohio State University.

McAuliffe, R., 1988. The FTC and the effectiveness of cigarette advertising regulations. *Journal of Public Policy and Marketing*, 7, 49-64.

McConnell, C. & Brue, S., 2005. *Economics: Principles, Problems, and Policies.* 16th ed. New York: McGraw-Hill/Irwin.

Mick, D., 1996. Are studies of dark side variables confounded by socially desirable responding? The case of materialism. *Journal of Consumer Research*, 23(2), 106-19.

Nakkash, R. & Lee, K., 2008. Smuggling as the "key to a combined market": British American Tobacco in Lebanon. *Tobacco Control*, 18, 310-316.

National Cancer Institute, 2001. *Changing Adolescent Smoking Prevalence*. Bethesda: National Cancer Institute.

National Treasury, Various years. *Estimates of National Revenue*. Pretoria: National Treasury.

Nelson, J., 2003. Cigarette demand, structural change, and advertising bans: international evidence, 1970-1995. *Contributions to Economic Analysis and Policy*, 2(1), Article 10.

Nelson, J., 2006. Cigarette advertising regulation: A meta-analysis. *International Review of Law and Economics*, 26(2), 195-226.

New Zealand Toxic Substance Board, 1989. *Health or Tobacco: an end to tobacco advertising and promotion*. Wellington: Department of Health.

Nikogosian, H., 2010. WHO Framework Convention on Tobacco Control: a key milestone. *Bulletin of the World Health Organization*, 88(2).

Peng, L. & Ross, H., 2009. The impact of cigarette taxes and advertising on the demand for cigarettes in Ukraine. *Central European Journal of Public Health*, 17(2), 93-98.

Perkurinen, M., 1989. The demand for tobacco products in Finland. *British Journal of Addiction*, 84, 1182-1192.

Pesaran, H. & Smith, R., 1995. Estimating Long-Run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics*, 68, 79-113.

Peto, R., 1994. *Smoking and death: the past 40 years and the next 40*. British Medical Journal, 309: 937.

Porter, R., 1986. The impact of government policy on the United States cigarette industry. In *Empirical Approaches to Consumer Protection Economics*. United States Government Printing Office.

Prinsloo, J. & Naude, B., 2009. Organised crime and corruption in South(ern) Africa. In: *A guided reader to research in comparative criminology/criminal justice*. Bochum: Universitätsverlag Brockmeyer.

Radfar, M., 1985. The effect of advertising on total consumption of cigarettes in the UK: A comment. *European Economic Review*, 29, 225-231.

Reekie, W., 1994. Consumers' surplus and the demand for cigarettes. *Managerial and Decision Economics*, 15, 223-234.

Republic of South Africa, 1993. *Tobacco Products Control Act*. Act 83 of 1993.

Republic of South Africa, 1999. *Tobacco Products Control Amendment Act*. Act 12 of 1999.

Robertson, D. & Symons, J., 1992. Some strange properties of panel data estimators. *Journal of Applied Econometrics*, 7(2), 175-189.

Royal College of Physicians, 1962. *Smoking and Health*. London: Pitman.

Rundle-Thiele, S., 2009. Bridging the gap between claimed and actual behaviour: the role of observational research. *Qualitative Market Research: An International Journal*, 12(3), 295-306.

Saffer, H., 2000. Tobacco advertising and promotion. In: Jha, P. & Chaloupka, F.J. (eds.) *Tobacco control in developing countries*. Washington DC: World Bank.

Saffer, H. & Chaloupka, F., 2000. The effect of tobacco advertising bans on tobacco consumption. *Journal of Health Economics*, 19, 1117-1137.

Schneider, L., Klein, B. & Murphy, K., 1981. Government regulation of cigarette health information. *Journal of Law and Economics*, 24.

Scollo, M. & Lal, A., 1996. The Big Mac index of cigarette affordability. *Tobacco Control*, 5, 69-70.

Scollo, M., Lal, A., Hyalnd, A. & Glantz, S., 2003. Review of the quality of studies on the economic effects of smoke-free policies on the hospitality industry. *Tobacco Control*, 12, 13-20.

Seldon, B. & Doroodian, K., 1989. A simultaneous model of cigarette advertising: Effects on demand and industry response to public policy. *The Review of Economics and Statistics*, 71, 673-677.

Shafey, O., Dolwick, S. & Guindon, G., 2003. *Tobacco Control Country Profiles.* 2nd ed. Atlanta: American Cancer Society.

Shafey, O., Eriksen, M., Ross, H. & Mackay, J., 2009. *The Tobacco Atlas.* 3rd ed. Atlanta: American Cancer Society.

Sloman, J., 2006. *Economics.* 6th ed. Harlow: Pearson Education.

Smee, C., 1992. *Effects of Tobacco Advertising on Tobacco Sponsorship: A discussion document reviewing the Evidence*. London: Economics and Operational Research Division, Department of Health.

Smith, R. & Fuertes, A., 2007. *Panel Time-Series*. IFS.

South African Reserve Bank, Various years. *Quarterly Bulletin*. Pretoria: South African Reserve Bank.

Statistics South Africa, Various years. *Consumer Price Index*. Statistical release P1.41.1. Pretoria: Statistics South Africa.

Stehr, M., 2005. Cigarette tax avoidance and evasion. *Journal of Health Economics*, 24(2), 277-297.

Steinberg, J., 2005. *The illicit abalone trade in South Africa*. Pretoria: The Institute for Security Studies.

Stewart, M., 1992. Tobacco consumption and advertising restrictions: a critique and Laugesen and Meads (1991). *International Journal of Advertising*, 11, 97-118.

Stewart, M., 1993a. Comment on the authors' reply to 'Tobacco consumption and advertising restrictions: a critique of Laugesen and Meads (1991)'. *International Journal of Advertising*, 12(1).

Stewart, M., 1993b. The effect on tobacco consumption of advertising bans in OECD countries. *International Journal of Advertising*, 12(2), 155-180.

Sunday Times, 2007. Unknown article title. *Sunday Times*. 27 July 2007.

Tan, W., 231. The Effects of Taxes and Advertising Restrictions on the Market Structure of the U.S. Cigarette Market. *Review of Industrial Organization*, 28.

Tegene, A., 1991. Kalman filter and the demand for cigarettes. *Applied Economics*, 23, 1175-1182.

Tobacco Board, Various years. *Annual Report*.

Tobacco Institute of South Africa, 2004. *Newsletter* , 1(3). Available at: www.tobaccosa.co.za.

Tobacco Institute of South Africa, 2008. *Presentation to Botswana Unified Revenue Service*. 8 April 2008. Available at: www.tobaccosa.co.za.

Tobacco Institute of South Africa, 2006. *Presentation to Vaalwater Main Tobacco Study Group*. 7 June 2006. Available at: www.tobaccosa.co.za.

Todaro, M. & Smith, S., 2003. *Development Economics*. Pearson.

Tremblay, C. & Tremblay, V., 1995. The impact of cigarette advertising on consumer surplus, profit, and social welfare. *Contemporary Economic Policy*, 13, 113-124.

Tremblay, C. & Tremblay, V., 1999. Re-interpreting the effect of an advertising ban on cigarette smoking. *International Journal of Advertising*, 18.

Union Bank of Switzerland, *Prices and Earnings: A comparison of purchasing power around the globe*, Available at: http://www.ubs.com/1/e/ubs_ch/wealth_mgmt_ch/research.html.

United States Bureau of Labor Statistics, Various years. *Consumer Price Index*, Washington DC: United States Department of Labor.

United States Department of Agriculture, 2007. *Tobacco Outlook*. Washington: United States Department of Agriculture. TBS-263, 24 October 2007.

United States Department of Health and Human Services, 1994. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General*. Atlanta: Unites States Department of Health and Human Services.

United States Department of Health and Human Services, 1989. *The health consequences of smoking: 25 years of progress. A report of the Surgeon General*. Rockville: United States Department of Health and Human Services.

United States Department of Health and Welfare, Public Health Service, 1964. *Smoking and Health: report of the advisory committee to the Surgeon General of the United States Public Health Service*. Washington DC: United States Department of Health and Welfare, Public Health Service.

Valdés, B., 1993. Cigarette consumption in Spain: Empirical evidence and implications for public health policy. *Applied Economics*, 25, 149-156.

Van Walbeek, C.P., 1996. Excise taxes on tobacco: How much scope does the government have? *South African Journal of Economics*, 64(1), 20-42.

Van Walbeek, C.P., 2005. *The Economics of Tobacco Control in South Africa.* Cape Town: University of Cape Town.

Van Walbeek, C.P., 2006. Industry responses to the tobacco excise tax increases in South Africa. *South African Journal of Economics*, 74(1), 110-122.

Van Walbeek, C.P., 2010. *The need for a new excise tax model for cigarettes in South Africa*, Cape Town: School of Economics, University of Cape Town.

Van Walbeek, C.P., Lewis-Fuller, E., Lalta, S. & Barnett, J., 2005. *The economics of tobacco control in Jamaica: Will the pursuit of public health place a fiscal burden on the government?* Cape Town: School of Economics, University of Cape Town.

Von Lampe, K., 2005. Explaining the emergence of the cigarette black market in Germany. In: van Duyne, P.C., von Lampe, K., van Dijck, M. & Newell, J.L. (eds.) *The organised crime economy: managing crime markets in Europe*. Nijmegen: Wolf Legal.

Warner, K.E., 1978. Possible increases in the underreporting of cigarette consumption. *Journal of the American Statistical Association*, 73, 362.

Warner, K.E., 2006. Tobacco Policy Research: Insights and Contributions to Public Health Policy. In: Warner, K.E. (ed.) *Tobacco Control Policy*. San Fransisco: Jossey-Bass.

Wilcox, G., Tharp, M. & Yang, K., 1994. Cigarette advertising and consumption in South Korea, 1988-1992. *International Journal of Advertising*, 13, 333-346.

Wilcox, G. & Vacker, B., 1992. Cigarette advertising and consumption in the United States. *International Journal of Advertising*, 11, 269-278.

Witt, S. & Pass, C., 1981. The effects of health warnings and advertising on the demand for cigarettes. *Scottish Journal of Political Economy*, 28(1), 86-91.

World Bank, 1999. *Curbing the Epidemic: Governments and the Economics of Tobacco Control*. Washington DC: World Bank.

World Bank, 2006. World Bank Country Classification. Available at: http://data.worldbank.org/about/country-classifications.

World Bank, World Development Indicators. Available at: http://data.worldbank.org/indicator

World Health Organization, 1998. *Guidelines for controlling and monitoring the tobacco epidemic*. Geneva: World Health Organization.

World Health Organization, 2008. *WHO Report in the Global Tobacco Epidemic, 2008: The MPOWER Package*. Geneva: World Health Organization.

World Health Organization, 2009. *Report on the Global Tobacco Epidemic, 2009: The MPOWER Package*. Geneva: World Health Organization.

World Health Organization, 2010. *WHO Technical Manual on Tobacco Tax Administration*. Geneva: World Health Organization.

Young, T., The demand for cigarettes: alternative specifications of Fujii's model. *Applied Economics*, 15, 203-211.

Yuclet, U. & Kaynak, E., 1984. A study of measuring influence of advertising and forecasting cigarette sales. *Managerial and Decision Economics*, 5, 213-218.

Zar, J., 1972. Significance testing of the Spearman rank correlation coefficient. *Journal of the American Statistical Association*, 67(339), 578-580.