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Economics of Tobacco Control Paper No. 11

Higher Tobacco Prices and Taxes in South-East Asia

An Effective Tool to Reduce Tobacco Use, Save Lives and Generate Revenue

G. Emmanuel Guindon, Anne-Marie Perucic and David Boisclair

October 2003

Tobacco Free Initiative
World Health Organization

HNP
HEALTH, NUTRITION, AND POPULATION
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Health, Nutrition and Population (HNP) Discussion Paper

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ECONOMICS OF TOBACCO CONTROL PAPER NO. 11

HIGHER TOBACCO PRICES AND TAXES IN SOUTH-EAST ASIA

An Effective Tool to Reduce Tobacco Use, Save Lives and Generate Revenue

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Paper prepared for South-East Asia Regional Office (SEARO) of the World Health Organization. Presented at a meeting on the Economics of Tobacco Control in the South-East Asia Region in Jakarta, Indonesia, December 3-4, 2003.

Abstract: This report summarises the health consequences and costs associated with tobacco use. It reviews price trends for tobacco products in Bangladesh, India, Indonesia, Nepal, Thailand and Sri Lanka. It reports trends in government tobacco tax revenues and how tobacco products are currently taxed in these countries, and in Maldives and Myanmar. The third section examines the demand for tobacco products in south-east Asian countries. A literature review on the demand for tobacco products in developing countries is followed by new analysis using time series and household-level data. The revenue-generating potential of tobacco taxes in south-east Asian countries is discussed. Finally, the report discusses contraband trade in tobacco products in South-East Asia, with emphasis on the industry's alleged role in smuggling.

Keywords: tobacco, smoking, economics of tobacco, tobacco tax, nicotine, cigarette, cigarette tax, cigarette price, demand, consumption, price elasticity, tobacco tax revenue, tax incidence, earmarking, kretek, bidi, gutka, tobacco control, tobacco policy, smuggling, counterfeit, contraband, Bangladesh, India, Indonesia, Maldives, Myanmar, Nepal, Thailand, Sri Lanka, South-East Asia, FCTC, Framework Convention on Tobacco Control

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NOTE FROM THE REGIONAL DIRECTOR
OFFICE FOR SOUTH-EAST ASIA, WORLD HEALTH ORGANIZATION

The trend in tobacco consumption in many developing countries is worrying. This is not only because of the millions of deaths and related suffering that it involves, but also due to its negative impact on economic development. Experiences from many countries have shown that cost effective tobacco control measures can be taken that could bring net economic gains for the country. Proven, cost-effective measures include: public education and information; a ban on tobacco advertising; tobacco smuggling deterrence and increased tobacco taxes. All these measures can be incorporated in national anti-tobacco legislation. Studies and research from countries around the world have revealed that an increase in tax on tobacco products is perhaps the most effective tool for tobacco control, and is especially effective in reducing tobacco use among young people and people with low incomes. Higher tobacco taxes can help a country in a number of ways – by generating additional revenue, reducing tobacco use leading to less tobacco-related morbidity and mortality and reduced expenditure on treatment of tobacco-related diseases.

Effective collaboration between health and finance ministries is essential to address appropriately the economic and fiscal aspects of tobacco control. Such collaboration could ensure improved health for millions of people by protecting them and their families from the harmful effects of tobacco use.

I am confident that the findings of the study initiated by World Health Organization and World Bank will encourage the policy makers, in particular, in the health and finance ministries, to take appropriate and coordinated action for tobacco control.

10 October, 2003

Dr Uton Muchtar Rafei
Regional Director
World Health Organization
Office for South-East Asia

FOREWORD

In 1999, the World Bank published "Curbing the Epidemic: governments and the economics of tobacco control", which summarizes trends in global tobacco use and the resulting immense and growing burden of disease and premature death. In 2000, there were nearly 5 million deaths from tobacco each year, and this huge number is projected to grow to 10 million per year by 2030, given present consumption trends. Already about half of these deaths are in high-income countries, but recent and continued increases in tobacco use in the developing world is causing the tobacco-related burden to shift increasingly to low- and middle-income countries. By 2030, seven of every ten tobacco-attributable deaths will be in developing countries.

"Curbing the Epidemic" also summarizes the evidence on the set of policies and interventions that have proved to be effective and cost-effective in reducing tobacco use, in countries around the world. Tax increases that raise the price of tobacco products are the most powerful policy tool to reduce tobacco use, and the single most cost-effective intervention. They are also the most effective intervention to persuade young people to quit or not to start smoking. This is because young people, like others with low incomes, tend to be highly sensitive to price increases.

Why are these proven cost effective tobacco control measures–especially tax increases–not adopted or implemented more strongly by governments? Many governments hesitate to act decisively to reduce tobacco use, because they fear that tax increases and other tobacco control measures might harm the economy, by reducing the economic benefits their country gains from growing, processing, manufacturing, exporting and taxing tobacco. The argument that "tobacco contributes revenues, jobs and incomes" is a formidable barrier to tobacco control in many countries. Are these fears supported by the facts?

In fact, these fears turn out to be largely unfounded, when the data and evidence on the economics of tobacco and tobacco control are examined. The team of about 30 internationally recognized experts in economics, epidemiology and other relevant disciplines who contributed to the analysis presented in "Curbing the Epidemic" reviewed a large body of existing evidence, and concluded strongly that in most countries, tobacco control would not lead to a net loss of jobs and could, in many circumstances actually generate new jobs. Tax increases would increase (not decrease) total tax revenues, even if cigarette smuggling increased to some extent. Furthermore, the evidence shows that cigarette smuggling is caused at least as much by general corruption as by high tobacco product tax and price differentials, and the team recommended strongly that governments not forego the benefits of tobacco tax increases because they feared the possible impact on smuggling, but rather act to deter, detect and punish smuggling.

Much of the evidence presented and summarized in "Curbing the Epidemic" was from high income countries. But the main battleground against tobacco use is now in low- and

middle-incomes countries. If needless disease and millions of premature deaths are to be prevented, then it is crucial that developing counties raise tobacco taxes, introduce comprehensive bans on all advertising and promotion of tobacco products, ban smoking in public places, inform their citizens well about the harm that tobacco causes and the benefits of quitting, and provide advice and support to help people who smoke and chew tobacco, to quit.

In talking to policy-makers in developing countries, it became clear that there was a great need for country-specific analytic work, to provide a basis for policy making, within a sound economic framework. So the World Bank and the Tobacco Free Initiative of the World Health Organization (as well as some of the WHO regional offices and several other organizations, acting in partnership or independently) began to commission and support analysis of the economics of tobacco and tobacco control in many countries around the world.

The report presented in the Economic of Tobacco Discussion Paper makes a valuable contribution to our understanding of the issues and likely economic impact of tobacco control in a specific country setting. Our hope is that the information, analysis and recommendations will prove helpful to policy makers, and help result in stronger policies to reduce the unnecessary harm caused by tobacco use.

Joy de Beyer

Tobacco Control Coordinator
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World Bank

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[1] The project as a whole generated a series of country-specific studies, which are referred to in this paper. The data and analyses presented here were constrained by data availability, which explains the changing sample of country under study throughout the document.

1. INTRODUCTION

Increasing the price of tobacco products is arguably the most effective method of curbing the prevalence of tobacco use and reducing consumption of tobacco products. Individuals who do not use tobacco may refrain from starting, and thus avoid addiction. High prices can also induce current users to consume less tobacco or persuade them to quit, as well as deter ex-users from starting again.

Scores of econometric studies have examined the relationship between prices and tobacco use using various time series, household level and individual level datasets. The consensus that emerges is unequivocal. Higher prices are effective at reducing tobacco use, especially among the young and the poor. The World Bank reviewed the evidence in a 1999 report and concluded that a 10% increase in prices would reduce tobacco use by about 4% in developed countries and about 8% in developing countries (World Bank, 1999; Chaloupka et al., 2000). Because the proportionate change in prices would exceed the proportionate change in tobacco consumption, price increases brought about by higher taxes would cause government revenue to increase.

The first section of this report summarises very briefly the health consequences and costs associated with tobacco use. The second section examines trends in prices of selected tobacco products. It also inspects trends in government revenues from tobacco taxes and looks at how tobacco products are currently taxed. The third section examines the demand for tobacco products in South-East Asian countries. This section begins with a thorough review of the literature that pertains to the demand for tobacco products in developing countries followed by an original analysis using both time series and household-level data. The fourth section looks at the revenue-generating potential of tobacco taxes in South-East Asian countries. The fifth section discusses issues related to contraband trade in tobacco products in South-East Asia, with emphasis on the industry's alleged role in smuggling and price-fixing. The final section offers policy proposals.

2. HEALTH CONSEQUENCES, COSTS AND POVERTY

There is no longer any debate surrounding the health consequences caused by tobacco use. The use of tobacco products has been linked to more than thirty diseases including hypertension, heart disease, stroke, chronic respiratory disease, pulmonary tuberculosis and cancers of the lung, oesophagus, bladder, pancreas, mouth, pharynx and larynx (Doll 1998). In 2000, an estimated 4.9 million deaths were caused by tobacco use. Without further action, it is predicted that by 2020 the mortality burden attributable to tobacco will nearly double and approximately 70 percent of these deaths will occur in developing countries (WHO 2002). The death toll from tobacco is not limited to cigarette-smoking. Use of other tobacco products such as bidi smoking and tobacco quid chewing have been shown to play a significant role in the development of fatal diseases (Dikshit and Kanhere 2000).

Table 1 presents tobacco use attributable mortality and morbidity (expressed in disability-adjusted-life years (DALYs)) by sex in South-East Asia. In 2000, more than 1.1 million deaths and almost 15 million DALYs were caused by tobacco in South-East Asia alone, amounting to about one-fifth of the world's total tobacco mortality.

Table 1. Tobacco use attributable mortality and morbidity, by sex, 2000

	Attributable mortality ('000s)			Attributable DALYs ('000s)		
	Males	Females	Total	Males	Females	Total
South-East Asia						
Low child, low adult[a]	181	12	193	2712	180	2 892
High child, high adult[b]	785	132	917	10 474	1 621	12 095
Total	966	144	1 110	13 186	1 801	14 987
World						
Developing countries	2 079	402	2 481	28 014	4 963	32 977
Developed countries	1 814	612	2 426	20 162	5 942	26 104
Total	3 893	1 014	4 907	48 176	10 905	59 081

Source: WHO 2002

a) Low child, low adult mortality stratum: Indonesia, Sri Lanka, Thailand

b) High child, high adult mortality stratum: Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Maldives, Myanmar, Nepal

There are also serious health risks from inhaling second-hand smoke and to the babies of women who use tobacco during pregnancy. In June 2002, the International Agency for Research on Cancer confirmed that second-hand smoke is carcinogenic (IARC 2002).

In addition to its devastating health impact, tobacco use imposes financial costs on national health systems. In an extensive review of the literature, the World Bank concludes that in high-income countries (where more data are available), the overall annual cost of healthcare attributable to tobacco use is between 6 and 15 percent of total healthcare costs (World Bank 1999). The World Bank also points out that recent reviews that take account of the growing number of tobacco-attributable diseases and other factors conclude that, overall, smokers' lifetime costs in high-income countries are somewhat greater than those of non-smokers, despite their earlier deaths. Cost-of-illness studies require considerable data, and so are scarce in developing countries.

Finally, tobacco use is increasingly seen as a major contributor to poverty. The burden of disease associated with tobacco use is increasingly borne by developing countries. As seen earlier, 70 percent (up from 50 percent in 2000) of tobacco-related deaths are expected to occur in developing countries by 2020. As well, within countries, the poor and uneducated are more likely to use tobacco (Bobak et al. 2000). The share of tobacco product expenditures in all expenditures can be significant for these groups. For example, expenditures on tobacco products of the lowest income quintile households that used tobacco products amounted to 9.6 percent of all expenditures in Nepal in 2001 (Karki et al. 2003) and 4.0 percent in Myanmar in 2001 (Nyo Nyo et al. 2003). Such large figures can have serious implications for the welfare of poor families by diverting scarce resources from food and other necessities. It is thus not surprising that tobacco use has

been found to be a major contributor to malnutrition in countries such as Bangladesh and India (Efroymson et al. 2001; Shukla et al. 2002).

As if the health and poverty impacts of tobacco use were not enough, tobacco farming has been shown to have serious health consequences for farmers and workers –especially children (McBride et al. 1998; Christian Aid 2002) – and is an important contributor to deforestation (Geist 1999).

3. PRICES, TAXES AND GOVERNMENT REVENUES

The World Health Organization (WHO) and the World Bank recommend that the price of all tobacco products rise by at least 5% per year in real terms (i.e. considering inflation). Table 2 presents March 2003 price data for cigarettes and other tobacco products in local currency units (LCU) and in US dollars in order to allow for some comparison among South-East Asian countries. The US dollar figures were calculated from the cigarette price expressed in local currencies and the exchange rate at the time of the survey.

Figure 1 presents trends in the real price of tobacco products. Consumer price index (CPI) data for tobacco products were obtained from national statistical agencies or central banks and were deflated by each country's CPI for all items. Data from 1980 on were available for Bangladesh, India, Indonesia, Nepal, Sri Lanka and Thailand. Data for New Zealand, which has actively used tobacco price policy as a health instrument, are also presented to allow some comparison to a "best practice". With the exception of India and Thailand from 1988 on, real tobacco prices remained surprisingly stable (compared to New Zealand) during the 1980s and 1990s in the South-East Asian countries for which data are available. In Bangladesh, real prices increased in the early 1990s and then subsequently decreased to almost their original level. In most countries, today's real tobacco prices are somewhat similar to what they were two decades ago.

Figure 2 presents trends in the "costliness" of tobacco products. Costliness is calculated by dividing relative tobacco prices by a country's per capita gross domestic product (GDP). A falling costliness index indicates that tobacco products are becoming more affordable or less costly. The data show that tobacco products in India, Indonesia, Nepal, Sri Lanka and Thailand became about 50% more affordable during the past two decades while costliness fluctuated quite significantly in Bangladesh, although tobacco products were more affordable at the end of the 1990s than at the beginning of the 1980s.

These trends are in sharp contrast to the trends observed in New Zealand, where real prices more than tripled and affordability was considerably reduced between 1980 and 2000.

Table 2. Price of tobacco products in South-East Asia, March 2003

Country	Product type	Price per pack (20 sticks)	
		LCU	US$
Bangladesh - Dhaka	Marlboro/Benson & Hedges	55.0	0.95
India - New Delhi	Marlboro/Rothmans	59.0	1.24
	Gold Flake[a]	38.0	0.83
	Bidi –502 Pataka (per 25)[a]	4.0	0.09
	Gutka –Dil Bagh (per pouch)[a]	1.0	0.02
Indonesia - Jakarta	Dunhill/Marlboro/B&H	7 500	0.80
	White cigarette[b]	6 400-8 000	0.69-0.87
	Machine-made kretek[b]	4 000-5 400	0.43-0.58
	Hand-rolled kretek[b]	4 000-6 800	0.43-0.74
Maldives	Marlboro/ Benson & Hedges	18.0	1.42
	Montana	10.0	0.79
	Lucky Strike	8.0	0.63
Myanmar[a]	*Foreign brands*		
	Marlboro	1 350	n.a.
	555	1 500	n.a.
	Mild Seven	1 100	n.a.
	Camel	1 600	n.a.
	Domestic Brands		
	London	550	n.a.
	Vegas	350	n.a.
	Duya	190	n.a.
	Cheroots		
	Jothein	140	n.a.
	Chin The Thone Kaung	100	n.a.
	Hmone Shwe Yee	80	n.a.
Nepal	555	75.0	0.95
	Khukuri Filter	15.5	0.20
	Bidi	4.0	0.05
Sri Lanka - Colombo[a]	Benson & Hedges	170	1.75
	Bristol	130	1.34
Thailand - Bangkok	Marlboro	55.0	1.29
	Krong thip 90	35.0	0.89
	Wonder	25.0	0.58
New Zealand - Wellington	Marlboro	9.45	5.25
	Local brand	8.35	5.19

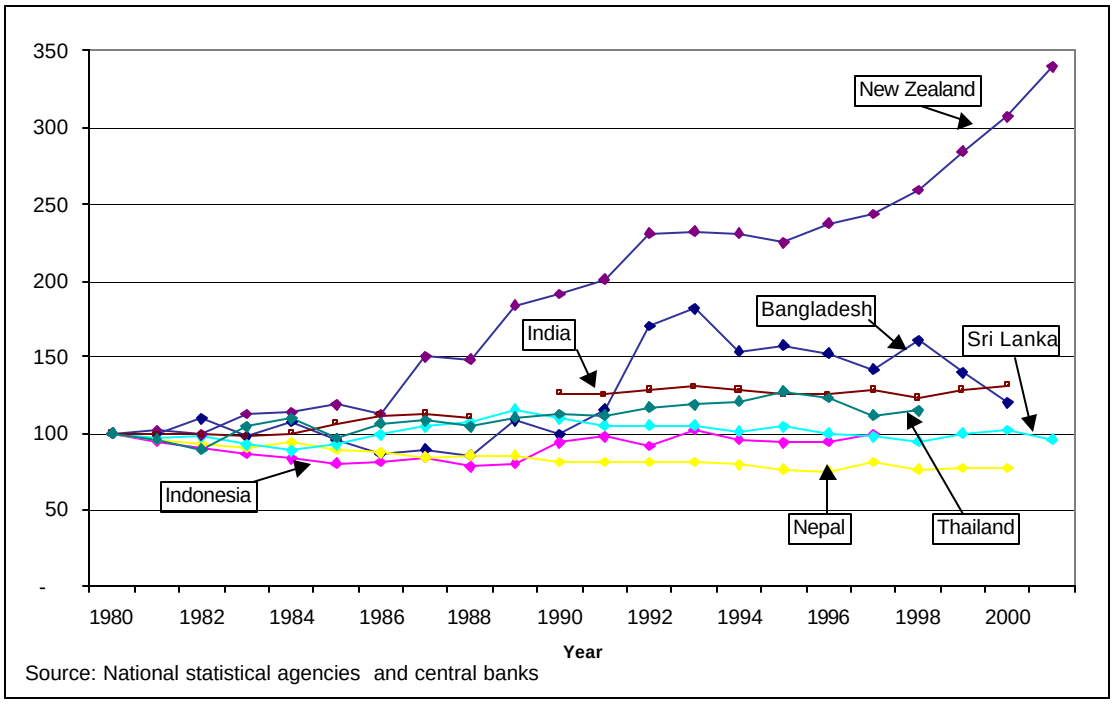
Source: EIU; USDA; WHO-SEARO; ERC

[a] August 2003

[b] Minimum retail prices as of November 2002

Figure 1. Real prices of tobacco products, 1980-2000

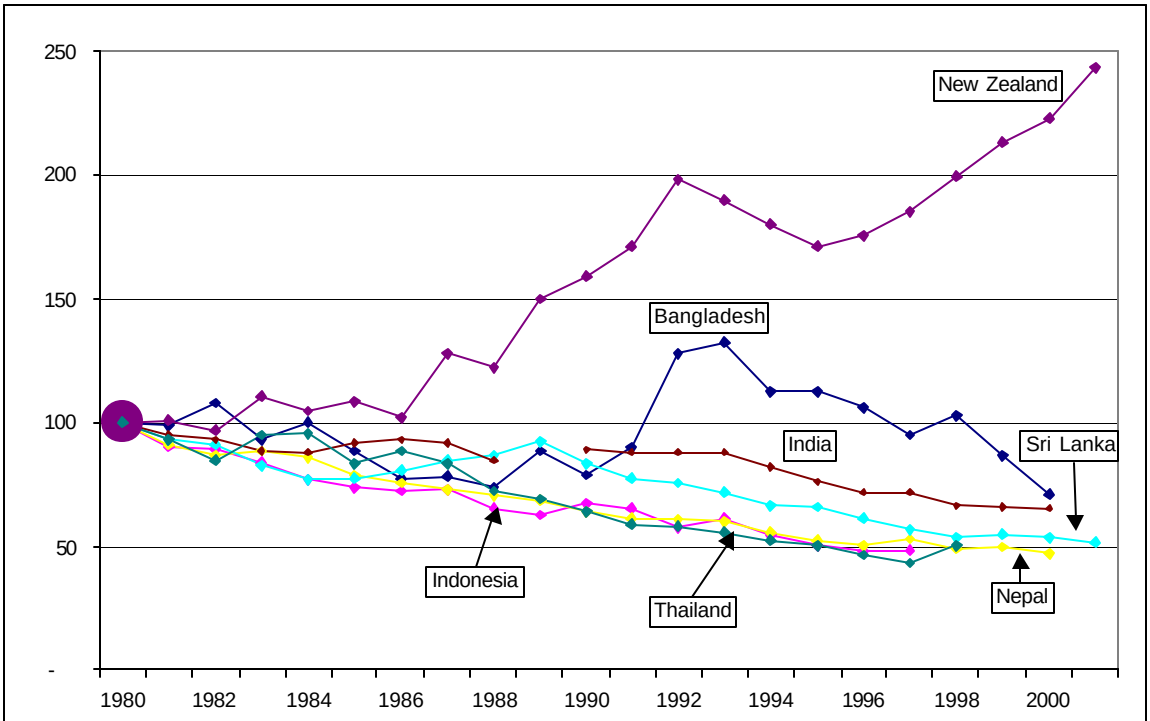
(Index 1980 = 100)



Source: National statistical agencies and central banks

Figure 2. Costliness* of tobacco products, 1980-2000

(Index 1980 = 100)



Source: National statistical agencies and central banks

3.1 Tax Incidence

There are various reasons why tobacco prices increase (decrease), such as higher (lower) production costs; greater (smaller) margins for the producers or the distributors; or higher (lower) taxes. A few governments, like that of Indonesia, influence the price of tobacco products by setting minimum prices—usually to ensure a certain stability in the revenue collected or prevent "unfair competition". Taxation is certainly the most easily manageable, flexible and powerful tool available to governments to influence tobacco product prices.

Tobacco taxes can take different forms: specific or ad valorem excises, specific or ad valorem import duties and general consumption taxes. A specific tax is based on a physical measure, such as the number of cigarettes, or their length. An ad valorem tax is levied as a percentage of a value, such as the ex-factory price. Most governments use more than one of these types of tax, sometimes yielding a complex system. The total tax burdens in the final price of tobacco products resulting from these systems vary significantly across jurisdictions, as Table 3 shows for cigarettes: even without accounting for important differences in import duties, which apply to a small proportion of the cigarettes consumed in most of these countries, the tax incidence can be as low as 8-10 percent of the retail price of domestic hand-rolled *kretek* in Indonesia and cheroots in Myanmar, and as high as 85 percent for cigarettes in Sri Lanka. In most cases, taxation is differential depending upon certain criteria: the filter or the length of the cigarette or the size of the factory (Indonesia), or the retail price (Bangladesh).

The variety of taxation formulas and levels (in terms of tax burden) might to a certain extent reflect the uniqueness of each jurisdiction, but it also highlights that a wide range of tax levels and tax mixes are available to policymakers. This report will argue that in most—if not all—cases, there is still room to increase tobacco taxes in such a way as to bring about significant public health improvements *and* increase government revenues at the same time. A comparison of the most up-to-date tax structures in Table 3 already illustrates this, as well as different means that could be used to meet public health objectives.

Table 3. Tax incidence of cigarettes in South-East Asia

Country	Date	Product	Price per pack of 20 sticks (LCU)	Specific excises per 1 000 sticks (LCU)	Ad valorem excises (% TIRSP)	VAT (% TIRSP)	Other prop. taxes (% TIRSP)	Other specific taxes per 1000 sticks (LCU)	Tax incidence (%TIRSP, excl. import duties)
Bangla-desh	June	Marlboro/B&H	55.00		55	15			70
	2003	Cigarettes	10.00-19.98		50	15			65
		Cigarettes	9.00-9.98		35	15			50
		Bidi/handmade cigarettes	n.a.		10	15			25
Indonesia	Nov	White cigarette	6 400-8 000		22-40	8.4			30-48
	2002	Machine-made kretek	4 000-5 400		22-40	8.4			30-48
		Hand-rolled kretek	4 000-6 800		0-22	8.4			8-30
Maldives	March	Marlboro/B&H	18	300[a]					33
	2003	Lucky Strike	8	300[a]					75
Myanmar	Aug	Cigarettes	190-1 600				75[b]		75
	2003	Cheroots	80-140				10[b]		10
Nepal	March	555 filter	75.00	530		10		20	25
	2003	Khurkuri filter	15.50	300		10		20	51
		Bidi	4.00	40		10			30
Sri Lanka	March	Benson & Hedges	170	5 022		20			79
	2003	Bristol	150	4 256		20			85
Thailand	May	Krong thip 90	38	45	75[c]	6.5			60
	2003	Marlboro	55	45	75[c]	6.5			40
		Wonder	25	45	75[c]	6.5			70

Source: WHO-SEARO; EIU; USDA; ERC

a) Import duties only (all tobacco products are imported).
b) Turnover tax applied only if sales exceed 240 000 kyats.
c) Ad valorem excise is applied as a % of wholesale price inclusive of excise. Incidence calculations are based on a wholesale or CIF price per pack of 6 bahts for Krongthip 90 and Marlboro and 5 bahts for Wonder.

Notes:
LCU = Local Currency Unit. TIRSP = Tax Inclusive Retail Sales Price. VAT = Value Added Tax.
Bangladesh: Excises differ by retail price (pack of 10, LCU) : 4.50 to 4.99 = 35%; 5.00 to 9.99 = 50%; > 10.00 = 55%
Indonesia: Government sets minimum prices. Excises differ depending upon factory size.
Nepal: Other excise is a Rs. 0.40 per pack earmarked cigarette tax. Excises differ by length and filter-type. Specific excises per 1 000: non-filter = Rs. 125; filter: < 70mm = Rs. 300; 71mm to 75mm = Rs. 385; 76mm to 85mm = Rs. 530; >85mm = Rs. 710
Sri Lanka: Excises differ by length. Specific excises per 1 000: < 60 mm in length = Rs. 1 555; 60 mm – 67 mm = Rs. 2 970; 67 mm – 72 mm = Rs. 4 256; 72 mm – 84 mm = Rs. 5 022; >84 mm = Rs. 5 228
Thailand: Two percent of the tax collected is earmarked for the Thai Health Promotion Foundation.

3.2 Government Revenue and Earmarking

Most governments impose some form of taxation on tobacco products. The rates and particular forms these taxes can take vary greatly from one country to another (see above), and even between sub-national jurisdictions. Their contribution to government revenues also varies greatly—even among a limited number of jurisdictions in the same WHO Region.

Table 4 shows that tobacco taxes represent 5% to 10% of total government revenues in most of the countries under study, the exceptions being the Maldives (1.7%) and Myanmar (1.3%). The figures are for the most recent years available for each country. These revenues come from varying sources: tobacco duties, general consumption taxes and import duties, as described above. The corporate taxes imposed on the tobacco industry, as well the income tax levied on the industry's workers are not directly borne by the consumer (they are not applied to the product itself) and so are not included here, except for Myanmar, where they could not be disentangled.

Table 4. Government revenue from Tobacco Products

Country	Year	Unit	Government revenue from tobacco	Total government revenue	Share of tobacco taxes
Bangladesh	2001-2002	Mn Taka	20 310	290 220	7.0%
Indonesia	2002	Mn Rupiah	22 300 000	402 054 500	5.5%
Maldives	1999	Mn Rufyiaa	36	2 053	1.7%
Myanmar	1999-2000	Mn Kyat	698	52 071	1.3%
Nepal	1998-1999	Mn Rupees	3 310	37.25	8.9%
Sri Lanka	1999	Mn rupees	20 481	195 905	10.5%
Thailand	2000	Mn Baht	37 877	746 816	5.1%

Source: National statistical agencies and central banks, WHO-SEARO country-case studies
Notes: Mn = million. For Indonesia, tobacco revenue only includes excises and the data are preliminary.

Three countries in South-East Asia earmark tobacco taxes for special programs. In India, 2 rupees per thousand manufactured beedis are earmarked under the Beedi Workers' Welfare Fund Act, 1976. This Welfare Fund is administered by the Ministry of Labour and is intended to provide housing, medical care, social security, educational and recreational facilities to workers employed in the beedi industry (Ministry of Labour, India 2003). In Nepal, a measure was adopted by the National Parliament to impose a "Health Tax" of 1 paisa per manufactured cigarette (domestically produced or imported). This health tax became effective in the fiscal year 1993/94 and was subsequently increased to 2 paisa in 1994/95. The revenues generated by this tax are earmarked for cancer control (Karki et al. 2003) but have been badly eroded by inflation. In 2001, the government of Thailand passed the Health Promotion Foundation Act which set up the Thai Health Promotion Foundation (ThaiHealth). ThaiHealth receives 2 percent of the total national tax revenue from alcohol and tobacco products (ThaiHealth 2003).

4. THE DEMAND FOR TOBACCO PRODUCTS IN SOUTH-EAST ASIA

This section presents evidence on the impact of tobacco prices on the demand for tobacco products in the WHO South-East Asia Region. First, published and unpublished country studies from South-East Asia are briefly reviewed. Second, new country and regional analyses are presented.

Appendix 1 provides a thorough review of the existing literature on cigarette price elasticity in the developing world.[2] It demonstrates that since the World Bank reviewed the literature on tobacco prices and taxes in 1999 (World Bank 1999), considerable research has been accomplished. Although the studies reviewed in appendix 1 differ in their methods and datasets used, all studies found that higher prices led to lower consumption levels. Long-run elasticities ranged from –0.4 to –1.5. In addition, results from studies using household-level data indicate that poorer households are more responsive to prices than wealthier households. Finally, this body of evidence suggests that income is positively related to tobacco consumption in the developing world, especially among poorer households.

4.1 Existing evidence in South-East Asia

Several studies have examined the relationship between the consumption of tobacco products and tobacco prices in South-East Asia. Appendix 2 summarises their methods and results.

Djutaharta et al. (2002) used two Indonesian time series datasets. First, annual data from 1970 to 2001 were used in a model that included, in addition to price and income, a time trend, a dummy variable to control for the economic crisis that shook Indonesia in 1997 and a dummy variable to proxy the inclusion of a health warning on cigarette packs. The model was estimated twice. The model was first estimated using data prior to the economic crisis (1970–96), then the whole dataset was used. The former yielded price and income elasticities of –0.57 and 0.46 while the latter yielded a somewhat smaller price elasticity and very similar income elasticity (–0.35 and 0.47). Second, a model using monthly data was estimated and produced similar results. The price elasticity was –0.32 while the income elasticity was 0.14. All elasticities were found to be significant with the exception of the income elasticity in the monthly data estimation.

Arunatilake (2002) used a conventional demand model with 1999–2000 household level data from Sri Lanka. Variables for sex, age, occupation, income, education and location of household were included and allowed the estimation of specific elasticities. The price elasticity over the entire income range was –0.53, and was significant. The price elasticity among the poorest two quintiles were –0.68 and –0.29 and significant. Income was found to be positively associated with tobacco consumption. The expenditure elasticity of the

[2] It should be noted that the review of the literature is an inventory of existing studies and not a critical review.

overall sample was 0.05 but in the three middle expenditure quintiles income had a negative relationship to conditional demand. In these quintiles, households would reduce their consumption of tobacco with an increase in per capita income.

Arunatilake (2001) used aggregate monthly data ranging from 1999 to 2000 from Sri Lanka to estimate price and income elasticities. The author used a static model as well as a myopic addiction demand model and a rational addiction model. Results from these different methods of estimations show a price elasticity ranging from –0.227 to –0.908 and an income elasticity ranging from 0.182 to 0.780. These results showed consistent signs in the values but they were not all statistically significant.

Adioetomo et al. (2001) used household level data from the 1999 Indonesia national socio-economic survey to estimate price and income elasticities. The conditional price elasticity (elasticity calculated only for people who use tobacco products) over the entire income range was found to be –0.60 and significant, while the smoking participation elasticity (the effect of price on the decision to smoke or not) was not found to be significant. Total price elasticity over the entire sample was estimated at –0.61 and, as expected, price elasticities decreased (in absolute terms) with income. That is, poorer households were found to be more responsive to changes in prices. Income was found to be positively associated with spending on tobacco products. Income was found to affect both smoking participation and the quantity consumed. Total income elasticity was 0.76 and decreased (in absolute terms) with income.

Supakorn (1993) used a log–linear model and national level data to analyse aggregate tobacco consumption in Thailand. Estimates of the price and income elasticity of demand for tobacco products were –0.67 and 0.36, respectively.

Isra (1995) used a linear expenditure system and Thailand household level data from 1988 to analyse demand for tobacco products. The study divided smokers by their level of per capita expenditure on tobacco products. Results show that, on average, the price and expenditure elasticities of demand for tobacco products were –0.09 and 0.14, respectively. Results of another study, Suchada (1997), came to a similar conclusion.

Isra et al. (2003) used a linear expenditure system and household level data from a 2000 Thailand socioeconomic survey. Price and income were found to affect significantly the demand for tobacco products. Price and income elasticities were –0.39 and 0.70, respectively. Urban smokers and, notably, poorer ones, were found to be more responsive to prices than their rural counterparts. As well, younger tobacco users were found to be more responsive to changes in price.

Karki et al. (2003) used household data from the 2000 Nepal smoking behaviour survey to estimate price and income elasticities. Results show that the conditional price elasticity of demand was significant and equal to –0.42 for the whole age and income ranges. The total price elasticity was –0.88 and significantly different from zero. The price elasticity was also estimated by income groups and age groups. Price elasticity (in absolute terms) decreased as age increased, except for the oldest group which also seemed to be very

sensitive to price changes. Results also showed that households from the lowest income group were more sensitive than households from the highest income group to changes in prices. The conditional income elasticity for the whole sample of smokers was low (0.11) but significant, whereas the total income elasticity was equal to 0.18 but not significant.

Nyo Nyo et al. (2003) estimated the price and income elasticities of demand using data from a household survey performed in 2000 in Myanmar. Estimates show a very high sensitivity to price changes. The conditional price elasticity over the whole income and region span was –0.34 and significant while the total price elasticity was –1.62 and significant. The price elasticity in terms of income groups did not show an important difference in behaviour among the groups but price elasticity decreased (in absolute terms) with greater age. The price elasticity was also calculated by geographical region. Households living in rural areas seemed more sensitive to price changes than households living in urban areas. The income elasticity was not found to be significant.

4.2 New time series and panel analyses

Data and methods

Annual per capita tobacco or cigarette consumption, price and income data are derived from various sources including national statistical agencies and ministries of finance, the International Monetary Fund (IMF), the World Bank, the United Nations Statistical Division, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Population Division, the Asian Development Bank and the Economist Intelligence Unit (EIU). See Appendix 3 for details.

In order to test the hypothesis that price and income affect the demand for tobacco products, two demand specifications were used. First, a conventional demand model was estimated, in which the consumption of tobacco products is a function of the real price of cigarettes and real income. Second, because tobacco consumption is addictive, a myopic addiction demand model was estimated in which the dependent variable, current tobacco/cigarette consumption, is lagged one year and used as an independent variable in the model.[3]

Conventional and myopic addiction demand models were estimated individually for Bangladesh, Indonesia, Nepal, Sri Lanka and Thailand[4]. In the Thailand model, dummy variables were included to control for the economic crisis that shook the Thai economy in 1998 and the introduction of a comprehensive package of tobacco control policies in 1992.

[3] See Appendix 4 for a description of statistical tests performed on the data to avoid problems of spurious regressions and possible mis-specification, and the results of these tests.

[4] Preliminary estimation of a "rational addiction" model yielded insignificant coefficients for many countries. Chaloupka and Warner (2001) noted that using a small number of observations may lead to imprecise estimation of the rational addiction model. For this reason, further analysis using the rational addiction model was not attempted.

In order to obtain regional price and income elasticity estimates, data for all the countries were pooled together with limited data from the Maldives and Myanmar and here again, conventional and myopic addiction demand models were both estimated[5].

Results

For all countries, higher prices are associated with lower consumption of tobacco products. Price elasticities are significant in Indonesia, Sri Lanka and Thailand. Short-run and long-run elasticities cluster around –0.50 and –0.70 respectively. That is, a 10% increase in the real price of tobacco products would lead to a decrease in consumption of about 5% in the short-run and 7% in the long-run.

Cigarette consumption is found to be positively associated with income in Indonesia and Thailand but inversely related to income in Sri Lanka. Results were insignificant for Bangladesh and Nepal. Data limitations may explain the results for Nepal and Bangladesh. In Bangladesh for example, cigarette consumption makes up only a small portion of the overall consumption of tobacco products. As expected, the two dummies included in the Thailand analysis have negative signs. That is, both the economic crisis and comprehensive tobacco control policies are inversely related to tobacco use. However, only the economic crisis dummy is significant. The tobacco control variable may well capture some of the counteracting effect of the GATT decision requiring Thailand to allow foreign tobacco companies to enter the Thai market. Detailed results of the time series analyses are provided in Appendix 5.

Table 5 presents the results of the regional analysis, for which various specifications and estimation methods were used (see Appendix 4 for details on these methods). As expected, prices are found to be inversely related to tobacco consumption. The estimation using the conventional model yields price elasticities ranging from about –0.60 to –0.90 while the myopic addiction models yields short-run elasticities ranging from –0.10 to –0.65 and long-run elasticities from –0.80 to –1.40. Prices are found to be significant in all 2SLS estimations. Short-run price elasticity estimates range from –0.17 to –0.78, clustering at around –0.74, while long-run price elasticities range from –0.4 to –1.21. As expected, income is found to positively contribute to the consumption of tobacco products in South-East Asia.

These results are in agreement with the body of evidence reviewed above. That is, increasing the price of tobacco products can significantly reduce tobacco consumption and hence bring about significant improvements in health. As well, income is found to be positively associated with tobacco consumption. In other words, the predicted rise in income in South-East Asia will likely lead to higher tobacco consumption levels, other things remaining the same.

[5] Baltagi and Levin (1986) have argued that the best approach to obtaining reliable cigarette price and income elasticity estimates is to pool the data to get a panel. In their cigarette demand study of the United States, they point out that cross-sectional studies cannot control for State-specific effects and that time series studies cannot control for unobservable taste changes occurring over time. Some of the models estimated and presented here account for these two effects by including country-specific (D_i) and period-specific (D_t) dummies.

Table 5. The demand for cigarettes in South-East Asia: panel analyses

	Constant	*ln* $C_{i,t-1}$	*ln* $P_{i,t}$	*ln* $Y_{i,t}$	*Long-run price elasticity*	*Long-run income elasticity*
Conventional model						
OLS	3.475*** (0.759)	-	-0.863*** (0.071)	0.439*** (0.101)	-	-
OLS + D_i	4.575** (0.471)	-	-0.776*** (0.109)	0.284*** (0.063)	-	-
OLS + D_t	2.235** (0.921)	-	-0.811*** (0.079)	0.599*** (0.122)	-	-
OLS + D_i + D_t	-0.472 (1.049)	-	-0.69*** (0.114)	0.986*** (0.162)	-	-
GLS + D_i	2.619*** (0.258)	-	-0.751*** (0.034)	0.549*** (0.035)	-	-
GLS + D_i + D_t	1.3*** (0.388)	-	-0.74*** (0.043)	0.667*** (0.045)	-	-
GLS - AR(1)	2.04*** (0.499)	-	-0.596*** (0.054)	0.621*** (0.067)	-	-
Myopic addiction model						
OLS	0.142 (0.302)	0.902*** (0.031)	-0.136*** (0.036)	0.073* (0.039)	-1.388	0.745
OLS + D_i	2.617*** (0.431)	0.432*** (0.044)	-0.633*** (0.083)	0.177*** (0.049)	-1.114	0.312
OLS + D_t	0.036 (0.337)	0.916*** (0.034)	-0.114*** (0.038)	0.073 (0.048)	-1.357	0.869
OLS + D_i + D_t	0.395 (0.862)	0.392*** (0.05)	-0.642*** (0.092)	0.552*** (0.139)	-1.056	0.908
GLS + D_i	0.248* (0.146)	0.911*** (0.035)	-0.085*** (0.02)	0.051** (0.026)	-0.956	0.573
GLS + D_i + D_t	-0.033 (0.187)	0.904*** (0.041)	-0.079*** (0.028)	0.079** (0.039)	-0.823	0.823
GLS - AR(1)	-0.334** (0.165)	0.911*** (0.033)	-0.106*** (0.031)	0.039* (0.021)	-1.191	0.438
2SLS	0.276 (0.47)	0.864*** (0.051)	-0.165*** (0.057)	0.089 (0.061)	-1.213	0.65
2SLS + D_i	3.652*** (0.542)	0.24*** (0.05)	-0.778*** (0.105)	0.211*** (0.063)	-1.024	0.278
2SLS + D_i + D_t	0.678 (1.113)	0.199*** (0.055)	-0.743*** (0.114)	0.696*** (0.176)	-0.928	0.869
FD2SLS	-0.014 (0.013)	0.358*** (0.066)	-0.742*** (0.092)	0.606*** (0.067)	-1.156	0.944
FD2SLS + D_i	-0.014 (0.013)	0.371*** (0.071)	-0.735*** (0.095)	0.621*** (0.071)	-1.169	0.987
FD2SLS + D_i + D_t	1.219*** (0.227)	0.397*** (0.073)	-0.243* (0.132)	1.034*** (0.107)	-0.403	1.715

***, ** and * : Statistically significant at the 1%, 5% and 10% levels, respectively.

5. TOBACCO TAXES AS A REVENUE-GENERATING TOOL

As demonstrated earlier, higher prices will lead to reduced consumption and, hence, better health. This alone should justify tobacco tax increases.

However, in addition to the health benefits they create, tax increases also generate additional government revenue. This has been seen in countries around the world and is contrary to the misconception that lower consumption will result in lower tax revenue. Price increases do decrease consumption, but these decreases are proportionately less than the price increases. Therefore higher taxes per pack generate larger total revenues, even on a somewhat reduced sales volume.

For consumption to decline in excess of the rate of increase in tax, tobacco users would have to show astonishingly high price sensitivity (Warner, 2000). As Warner points out, "for all politically feasible tax increases, revenue increases would be expected in nearly every country in the world, at least for some period of years".

Secondly, because taxes are only a proportion of the price, government revenues increase while consumption drops. For example, if tax constitutes 50% of the price of a pack of cigarettes, increasing the tax rate by 100% would increase price by 50%. If price elasticity were –0.5, this would imply a 25% decrease in consumption. Thus twice as much tax per pack would be collected on a sales volume that would fall by 25%.

In order to show the revenue-generating potential of tobacco taxes in South-East Asia, a scenario that simulates the effect of a 5% annual increase in real prices is contrasted to a baseline scenario of constant real prices. From the panel results presented earlier, conservative price and income elasticity estimates of –0.75 and 0.5 are used. It is further assumed that the entire 5% real price increase is driven entirely by higher tax rates and that real GDP per capita in the region would grow at an annual rate of 4%. This is a fairly conservative estimate in light of recent detailed projections published by the IMF (IMF, 2002). These assumptions are applied evenly to all countries. Government revenues from tobacco taxes are simulated to 2010 from a 2000 baseline for Bangladesh, Indonesia and Thailand, a 1999 baseline for Sri Lanka and the Maldives and a 1998 baseline for Nepal. All other factors that may influence the consumption of tobacco products are assumed to remain the same. The sensitivity of the above assumptions is examined using Thailand data and presented in Appendix 6.

Table 6 presents the results of the simulation. The data shown in the first two columns represent projected per capita consumption for the baseline (real prices constant) and 5% annual real price increase scenarios. The next two columns show total annual government revenue under both scenarios. The last four columns show the revenue gains (ie. the difference in revenue between the constant prices scenario and the 5% real increase scenario) in million LCU and US$. These results suggest quite clearly that following

WHO's recommendation to increase tobacco prices by 5% in real terms annually would reduce tobacco consumption and significantly increase government revenue. It is important to note that in most countries, nominal prices failed even to match overall inflation. In other words, the baseline scenario of constant real prices over the next decade would be an improvement over past pricing and taxing policies in many South-East Asian countries.

Table 6. Potential revenue from tobacco taxes

		Per capita consumption		Total revenue (million LCU)		Revenue gain (million LCU)		Revenue gain (million US$)	
		Constant prices	5% real increase	Constant prices	5% real increase	Annual	Cumulative*	Annual	Cumulative*
Bangladesh	Baseline	233		16 897					
	2005	262	209	19 028	23 151	4 122	14 113	88	302
	2010	289	192	21 009	29 120	8 111	46 465	174	994
Indonesia	Baseline	1 407		13 777 558					
	2005	1 585	1 266	15 515 768	22 929 547	7 413 778	25 513 453	740	2 548
	2010	1 750	1 159	17 130 662	29 929 547	14 363 217	83 114 737	1 434	8 300
Maldives	Baseline	2 143		36					
	2005	2 462	1 894	41	66	25	95	2	8
	2010	2 718	1 734	46	91	46	280	4	24
Nepal	Baseline	574		3 310					
	2005	673	499	3 878	6 305	2 426	9 803	39	158
	2010	743	457	4 282	8 457	4 259	27 265	69	440
Sri Lanka	Baseline	1 362		20 297					
	2005	1 565	1 204	23 315	27 421	2 426	9 803	64	238
	2010	1 727	1 102	25 742	33 395	4 259	27 265	126	725
Thailand	Baseline	846		37 877					
	2005	953	761	42 656	60 167	17 511	60 220	423	1 456
	2010	1 052	697	47 095	81 093	33 998	196 461	822	4 750

Source: Authors' estimates
* From 2000

The cumulative revenue gains from increasing tobacco prices by 5% in real terms annually are significant. For example, by 2010 this policy could bring in an extra US$ 440 million in Nepal, US$ 725 million in Sri Lanka and US$ 994 million in Bangladesh.

6. SMUGGLING, PRICE FIXING AND TOBACCO INDUSTRY'S CONDUCT

The effectiveness and the cost-effectiveness of taxes on tobacco products is well understood within the tobacco industry. Consistent with the evidence and analysis compiled by the World Bank, the International Monetary Fund (IMF) and the World Health Organization (WHO), the tobacco industry realises the impact that increases in taxes might have on its sales volume. Two previously secret internal Philip Morris documents made available through litigation could not be clearer:

> "Jeffrey Harris of MIT calculated that … the [US] 1982-83 round of price increases caused two million adults to quit smoking and prevented 600,000 teenagers from starting to smoke … We don't need to have that happen again" (Philip Morris 1987).

> "Of all the concerns, there is one—taxation—that alarms us the most. While marketing restrictions and public [sic] and passive smoking do depress volume, in our experience taxation depresses it much more severely. Our concern for taxation is, therefore, central to our thinking about smoking and health" (Philip Morris 1985).

The following statement by Vincent Allilaire, credit analyst at Standard & Poor's, one of the leading credit rating agencies, shows the extent of the consensus that price increases reduce consumption:

> "Regulation, however, affects directly the price of tobacco products, the most powerful driver of consumption" (TJI 2003)

In order to discourage governments from using fiscal policy to improve health and increase their revenues, the tobacco industry usually argues that increasing tobacco taxes will inevitably lead to the smuggling of tobacco products, especially cigarettes. Differences in prices across countries, it argues, will lead to smuggling.

In some countries such as Canada, misinformation campaigns and heavy lobbying persuaded governments to decrease their tobacco taxes. As expected, but contrary to the tobacco industry allegations, government revenue from tobacco fell after the tax cut and consumption increased, especially among youth (Warner 2000).

Two important points are essential to explode the myth that higher taxes will simply create a larger contraband market. First, there is no independent empirical evidence that supports the smuggling myth. It is basic economics to state that price differentials caused by differences in taxes create an incentive to smuggle. However, there is little if any factual evidence to link price differentials with increased smuggling (Warner 2000). The World Bank emphasizes that smuggling is determined by much more than price alone. In a study that aimed to shed some light on the determinants of cigarette smuggling, the World Bank observed that the level of cigarette smuggling was closely related to

corruption levels as measured by Transparency International's Index (World Bank 1999). Moreover, the econometric evidence reviewed above shows very clearly that price is a significant determinant of tobacco consumption. Although most time series data analyses do not control for changes in smuggling, household level analyses implicitly control for smuggling as they are based on survey data that captures total consumption, whether purchased in the legal or black market.

Second, previously secret internal documents that show the tobacco industry's hand in organising and facilitating the contraband flows of their international brands are accumulating at an astonishing rate. The Guardian and the International Consortium of Investigative Journalists released damning documents in early 2000 documenting how BAT secretly encouraged tax evasion and cigarette smuggling. In April 2001, the Campaign for Tobacco Free Kids (CTFK), a US non-governmental Organization (NGO), released a report along side numerous documents that detailed the involvement of several multinational tobacco companies in cigarette smuggling. Country examples include BAT in Cameroon, Philip Morris in Colombia, BAT in Bangladesh, and RJR in Spain. These and other revelations have led to several legal actions against multinational tobacco companies. The European Union and ten of its member states, as well as Canada, Colombia, Ecuador, Honduras and Belize all have filed cases against multinational tobacco companies.[6]

Estimating the size of a country's tobacco contraband market is at best extremely difficult and at worst downright impossible. Official statistics do not take into account the smuggling of goods, survey data are questionable because respondents are unlikely to reveal their true consumption of illegal products, and finally data originating from tobacco companies must be treated with great care as tobacco companies have an incentive to mislead the public and policymakers. The following provides a very brief overview of what is known about the tobacco underground market in South-East Asian countries.

Bangladesh. Evidence uncovered by the Campaign for Tobacco Free Kids suggests that smuggling is quite significant in Bangladesh. BAT's own internal document show that large volumes of BAT cigarettes have been smuggled into Bangladesh for many years. BAT's interest in the Bangladesh market is probably due to its large population, a liking for British-style cigarettes and its geographic proximity to India, the largest South-East Asian market (CTFK 2001). It is not known what volume of the smuggled cigarettes are sold and consumed within Bangladesh and what volume is just in transit. ERC, a UK market research firm estimates that cigarette smuggling is not very prevalent in Bangladesh (ERC 2001).

India. Little information is available with regards to the smuggling of cigarettes in India. Some trade reports suggest that about 20 percent of the market consists of contraband cigarettes (ERC 2001). Previously secret internal company documents suggest that

[6] For more details please see Action on Smoking and Health, UK (ASH) extensive coverage of smuggling legal actions against tobacco companies at http://www.ash.org.uk/html/smuggling/html/ricomenu.html

Bangladesh and indirectly Myanmar are the main supply markets of contraband cigarettes (CTFK 2001).

Indonesia. The Indonesia tobacco market is dominated by clove cigarettes, known as kreteks. In 2000, kreteks accounted for almost 90 percent of the cigarette market in Indonesia (ERC 2001). Partly because of the market dominance of clove cigarettes and the geographic characteristics of Indonesia – an archipelago of 6 000 inhabited islands (17 000 in total) – smuggling is not an important factor in the tobacco market.

Maldives. Because of Maldives' small population and its geographic characteristics – an archipelago distant from major markets – smuggling is insignificant in the Maldives.

Myanmar. Considerable evidence – produced by CTFK and ASH UK (CTFK 2001 and ASH 2000) – suggests that Myanmar has been used by BAT to transit cigarettes illegally into Bangladesh. It is not known how many of the smuggled cigarettes are sold and consumed within Myanmar.

Nepal. Little information is available with regards to cigarette smuggling in Nepal. Some media reports suggest that since the introduction of VAT in 1997 smuggling of manufactured goods across the border between India and Nepal is on the increase (Karki et al. 2003).

Sri Lanka. Prior to 2000, the contraband share of the cigarette market was believed to be negligible. The Ceylon Tobacco Company (BAT) contends that more than 16 percent of cigarettes are now illegally sold in Sri Lanka. According to BAT, this rise is due to the emergence of 'white cigarettes' (both filter and plain). These 'white cigarettes' are of low quality, and of similar appearance to bidis. BAT's estimates are primarily based on toilet paper import data as it believes that the paper used for 'white cigarettes' is being imported as toilet paper, in order to avoid customs duties. As mentioned above, data originating from multinational tobacco companies should be treated with a good dose of scepticism.

Thailand. Although not non-existent, the market share of contraband cigarettes is thought not to be high. The geography of the country, large borders with Myanmar, Laos and Cambodia and a lengthy coastline, renders smuggling control difficult. ERC estimates that the Thai contraband market represents about 6 to 8 percent of cigarette consumption (ERC 2001). A recent survey found that about 15 percent of packs purchased by Thai smokers carried health warnings either in English or in non-Thai languages. The absence of the official Thai health warning suggests that these packs were illegally sold in Thailand (Isra et al. 2003).

In 2001, The Economist, a British news magazine, uncovered evidence that tobacco multinationals colluded to fix prices in as many as 23 countries in Africa, Asia, the Middle East, Latin America and Europe. Of particular interest is a document discovered by The Economist that pertains to the Thai Market dated 1 March 1991, just after the GATT required Thailand to open its market to imported cigarettes. The memo indicates

that Philip Morris and RJR proposed to enter the Thai market at 40 baht and "continue with transit [industry jargon for smuggling] to supply demand." The memo then explains that the rationale for entering the Thai market at such a high price level is "to demonstrate that the legal business will be minimal". It appears that multinational tobacco companies were not only colluding to fix prices to raise their profit margins but also to keep initial legal sales volumes low in order to avoid the implementation of strong tobacco control policies (The Economist 2001).

7. POLICY IMPLICATIONS

Increase taxes on all tobacco products

The literature review and original analyses presented above provide more than sufficient evidence that higher prices lead to lower consumption of tobacco products and hence better health. **Tax rates should be increased so that the prices of all tobacco products increase by at least 5 percent in real terms every year** as recommended by the World Health Organization and the World Bank. It is important to increase the price of all tobacco products uniformly so as not to encourage substitution.

Strengthen national and local tobacco control measures

An array of cost-effective interventions exist to curb tobacco use and improve population health outcomes. Recent analyses and reviews by the World Health Organization (WHO 2002) and the World Bank (World Bank 1999) identify a package of interventions including real price increases, comprehensive advertising and sponsorship bans, clean indoor air laws in public places, information dissemination through health warning labels and counter-advertising and treatment for tobacco dependence. Regional, national and local authorities should implement comprehensive tobacco control measures to address the current and future health consequences of tobacco use.

Earmark tobacco tax revenues

The World Health Organization recommends earmarking a small portion of the total national tax revenue on tobacco products to fund health promotion initiatives including tobacco control programs. Earmarked funds can also be used for programs that will ease the transition away from tobacco activities for poor tobacco farmers and workers, whose livelihoods may be affected by reduced consumption.

Strengthen research, monitoring and evaluation

Current knowledge on the health consequences of tobacco use and on effectiveness and cost-effectiveness of tobacco control measures is sound and comprehensive. That is not to say, however, that gaps do not exist. Research on the tobacco industry's conduct, malnutrition induced by tobacco use, child labor in tobacco cultivation and manufacturing and the determinants of smuggling is still in short supply. Surveillance and monitoring systems that systematically track tobacco use and its consequences (mortality and morbidity) among adults and youth and that monitor real prices and evaluate the effectiveness of existing tobacco control programs and legislation do not exist in South-East Asia. Such surveillance and monitoring systems need to be developed.

Integrate tobacco control in broader poverty reduction efforts

Health and education are important cornerstones of human and economic development. The devastating health impact of tobacco use is well documented and understood. The contribution of tobacco use and production to poverty, although less well appreciated, is equally disturbing. The following factors heighten the importance of acting swiftly and integrating tobacco control in broader poverty reduction efforts (WHO 2003a):

- Poor and uneducated people are more likely to suffer the consequences of tobacco use;
- The burden of disease associated with tobacco use is huge, growing, and increasingly borne by developing countries;
- Tobacco use can contribute to malnutrition;
- The growing of tobacco leaves can have serious health consequences for farmers, and workers–especially children;
- Tobacco farming (of wood-cured tobacco) contributes to deforestation.

Ratify the Framework Convention on Tobacco Control

On May 21 2003, the 192 members of the World Health Organization unanimously adopted the Framework Convention on Tobacco Control (FCTC) aimed at curbing the devastating impact of tobacco use (WHO 2003b). The Convention addresses a wide range of issues including price and tax measures, protection from exposure to second-hand smoke, regulation and disclosure of the contents of tobacco products, packaging and labelling, education, communication, training and public awareness, advertising, promotion and sponsorship, tobacco dependence and cessation measures, illicit trade, sales to and by minors, and liability (WHO 2003c). Countries should sign and ratify the FCTC. As of October 15 2003, seventy-four countries and the European Community had signed the WHO Framework Convention on Tobacco Control. Only five countries from South-East Asia are among the signatories: Bangladesh, the Democratic People's Republic of Korea, India, Sri Lanka and Thailand.

APPENDIX 1
DEMAND FOR TOBACCO PRODUCTS IN DEVELOPING COUNTRIES: A LITERATURE REVIEW

This Appendix provides a review of the research done on price elasticity in the developing world. It is divided into two subsections: the studies based on aggregate time series data, which are more expanded, and the studies based on micro-level household surveys. Tables A1 and A2 summarize their methods and results.

Both times series data and micro-level household survey data have their advantages and disadvantages. A problem arises in aggregate data due to the high correlation existing between price and many important key independent variables and this produces biased estimates. Another difficulty arises as aggregate data tend to understate consumption in countries where smuggling is important. Also, using aggregate data does not necessarily take into account the simultaneous interaction of the demand and supply while price, sales and consumption of cigarettes are determined. Finally, aggregate data estimate the impact of price and other factors on cigarette consumption but they fail to provide information on the effect of those factors on specific issues like prevalence, initiation, etc.

Individual (or household) level data avoid some of the problems faced by aggregate data. For example, data collected by individual surveys avoid the problem of approximating consumption of cigarettes by sales. They also avoid simultaneity and correlation problems and, unlike aggregate data, they allow the exploration of issues such as effects on prevalence, initiation and cessation. But they have disadvantages. For example, individual level data may be subject to ecological bias in that some omitted variables affecting tobacco use are correlated with the included variables, and excluding those variables produces biased estimates for the included variables. Also, underreporting can arise from this type of data causing problems in the interpretation of estimates. Thirdly, like aggregate data, individual level data fail to account for differences in cigarette prices across country or regional borders and this biases price elasticity towards zero. Finally, individual level data obviously do not include macro level data such as advertising, policies etc., which play an important role in determining the level of consumption.

1.1 Time series data

Da Costa e Silva (1998) worked on annual data for the period 1983–94 in the Brazilian market. She estimated different types of model, including the myopic (including past consumption) and rational (including past and future consumption) demand models. Results showed that the short-run price elasticity ranged between –0.11 and –0.2 and the long-run price elasticity ranged between –0.48 and –0.8. The income elasticity can also be abstracted from these calculations. The short-run elasticity calculated ranged from 0.23 to 0.31 and the long-run elasticity ranged from 0.76 to 0.8.

Working with the Chinese economy, Hu and Mao (2002) considered the conventional demand model including only the price of cigarettes and income as independent

variables. They also used the myopic addiction model. The period covered was 1980–1996. In the first model the price elasticity was –0.54 and significant. In the myopic addiction model, estimates were also significant; the short-run price elasticity was –0.35 and the long-run price elasticity was –0.66.

Nassar (2003) in Egypt, estimated a myopic addiction model and added also, as independent variable, a dummy taking into account an estimated structural change occurring in 1984. The period covered the years 1970 to 1992, and the estimated short-run price elasticity was –0.3, while the short-run income elasticity was 1.02.

Aloui (2003) in Morocco estimated a myopic addiction model including a dummy variable representing the evolution of importance of various institutional measurements relating to the consumption of tobacco (such as including health warnings on cigarette packets and prohibiting smoking in public places). The period covered the years 1965 through 2000. By using different estimation methods, the author generated significant estimates of the short-run price elasticity, ranging from –0.51 to –0.73, and the long-run price elasticity, ranging from –1.36 to –1.54. The short-run income elasticity ranged from 0.32 to 0.56 and the long-run income elasticity from 0.87 to 1.04.

Chapman and Richardson (1990) used two data sets in Papua New Guinea: cigarettes and non-cigarette products for 1973 to 1986. They estimated the excise elasticity of demand of cigarettes and non-cigarette products. For each set they included personal income, the product's own excise tax and the excise tax of the substitute product (in the case of cigarettes, non-cigarettes and vice versa). Results were significant and showed that for cigarettes the excise elasticity was –0.71 and the income elasticity was 0.86. For the non-cigarette products, the excise elasticity was –0.5 and the income elasticity 1.37.

Kim (2001) used data from Korea for 1960 to 1997. The author used a myopic addiction model including a time trend and a dummy variable capturing the first health warning label appearing on cigarette packages in Korea in 1976. The short-run price elasticity of demand (on the smokers' population) was –0.27, the long-run price elasticity was –0.36. Estimates were significantly different from zero. Estimates of income elasticity were not significant; the short-run income elasticity was 0.05, long-run income elasticity was 0.07.

In South Africa, Reekie (1994) estimated a conventional demand model on data covering the period 1970 through 1989. The price elasticity had a high value of –0.88 and the income elasticity was 0.59.

Van Walbeek (1996) in South Africa made a study covering four different sources of data to measure the price elasticity. The first set of data came from the Tobacco Board of South Africa for the years 1972–1990. The model used was the myopic addiction model, the dependent variable considered was the consumption of leaf tobacco and the independent variable was the real price of tobacco products along with the lagged value of consumption. The short-run elasticity had a value of –0.32 and the long-run price elasticity –0.53. The second set of data came from the South African Industrial Development Corporation for the years 1973–1990. A conventional demand model, with

tobacco products consumption expenditures as a dependent variable and real personal disposable income and real price of tobacco products as independent variables was used. The estimated price elasticity was –0.53 and the income elasticity 0.48. The third set of data came from Reekie for the years 1970–89. The model was also a conventional demand model with the consumption of packets of cigarettes used as a dependent variable and real personal disposable income as well as the real price of cigarettes as independent variables. The price elasticity had a high value of –0.99 and the income elasticity was equal to 0.58. The last set of data was also taken from Reekie for the years 1971–89, and the estimated model was the myopic addiction model including the real price of cigarettes and the lagged consumption of cigarettes as dependent variables. The short-run price elasticity was –0.66 and the long-run price elasticity was –1.52.

Another study in South Africa was by Van der Merwe and Annett (1998), using yearly data from 1970 to 1996. They estimated demand-side and supply-side equations. They used a different set of independent variables for the consumption equation: past consumption, future consumption, real expenditure on advertising by cigarette companies, total number of divorces in proportion to total population, unemployment rate and an anti-tobacco advertising dummy. The first model estimated single equations for demand and supply. The price elasticity calculated was –0.68 and income elasticity was 1.68. The second model used a simultaneous equation framework integrating demand-side and supply-side equations. The price elasticity calculated was –0.57 and income elasticity was 1.57. The third model was a demand equation, with myopic addiction. The short-run price elasticity estimated was –0.59 and the long-run price elasticity was –0.69; the short-run income elasticity was 1.62 and the long-run income elasticity was 1.7.

Another study by Van Walbeek (2000) for South Africa covered the period 1970 to 1998. The author used the Engle–Granger two-step cointegration procedure; he estimated a long-run relationship and an error-correction model. In the second model he introduced a dummy indicating the more hostile environment facing the tobacco industry since 1994. In the first model, the price elasticity was equal to –0.66 and the income elasticity was 0.98. In the second model, the price elasticity was –0.48 and the income elasticity 0.57.

Hsieh, Hu and Lin (1999) worked on annual data from China, Taiwan covering the period 1966 to 1995. They used a myopic addiction model and added a variable measuring the market share of low-tar cigarettes (which is expected to expand if consumers are more aware of the health impact of smoking) and other variables such as a dummy measuring the impact of more strongly worded warning labels adopted in 1992, the market share of imported cigarettes and the participation rate of females in labour force. They estimated an aggregate model and a disaggregated model. The disaggregated model distinguishes between domestic and imported cigarette demand affected both by domestic and imported cigarette prices. In the aggregate model the price elasticity ranged from –0.5 to –0.6 and the income elasticity ranged from 0.14 to 0.22. Regarding the disaggregated model, for domestic cigarettes the price elasticity was –0.6 (significant), the cross price elasticity was 0.08, and the income elasticity was 0.26. As for imported cigarettes, the own price elasticity was –1.1, the cross price elasticity was 2.78 and the income elasticity was 1.42.

In Turkey, Tansel (1993) used yearly data from 1960 to 1988 to estimate a myopic addiction model, including a dummy to proxy the effect of the health warning introduced in 1982. The second model used was the conventional demand model, and two variables were added to measure the effect of education on consumption. In the myopic model, the short-run price elasticity was equal to –0.21 and the long-run price elasticity was –0.37. The short-run income elasticity was 0.41 and the long-run income elasticity 0.71. In the conventional model, the price elasticity was –0.17 and the income elasticity 0.89.

Önder (2002) used data from 1960 to 2000 in Turkey to estimate the price and income elasticity of demand of cigarettes. She estimated the conventional model, the myopic addiction model and the rational addiction model. Results from the myopic addiction model showed that the short-run price elasticity was around –0.11 and the long-run price elasticity was –0.2, but estimates were not significant. The short-run income elasticity was 0.17 and the long-run income elasticity was 0.31; these estimates were significant. The author also tried to calculate the substitution elasticity using domestic filter cigarettes, domestic non-filter cigarettes and foreign brand name cigarettes using data from 1987 to 2000. Estimates showed a strong and significant substitution effect between domestic filtered and unfiltered cigarettes, with an elasticity of 1.35. When a time trend variable was included in the estimations, results were no longer significant. This suggested that the changing market shares of the different types of cigarette were not necessarily due to the changes in relative prices of different types of cigarettes but maybe to changes in taste or other variables not included in the model.

Krasovsky et al. (2001) used monthly data from January 1998 to June 2001 in Ukraine. Using a SUR estimation to solve the price endogeneity problem, they calculated a significant price elasticity of –0.25 and a significant income elasticity of 0.47.

Gabaldon and Herrera (2001) in Venezuela used yearly data for 1970–2000 to estimated several models. The first model included real price and real income as independent variables; the price elasticity ranged from –0.04 to –0.14 and income elasticity ranged from 1.9 to 2. The second model replaced real income by remuneration on the job. The estimate of price elasticity ranged from –0.29 to –0.36 and income elasticity from 1.1 to 1.22. A myopic addiction model with the remuneration on the job yielded price elasticity ranging from –0.13 to –0.2 and income elasticity ranging from 0.13 to 0.22.

In Zimbabwe, Maravanyika (1998) worked on data covering the period 1970 to 1996. The author used a myopic addiction model. The estimated short-run price elasticity had the value –0.86 and the short-run income elasticity was 1.67. The results were significant.

Table A1. Characteristics, methods and results of reviewed studies: Time series studies

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
Brazil	Da Costa e Silva (1998)	1983-1994	**Dependent variable** -Cigarette consumption **Independent variables** - price of cigarettes -income -Past and future consumption	-Model 1: estimation excluding the income variable -Model 2: myopic demand (includes Ct-1) -Model 3: rational demand (includes Ct-1 and Ct+1).	Short-Run (SR) η_p = -0.11 Long-Run (LR) η_p = -0.8 SR η_p = -0.2 LR η_p = -0.48 SR η_y = 0.31 LR η_y = 0.76 SR η_p = -0.14 LR η_p = -0.49 SR η_y =0.23 LR η_y =0.8
China	Hu and Mao (2002)	1980-1996	**Dependent variable** -cigarette sales **Independent variables** - price of cigarettes -income -past consumption -time trend	-Model 1: excludes the lagged dependent variable; log-lin function. -Model 2: includes the lagged dependent variable; log-lin function with correction for autocorrelation.	η_p = -0.54 SR η_p = -0.35 LR η_p = -0.66
Egypt	Nassar (2001)	1970-1992	**Dependent variable** -Per capita cigarette consumption in packs **Independent variables** -price of cigarettes -Per capita income -Past consumption; -1984 dummy for structural change	Log-log estimation of OLS	η_p = -0.3 η_y = 1.02

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
Morocco	Aloui (2001)	1965-2000	**Dependent variable** -cigarette consumption **Independent variables** -price of cigarettes -GDP -Past consumption; -"Law" variable representing important tobacco control legislations	Four different methods: 1- OLS, linear excluding the "law" variable 2- OLS, log-log excluding "law" 3- Two-stage least squares estimation to correct for endogeneity of the price variable (2SLS), linear, including "law" 4- 2SLS, linear, excluding "law".	1- SR η_p = -0.595 LR η_p = -1.51 SR η_y = 0.35 LR η_y = 0.88 2- SR η_p = -0.51 LR η_p = -1.41 SR η_y = 0.32 LR η_y = 0.87 3- SR η_p = -0.73 LR η_p = -1.36 SR η_y = 0.56 LR η_y =1.04 4- SR η_p = -0.67 LR η_p = -1.54 SR η_y = 0.4 LR η_y = 0.92
Papua New Guinea	Chapman, Richardson (1990)	Two sets of data: for cigarettes and non-cigarette products. 1973-1986	**Dependent variable** -cigarette consumption -other tobacco products consumption (ie.excluding cigarettes) **Independent variables** -Excise tax per kg of cigarettes -Non cigarette excise tax -Total consumption expenditure -Time trend.	Estimation using ordinary least squares and a multiplicative model.	- Cigarettes: Excise elasticity = -0.71 η_y = 0.86 - Other tobacco products: Excise elasticity = -0.5 η_y = 1.37
Republic of Korea	Kim (2001)	1960-1997	**Dependent variable** -Cigarette consumption of adult smoker **Independent variables** - price of cigarettes -disposable income -past consumption -1976 warning label dummy.	GLS Log-log estimation of the first difference of the data.	SR η_p = -0.27 LR η_p = -0.36 SR η_y = 0.05 LR η_y = 0.07

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
South Africa	Reekie (1994)	1970-1989	Dependent variable -cigarette consumption Independent variables -price of cigarettes, disposable income, -advertising expenditures	Log-log OLS estimation	η_p = -0.88 η_y = 0.59
	Van Walbeek (1996)	Four datasets used: 1- Tobacco Board: 1972-90 2- IDC: 1973-90 3- Reekie : 1970-1989 4- Reekie: 1971-1989	1-Dependent variable - leaf tobacco consumption Independent variables -price of tobacco products, past consumption 2-Dependent variable - tobacco products private consumption expenditures Independent variables -personal disposable income, price of tobacco products. 3- Dependent variable - cigarettes consumption Independent variables -personal disposable income, price of cigarettes. 4- Dependent variable: - cigarettes consumption Independent variables -price of cigarette, past consumption.	Linear estimation	1- SR ηp = -0.32 LR ηp = -0.53 2- η_p = -0.53 ηy = 0.48 3- η_p = -0.99 ηy = 0.58 4- SR ηp = -0.66 LR ηp = -1.52 --- If excise revenues were to be maximized: 1- Raising the excise duty to 191% of the producer price leads to 46% decrease in quantity demanded. 2- Excise duty: 113% of the Producer price => -43% in quantity demanded 3- Excise duty: 123% of the Producer price => -44% in quantity demanded 4- Excise duty: 88% of the Producer price => -41% in quantity demanded

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
	Van der Merwe and Annett (1998)	1970-1996	* Consumption equation: **Dependent variable** -cigarettes consumption **Independent variables** price of cigarettes, disposable income, past consumption, future consumption, advertising expenditure, number of divorces per total population, unemployment rate, anti-tobacco advertising dummy. * Price equation: **Dependent variable** -price of cigarettes. **Independent variables** derivative of cost function with respect to the quantity of cigarettes manufactured, excise and customs duty on cigarettes. * Cost equation: **Dependent variable** -total cost of manufacture **Independent variables** quantity of cigarettes manufactured, manufacturing wages per employee, rental rate of capital, tobacco prices.	Estimation of the demand-side and supply side equations. Estimation method: long-run cointegrating equation and a short-run error correction model. - Model 1: Single equation estimation of the demand-side and the supply-side equations. - Model 2: simultaneous equation framework integrating demand-side and supply-side equations. - Model 3: single equation modeling of the demand side equation.	- Model 1: η_p = -0.68 η_y = 1.68 - Model 2: η_p = -0.57 η_y = 1.57 - Model 3: SR η_p = - 0.59 SR η_y = 1.62 LR η_p = -0.69 LR η_y = 1.70

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
	Van Walbeek (2000)	1970-1998	**Dependent variable** -cigarette consumption: total excise revenues from cigarettes and cigarette tobacco divided by the excise rate per pack. **Independent variables** price of cigarettes, disposable income, 1982 dummy (unusually high consumption), 1994 dummy (Government of National Unity)	Engle-Granger two-step cointegration procedure:	- LR relationship model: η_p = -0.66 η_y = 0.98 - Error-correction model: η_p = -0.481 η_y = 0.57
Taiwan, province of China	Hsieh, Hu and Lin (1999)	1966-1995	**Dependent variable** Cigarette consumption **Independent variables:** price of cigarettes, disposable Income, past consumption, low-tar market share dummy, 1992 health warning dummy, market share of imported cigarettes, female labor force participation rate	- Aggregate model OLS with AR(1) correction and 2SLS - Disaggregated model Estimation model: SUR.	- Aggregate model: η_p = –0.5 to –0.6 η_y = 0.14 to 0.22. - Disaggregated model: *For domestic cigarettes:* Own η_p = -0.6 Cross η_p = 0.08 η_y = 0.26 *For imported cigarettes:* Own η_p = -1.1 Cross η_p = 2.78 η_y = 1.42
Turkey	Tansel (1993)	1960-1988	**Dependent variable** -amount of cigarettes sold by Tekel (the state monopoly) to the retailers **Independent variables:** price of cigarettes, GNP, past consumption, -health warning dummy, education (enrolment ratios)	- Model 1: OLS log-log estimation including Ct-1 and warning dummy Model 2: OLS log-log estimation including warning and education variables	- Model 1: SR η_p = -0.214 LR η_p = -0.37 SR η_y = 0.411 LR η_y = 0.714 - Model 2: η_p = -0.169 η_y = 0.888

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
	Önder (2002)	1- 1960-2000 2- 1987-2000	1- **Dependent variable** -cigarette consumption **Independent variables:** price of cigarettes, income, time trend, health warning dummy, smokefree public places dummy 2- Three types of cigarettes for the consumption and price of cigarettes: -domestic filter cigarettes -domestic non-filter cigarettes -cigarettes with foreign brand names.	2SLS Log-log estimation	1- a) Conventional demand: η_p: –0.25 to -0.5 (not significant) η_y = 0.233 b) myopic addiction model (without trend): SR η_p = -0.11 LR η_p = -0.2 (both insignificant) SR η_y = 0.17 LR η_y = 0.31 c) rational addiction model (without trend): SR η_p = -0.1 LR η_p = -0.14 SR η_y = 0.11 LR η_y = 0.16 (all insignificant) 2- - elasticity of substitution between domestic filtered and unfiltered cigarettes = 1.35 - elasticity of substitution btw domestic filtered and foreign cigarettes = -0.33 (not significant)
Ukraine	Krasovsky et al. (2002)	Monthly data, January 1998-June 2001	**Dependent variable** -cigarette consumption **Independent variables:** price of cigarettes, household disposable income, smuggling dummy, four producer expectations dummy	SUR estimation	η_p = -0.25 η_y = 0.47

Country/ Area	Authors	Years	Variables	Estimation Methods	Results
Venezuela	Gabaldon, Herrera (2001)	1970-2000	**Dependent variable** -cigarette consumption **Independent variables:** price of cigarettes , income, job remuneration, past consumption	Linear, lin-log, log-lin and log-log estimations: 1- income 2- job remuneration. 3- past consumption with job remuneration	1- η_p = –0.04 to –0.14. η_y = 1.9 to 2.0. 2- η_p = -0.29 to –0.36 η_y =1.10 to 1.22 3- η_p = -0.13 to –0.2 η_y = 0.13 to 0.22
Zimbabwe	Maravanyika (1998)	1970-1996	**Dependent variable** -cigarette consumption **Independent variables:** price of cigarettes (previous year), disposable income (previous year), past consumption	Log-log OLS estimation	η_p = -0.86 η_y = 1.67

1.2 Household data

Sayginsoy, Yürekli and de Beyer (2002) utilized a household survey of 1995 while working with the Bulgarian economy. The authors used the conventional demand model. They added a wide range of variables such as the mean age of the household, the number of years of education received by the most educated household member, litres of alcohol consumed per capita in each household, the ratio of number of adult males in each household to the size of the household and a dummy equalling 1 if the household had at least one member who was a widow(er), divorced or separated or was older than 35 and had never married. The estimation was made in four income groups: low and middle income, middle–high income, high-income, and overall. The price elasticity ranged from –0.52 to –1.33; the price elasticity for the low- and middle-income groups was –1.33. This showed that poorer groups were more affected by changes in price. The income elasticity was not significant by income group but it was significant for the overall group and was equal to 0.34.

Lance et al. (2002) worked on two sets of data from China and Russia. The study in China was made on a micro-level data survey, 1993 and 1997 panels. Different sets of estimations were made using smoking participation and smoking intensity as dependent variables. The independent variables were the cigarette price, a panel dummy and dummies controlling for age, wealth, education, household size and gender. The total elasticity, the result of a summation between the participation elasticity and the intensity elasticity, ranged from –0.02 to –0.11. The Russian study was based on longitudinal household surveys made in eight rounds between 1992 and 2000. The authors used the same method of estimation as in the Chinese study and they calculated slightly higher price elasticities ranging from –0.02 to –0.18.

In Egypt, Nassar (2003) used cross-sectional data on family budget from 1994–95 and 1995–96 surveys. She used tobacco expenditure as a dependent variable and the aggregate prices and the total household expenditure as independent variables. She made different estimations by expenditure quartiles, educational levels and work status. She obtained the price elasticity by expenditure quartiles, ranging from –0.3 to –0.35. The price elasticity by educational level ranged from –0.27 to –0.38 and the price elasticity by work status ranged from –0.35 to –0.82. Expenditure elasticities by expenditure quartiles ranged from 0.39 to 0.83. Expenditure elasticity by educational level ranged from 0.38 to 0.63, and expenditure elasticity by work status ranged from 0.49 to 1.52.

Sesma-Vazquez et al. (2002) used logistic and linear regression models with four cross sections to estimate the demand for cigarette in Mexico between 1992 and 1998. Prices were found to be the most important determinants of cigarette spending while income was found to be positively related to cigarette spending.

Ogloblin and Block (2003), using 1996 and 1998 data from a national survey, calculate the price elasticity of the decision to smoke. Results show an elasticity of –0.085 for men and a significantly higher elasticity for women of –0.628.

Berg and Kaempfer (2001) estimated household level data from South Africa measuring the attitudes of blacks and whites towards an increase in cigarette prices. Results show that the price elasticity using the whole black population was –0.8 while for whites it was –1.79. The values of income elasticity were 2.29 for blacks and 4.34 for whites.

Van Walbeek (2002) worked on the income and expenditure household surveys of 1990 and 1995 in South Africa. He subdivided his estimations by income quartiles. His results show a price elasticity ranging from –0.81 to –1.39 with the groups having the lowest incomes reacting more strongly to a change in prices. The income elasticity in the 1990 data ranged from 0.08 to 0.48 and in the 1995 data, from 0.24 to 0.52. Also, the groups with the lowest income were inclined to increase their consumption if their income rose.

Önder (2002) worked on 1994 household level data from a survey undertaken in Turkey. The author used the conventional demand model and added other independent variables. Those variables included education, sex, age, the number of adults in the household, the region and the location of the household, a dummy for whether the head of the household was unemployed and a dummy for whether the head of the household was a white-collar worker. The estimation divided the groups by income quintiles. Estimates showed that the total price elasticity of the overall sample was equal to –0.41, but the values by quintiles ranged from –0.16 to –0.9 with the highest elasticities in the poorest income groups. The total income elasticity was equal to 0.09. The income elasticity was 0.09 in the poorest group and 0.03 for the richest group.

Krasovsky et al. (2001) used micro-level data in Ukraine from a June 2001 national survey. They added to the conventional model variables such as age, sex, region dummies and a dummy reflecting whether a smoker had under-age children. They made their estimations by income groups and age groups. The price elasticity for the age group of 18–28 was –0.37 for the low income group, –0.42 for the middle income group and –0.24 for the high income group. Overall, results showed that as smokers become older, the less sensitive they are to price changes. Also the price elasticity seems to be the lowest in high income groups. Average price elasticity across all income and age groups was –0.4. The overall income elasticity was 0.06 (differentiation between income groups was not significant).

Table A2. Characteristics, methods and results of reviewed studies: Household level studies

Countries -Province	Authors	Years	Variables	Estimation Methods	Results
Bulgaria	Sayginsoy, Yürekli, de Beyer (2002)	Living Standards Measurement Study household survey of 1995	**Dependent variable:** -Number of packs of 20 smoked by the household per month per capita. **Independent variables:** average price paid for a pack of cigarette, total household income, mean age of all the members of the household, years education received by the most educated household member, litres of alcohol consumed per capita in each household, ratio of number of adult males in each household to the size of the household, dummy=1 if the household has at least one member who is a widow(er), divorcee, living separate from husband/wife or is older than 35 and is not married at all.	2SLS lin-log estimation for overall sample and by income group.	Overall sample: η_p = -1.33 η_y = 0.34 Low and middle income group: η_p = -1.02 Middle income group: η_p = -0.52 High income group: η_p = -0.8 η_y insignificant by income
China	Xu, Hu, Keeler (1998)	1992		Based on results of Mao (1996), price elasticity of demand of -0.65 is used. Price elasticity of supply is assumed between 1.0 and 1.5. A linear demand and supply function are used to estimate the impact of a one cent increase on consumer surplus, government revenue and net welfare loss.	Even allowing different weightings for consumer surplus in the social welfare function (1, 0, -0.25, -0.5,-1) the dead-weight loss is very small compared to the gain in government revenue. Thus, increasing the tax by one cent yields a social gain.

Countries -Province	Authors	Years	Variables	Estimation Methods	Results
China and Russia	Lance et al. (2002)	* China: Micro-level data, survey, 1993 and 1997 panels. * Russia: Longitudinal household surveys, 1992-2000	**Dependent variables** - smoking participation - smoking intensity **Independent variables** cigarette price , price deflator, panel dummy, controls for age, wealth, education, household size and gender.	Two basic models: 1- participation and intensity depend only on price and the panel dummy 2- adding to the first model the other mentioned exogenous variables. - Three specifications for each of these two basic models: a- pooled cross sectional specification b- provincial/regional specification: adding controls for region (Russia) or interaction of province with urban (China). c- Country-level fixed-effects specification: to control for community-level unobserved heterogeneity.	For total population: Total elasticity = participation elasticity + intensity elasticity * China: η_p = between –0.023 and –0.113 * Russia: η_p = between –0.02 and –0.176
Egypt	Nassar (2001)	Cross sectional data on family budget 1994/1995 and 1995/1996 surveys	**Dependent variable** - tobacco expenditure **Independent variables** aggregate prices on the different types of tobacco, total household expenditure, education, expenditure, work status, urban/rural regions	Log-log estimation of OLS on the pooled data by expenditure quartiles, educational level and work status.	(η_e : expenditure elasticity) By expenditure quartiles: η_p = between -0.3 and –0.35 η_e = between 0.39 and 0.83 By educational level: η_p = between -0.27 and –0.38 η_e = between 0.38 and 0.63 By work status: η_p = between -0.35 and –0.82 η_e = between 0.49 and 1.52

Countries -Province	Authors	Years	Variables	Estimation Methods	Results
Mexico	Sesma-Vazquez et al. (2002)	Cross sectional data 1992, 1994, 1996 and 1998	**Dependent variable** - smoking prevalence - cigarette expenditure **Independent variables** Price, age, education, sex, household size	Logistic and linear regression estimation.	n.a.
Russia	Ogloblin et al. (2003)	Household data from national surveys 1996 and 1998	**Dependent variable** - Decision to smoke (probit) **Independent variables** real monthly income, real price of cigarettes, age, dummies for community type, marital status, education, occupation and obesity	Estimation of a probit model to estimate smoking decision.	Price elasticity of the decision to smoke: η_s η_s (men) = -0.085 η_s (women) = -0.628
South Africa	Berg and Kaempfer (2001)	Household survey, 1997 (6500 black households and 1350 white households)	**Dependent variable** - Quantity demand of seven commodities (including cigarettes) **Independent variables** - prices of the seven commodities - expenditure on seven commodities - number of adults in the household - number of children in the household	1- Censored maximum likelihood assuming homoskedasticity 2- Censored maximum likelihood assuming heteroskedasticity 3- Censored least absolute deviation	- all observations: $\eta_{p\ Black}$ = -0.8 $\eta_{p\ White}$ = -1.79 $\eta_{y\ Black}$ = 2.29 (significant) $\eta_{y\ White}$ = 4.34 - observations with positive consumption: $\eta_{p\ Black}$ = 0.34 $\eta_{p\ White}$ = 0.09 $\eta_{y\ Black}$ = 0.38 $\eta_{y\ White}$ = 0.63

Countries -Province	Authors	Years	Variables	Estimation Methods	Results
	Van Walbeek (2002)	The Income and Expenditure household surveys of 1990 and 1995	**Dependent variable** - household's annual expenditure on cigarettes. **Independent variables** real household income subdivided into four income quartiles, real price of cigarettes	- Log-log estimation of income elasticity for each income quartile for 1990 and 1995 (log of the cigarette expenditure divided by the income and function of the income quartiles). - Calculation of net change of cigarette consumption between 1990 and 1995 (%change in average cigarette consumption minus the effect of income change on consumption) - Estimation of price elasticity (net change of cigarette consumption divided by real price change)	η_p (Q1) = -1.39 η_p (Q2) = -1.13 η_p (Q3) = -1.08 η_p (Q4) = -0.81 *1990*: η_y (Q1) = 0.27 η_y (Q2) = 0.48 η_y (Q3) = 0.4 η_y (Q4) = 0.08 *1995*: η_y (Q1) = 0.52 η_y (Q2) = 0.41 η_y (Q3) = 0.54 η_y (Q4) = 0.24
Turkey	Onder (2001)	Household level data Survey, 1994	**Dependent variables** - number of cigarettes smoked by the smoker households - smoking participation decision (probability of smoking) - cigarette price - cigarette excise tax. **Independent variables** cigarette price per package of 20, per capita household income per month, education, gender, age, number of adults in the household, location, region, dummy: employed head, dummy: white collar head	- First step: Estimation of the smoking participation decision of the households with a logit model for all households and by income quintiles. Estimation of the cigarette tax as a function of household income and estimation of the price for non smoker households. - Second step: Log-log estimation of the conditional demand for cigarettes by the smoker. Two-stage least squares estimation to correct for endogeneity of the price variable.	η_p = -0.41* η_y = 0.09* η_p (Q1) = -0.47* η_y (Q1) = 0.09 η_p (Q2) = -0.9* η_y (Q2) = -0.15 η_p (Q3) = -0.56 η_y (Q3) = 0.02* η_p (Q4) = -0.43 η_y (Q4) = -0.03 η_p (Q5) = -0.16* η_y (Q5) = 0.03* Tax elasticity of price = 0.73 * *statistically significant coeff.*

Countries -Province	Authors	Years	Variables	Estimation Methods	Results
Ukraine	Krasovsky et al. (2001)	June 2001 national survey	**Dependent variable** - number of cigarettes consumed (cigarette expenditure divided by cigarette prices) **Independent variables** real price of cigarettes, household income, age, sex, strength of addiction, region dummies, dummy reflecting whether a smoker has under-age children.	1- OLS estimation of the demand equation 2- Binary regression using the ML method to estimate the participation equation model	1- For adults aged 18 to 28 Overall population: $\eta_p = -0.4 \quad \eta_y = 0.06$ η_p (Q1) = -0.37 η_p (Q2) = -0.42 η_p (Q3) = -0.24 (η_y not significant among income groups) 2- η_p (Q1) = -0.11 η_p (Q2) = -0.027

APPENDIX 2. SOUTH-EAST ASIAN STUDIES

Table A3. Characteristics, methods and results of studies reviewed: South-East Asian studies

a. Time Series

Country-Province	Authors	Years	Variables	Estimation Methods	Results
Indonesia	Djutaharta, Surya, Pasay, Hendratno, Adioetomo (2002)	1- Yearly data: 1970-2001 2- Monthly data: January 1996- June 2001	*Dependent variable* - per capita cig consumption, packs (of 16) *1- Independent variables* price of cigarette, per capita income, crisis dummy (1997), dummy (introduction of the warning "smoking is dangerous for health") (1991), time trend. *2- Independent variables* (same as model one excluding the warning's dummy)	1- OLS log-log estimation a- pre-crisis period: 1970-1996. b- whole period: 1970-2001. 2- Log-log estimation with AR terms. (Also different sets of regressions).	1. a- η_p = -0.57 η_y = 0.46 b- η_p = -0.35 η_y = 0.47 Tax elasticity of price = 0.26 Tax elasticity of demand=-0.01 2. η_p = -0.32 η_y = 0.14 Tax elasticity of price = 0.1 Tax elasticity of demand = -0.03
Sri Lanka	Arunatilake (2001)	Monthly time series data 1999 to 2000	*Dependent variable* - per capita consumption of cigarettes *Independent variables* - real price of cigarettes - real per capita income - real average tax paid per stick - variables controlling for regulation on cigarettes advertising. - time trend	Estimation using instrumental-variables technique 1- static model without time trend 2 - static model with time trend 3 - myopic addiction demand model 4 - rational addiction demand model	1- η_p = -0.227 η_y = 0.182 2- η_p = -0.908 η_y =0.78 3- η_p = -0.279 η_y =0.249 4-- η_p = -0.307 η_y =0.252
Thailand	Supakorn (1993)	na	na	Log-linear estimation	η_p = -0.67 η_y = 0.36

b. Household data

Country-Province	Authors	Years	Variables	Estimation Methods	Results
Indonesia	Adioetomo, Djutaharta, Hendratno (2001)	1999 National Socio-economic Survey data	**Dependent variable** - quantity of cigarettes consumed **Independent variables** cigarette prices (household expenditure on cigarettes divided by the quantity of cigarettes consumed), household income, excise tax, dummies: area, big islands, residence, sex, age, education and head of household's type of education	- OLS estimation of the price equation - Logit model (with independent variables in log) to estimate the probability of smoking of the household (extract from there price elasticity of smoking participation). - OLS model for consumption. Total price elasticity = (1-probability of smoking)*(price elasticity of smoking participation) + conditional price elasticity of smokers Estimation made by income group: low, middle and high income groups.	η_p = -0.61 η_y = 0.76 η_p (Q1) = -0.67 η_y (Q1) = 1.22 η_p (Q2) = -0.33 η_y (Q2) = 0.1 η_p (Q3)= -0.31 η_y (Q3) = 0.04
Myanmar	Nyo Nyo et al. (2003)	Household level data (2000)	**Dependent variable** - Monthly consumption of cigarettes, cheroots and phet kyan (per stick) **Independent variables** price of cigarettes, cheroots or phet kyan, per capita monthly income, tax on cigarette/cheroots, dummies for: age, sex, literacy, marital status, addiction, education level, place of residence	- OLS estimation of price equation - Logit model (with independent variables in log) to estimate probability of smoking in the household (extract from their price elasticity of smoking participation). - OLS estimation method for the consumption equation. Total price elasticity = (1-probability of smoking)*(price elasticity of smoking participation) + conditional price elasticity of smokers Estimation by age group, income quintile	η_p = -1.619 Age group: η_p (A1) = -2.41 η_p (A2) = -1.6 η_p (A3) = -1.4 η_p (A4) = -1.26 η_p (A5) = -1.25 η_p (A6) = -1.17 Location η_p (urban) = -1.43 η_p (rural) = - 1.65 (η_y : Income elasticities not significant for age and income groups)

Country-Province	Authors	Years	Variables	Estimation Methods	Results
Nepal	Karki et al. (2003)	Household level data (2003)	**Dependent variable** - Monthly consumption of cigarettes and bidis (per stick) **Independent variables** price of cigarettes or bidis, per capita monthly income, cigarette and bidi tax, dummies for: age, sex, occupation, marital status, addiction, education level, place of residence	- OLS estimation of the price equation - Logit model (with independent variables in log) to estimate the probability of smoking of the household (extract from there price elasticity of smoking participation). - OLS estimation method for the consumption equation. Total price elasticity = (1-probability of smoking)*(price elasticity of smoking participation) + conditional price elasticity of smokers Estimation by age groups and income quintile	η_p = -0.886 η_y = 0.177 η_p (Q1) = -0.79 η_p (Q2) = -0.86 η_p (Q3) = -0.83 η_p (Q4) = -0.63 η_p (Q5) = -0.6 η_p (A1) = -1.87 η_p (A2) = -0.95 η_p (A3) = -0.91 η_p (A4) = -0.61 η_p (A5) = -0.68 η_p (A6) = -1.1 η_p (urban) = -1.02 η_p (rural) = - 0.92 (η_y : Income elasticities not significant for income and age groups)
Sri Lanka	Arunatilake (2002)	Household level data 1999/2000	**Dependent variable** - Per capita monthly tobacco consumption. **Independent variables** - tobacco price per unit of tobacco - monthly per capita income - male ratio, occupation, education, age category and location. (Equations divided by expenditure groups, quintiles)	-First step: logit model estimating the smoking participation. - Second step: OLS estimation of the tobacco consumption. Total price elasticity derived from the elasticity estimates of the smoking participation and conditional demand equations. Analogous calculation for the total income elasticity.	η_p = -0.45 η_y = 0.09* η_p (Q1) = -0.74* η_y (Q1) =0.15* η_p (Q2) = -0.69* η_y (Q2) = -0.04 η_p (Q3) = -0.61 η_y (Q3) = 0.00 η_p (Q4) = 0.03 η_y (Q4) = -0.12 η_p (Q5) = 0.12 η_y (Q5) = -0.01*

Country-Province	Authors	Years	Variables	Estimation Methods	Results
Thailand	Isra (1995)	Linear Expenditure System and household level data of 1988	Na (data divided by per capita expenditure on tobacco products)	Na	η_p = -0.09 η_e = 0.14
	Suchada (1997)	na	Na	Na	Na
	Isra et al. (2003)	Household socio-economic survey 2000. Consumer price index from the Department of Business Economics, Ministry of Commerce)	**Variables included** tobacco consumption, expenditure on cigarettes and other tobacco products, cigarette price, household income, prices of 12 consumer goods, age, education, dummy: urban/rural (in the study cigarette = cigarette and other tobacco products)	Linear Expenditure System Model. Maximization of the utility subject to consumers' consumption expenditure. And based on the LES, estimation of the expenditure elasticity, own price elasticity and cross price elasticity of demand of each good including cigarettes and other tobacco. Estimation by age groups and households divided into 10 classes, 5 urban and 5 rural households.	Whole Kingdom: -Expenditure elasticity of demand for cigarettes = 0.704 -Own price elasticity = -0.393 -Cross price elasticity of cigarette on other goods very low. Income class: Own price elasticity of demand for cigarettes - Urban1 = -1.003 - Urban2 = -0.355 - Urban3 = -0.126 - Urban4 = -0.098 - Urban5 = -0.042 - Rural1 = -0.487 - Rural2 = -0.046 - Rural3 = -0.028 - Rural4 = -0.148 - Rural5 = -0.069

APPENDIX 3: DATA SOURCES

ADB
Asian Development Bank. Key Indicators 2002: Population and Human Resource Trends and Challenges.
URL: http://www.adb.org/Documents/Books/Key_Indicators/2002/default.asp

BBS
Bangladesh Bureau of Statistics, Monthly Statistical Bulletin Bangladesh, August 2000.

EIU
Economist Intelligence Unit (1985-2002) Worldwide Cost of Living survey.
URL: http://eiu.enumerate.com/asp/wcol_HelpWhatIsWCOL.asp

FAO
Food and Agriculture Organization of the United Nations. FaoStat Statistical databases.
URL: http://apps.fao.org/

IMF
International Monetary Fund (IMF), The World Economic Outlook Database September 2002.
URL: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Statistik Indonesia
Data obtained from The World Bank.
URL: http://www1.worldbank.org/tobacco/pdf/country%20briefs/Indonesia%20.doc

TONESDB
Thailand Office of the National Economic and Social Development Board

UNPD
United Nations dataset World population prospects 1950—2050 (2000 revision), New York, United Nations Population Division, 1998.

UNSD
United Nations Industrial Commodity Production Statistics Database, 1950-2000, CD-ROM. Prepared by the Energy and Industry Section, United Nations Statistical Division, 11 December 2002, New York, USA.

United Nations Statistics Division. Commodity Trade Statistics Data Base (COMTRADE).
URL: http://unstats.un.org/unsd/comtrade/

WDI
The World Bank 2002. The World Development Indicators. WDI 2003 CD-ROM Query database.

Table A4. Country data sources

Country	Consumption	Price	Income
Bangladesh	Per capita cigarette consumption (1970-2000) –based on cigarette production (UNSD 1970-1997 and BBS 1998-2000), import (FAO) and export data (FAO) and 15+ population data (UNPD). Missing trade data are assumed to be negligible.	Cigarettes, real price 1995 LCU, USD, PPP (1971-2000) – based on average retail price (BBS), CPI (BBS), exchange rate (IMF) and PPP conversion factor (WDI)	GDP per capita, constant 1995 LCU, USD, PPP (1970-2000) – based on GDP per capita, constant 1995 LCU (IMF), exchange rate (IMF) and PPP conversion factor (WDI)
Indonesia	Per capita cigarette consumption (1970-2000) –based on cigarette production (USDA), import (UNSD) and export data (FAO/UNSD) and 15+ population data (UNPD).	Cigarettes, real price 1995 LCU, USD, PPP (1970-1997) – based on nominal price (Statistik Indonesia), CPI (WDI), exchange rate (IMF) and PPP conversion factor (WDI)	GDP per capita, constant 1995 LCU (1970-2000) – based on GDP per capita, constant 1993 LCU (IMF), inflation (IMF), exchange rate (IMF) and PPP conversion factor (WDI)
Maldives	Per capita cigarette consumption (1989-2000) – based on import (Maldives Customs Services and UNSD) and 15+ population data (UNPD).	Cigarettes, real price 1995 LCU, USD, PPP (1997-2000) – based on nominal Marlboro prices (Maldives Ministry of Planning and National Development), inflation (IMF), exchange rate (IMF) and PPP conversion factor (WDI)	GDP per capita, constant 1995 LCU, USD, PPP (1970-2000) – based on GDP per capita, constant 1995 LCU (IMF), inflation (IMF), exchange rate (IMF) and PPP conversion factor (WDI)
Myanmar	Per capita cigarette consumption (1990-1999) – based on cigarette production (Myanmar Central Statistical Organization) and 15+ population (UNPD) and assuming negligible imports and exports of cigarettes.	Cigarettes, real price 1995 LCU, USD, PPP (1986, 1988-1997) – based on nominal price (Myanmar Central Statistical Organization) and CPI (Myanmar Central Statistical Organization), exchange rate (IMF) and PPP conversion factor (EIU)	GDP per capita, constant 1995 LCU, USD, PPP (1970-2000) – based on GDP per capita, constant 1982 LCU (IMF), inflation (IMF), exchange rate (IMF) and PPP conversion factor (EIU)
Nepal	Per capita cigarette consumption (1970-2000) – based on cigarette production (UNSD & Nepal Ministry of Finance), import (FAO) and export data (FAO) and 15+ population data (UNPD).	Cigarettes, real price 1995 LCU, USD, PPP (1972-2000) – based on CPI cigarettes (Nepal Rastra Bank), nominal price in 1999 (Nepal SEAR country report) and CPI (WDI), exchange rate (IMF) and PPP conversion factor (WDI)	GDP per capita, constant 1995 LCU, USD, PPP (1970-2000) – based on GDP per capita, constant 1985 LCU (WDI), inflation (WDI), , exchange rate (IMF) and PPP conversion factor (WDI)

Country	Consumption	Price	Income
Sri Lanka	Per capita cigarette consumption (1974-2000) – based on cigarette production (UNSD 1970-1998 & ADB 1999-2000), import (FAO) and export data (FAO) and 15+ population data (UNPD).	Tobacco, real price 1995 LCU, USD, PPP (1980-2001) – based on Colombo Tobacco Consumers' Price Index (DSS), Nominal local brand price (EIU) and Colombo All Items Consumers' Price Index (Sri Lanka Department of Census & Statistics), exchange rate (IMF) and PPP conversion factor (WDI)	GDP per capita, constant 1995 LCU, USD, PPP (1970-2000) – based on GDP per capita, constant 1996 LCU (IMF), inflation (IMF), exchange rate (IMF) and PPP conversion factor (WDI)
Thailand	Per capita cigarette consumption (1972-2000) – based on cigarette production (USDA), import (UNSD) and export data (UNSD) and 15+ population data (UNPD).	Tobacco, real price 1995 LCU, USD, PPP (1972-1998) – based on Tobacco Consumption Expenditures (TONESDB), total cigarette consumption and inflation (IMF), exchange rate (IMF) and PPP conversion factor (WDI)	-Private Consumption Expenditure, constant 1995 LCU (1970-1998) – based on private consumption expenditure, 1988 LCU (TONESDB), total population (UNPD) and inflation (IMF) - GDP per capita, constant 1995 USD, PPP (1970-2003) – based on GDP per capita, constant 1988 LCU, inflation (IMF) and 1995 exchange rate (IMF) and PPP conversion factor (WDI)

APPENDIX 4
STATISTICAL TESTS PERFORMED ON THE DATA AND RESULTS

In order to avoid the possible problems of spurious regressions and possible mis-specification in the proposed models, a sequence of tests was performed on the data series prior to testing the relationship between consumption and prices and incomes. First, the augmented Dickey–Fuller (ADF) test was used to establish the order of integration of each variable (Dickey and Fuller, 1979). The number of lags to include in the ADF regression was chosen first by calculating the ADF test with six lags.

Then, if the coefficient of the last lag was not significant, a subsequent ADF test was applied with one fewer lag, until an ADF with a significant lag was found. This procedure is necessary to ensure that the data used are stationary. As well, the possibility of the existence of a long-term relationship between the variables used was verified using a procedure proposed by Engle and Granger (1987). Finally, various possible mis-specification in the model were examined using several tests such as the Hausman test to determine whether the price variable was endogenous or exogenous (Hausman, 1978), the White test for heteroskedasticity to determine if the errors have a constant variance over time (White, 1980), and the Durbin–Watson *d* statistic tests for autocorrelation (Durbin and Watson, 1950).

If there was evidence of heteroskedasticity, ordinary least squares (OLS) are used along with the White robust estimation of variance. If there was evidence of autocorrelation, the feasible generalized least squares (FGLS) Prais–Winsten estimator was used to correct for autocorrelated disturbances. If tests showed that errors were both heteroskedastic and autocorrelated, the FGLS Prais–Winsten estimator was used with the White robust estimation of variance.

For the pooled, multi-country data, a methodology developed by Baltagi et al. (2000), which proposes several pooled-estimators, was followed. The model first used an OLS estimation with and without time and country dummy variables. A generalized least squares (GLS) estimation was then used to correct for possible presence of heteroskedasticity, also with and without time and country dummies. Another GLS estimation with an AR(1) residual correction was made to correct for possible presence of autocorrelated errors. In the myopic addiction model, the presence of a lagged dependent variable will bias OLS results and make them inconsistent. To deal with the lagged consumption variable, instrumental variable estimators were used: 2SLS with and without time and country dummies, and the Andersen–Hsiao estimator (labelled FD2SLS in the text), which first differences the data and then applies 2SLS using lagged values of the explanatory variables as instruments. A log–log functional form that yields short-term elasticities was used in all estimations. All estimations were conducted using STATA 7.0.

The results of the ADF test suggest that all three variables—*consumption*, *price* and *income*—are integrated of order one. The results of the Engle–Granger test suggest that there exist a cointegration relationship between the dependent variable *consumption* and

the explanatory variables for all countries. It is therefore valid to model undifferenced, non-stationary variables. The Hausman test suggests that the price variable is exogenous for both models in all countries. Table A5 provides details on the results of the ADF test, while the results ofthe Engle–Granger test, Hausman test, the White test and the Durban–Watson test are reported in Table A6. In the former, Japan and the Republic of Korea are presented for comparison.

Table A5. Dickey-Fuller tests for stationarity

	Variables [a]			**Cointegration test** [b]
	Consumption	**Real Price**	**Real GDP**	
Bangladesh				
Level	-2.94*	-1.72	0.97	-4.15***
First difference	-7.35***	-5.12***	-12.39***	
Indonesia				
Level	-1.83	-1.97	-0.08	-5.27***
First difference	-5.88***	-6.8***	-3.39**	
Japan				
Level	-234	-3.57**	-2.03	-7.22***
First difference	-4.86***	-5.23***	-3.73***	
Korea				
Level	-2.9*	-2.95*	-0.72	-3.91***
First difference	-5.8***	-3.81***	-4.98***	
Nepal				
Level	-2.42	-1.91	-0.42	-4.58***
First difference	-3.62**	-5.41***	-5.61***	
Sri Lanka				
Level	-0.44	-1.542	-0.8	-4.996*
First difference	-5.52***	-3.55**	-2.95*	
Thailand				
Level	-2.37*	-1.64	-0.92	-4.15*
First difference	-5.03***	-6.87***	-3.1**	

[a] Dickey-Fuller test applied on the Logarithm of the following variables and assuming there is a constant.

[b] Dickey-Fuller test with a constant applied on the estimated errors of the myopic addiction model.

***, ** and *: Reject the hypothesis of a presence of a unit root at the 1%, 5% or 10% levels, respectively.

Table A6. Tests results

	Conventional model	Myopic addiction model
Bangladesh		
White test	5.792 t_c =5.792 $\approx c^2_{(5)}$ [a]	12.8 t_c =12.799 $\approx c^2_{(9)}$ [a]
Durbin-Watson test	0.816 d_c =0.816 [c]	-0.107 h =-0.107 [e]
Hausman test	0.1 t_c =0.1 $\approx c^2_{(1)}$ [b]	0.13 t_c =0.13 $\approx c^2_{(2)}$ [b]
Indonesia		
White test	4.828 t_c =4.828 $\approx c^2_{(5)}$ [a]	9.787 t_c =9.787 $\approx c^2_{(9)}$ [a]
Durbin-Watson test	1.544 d_c =1.544 [d]	-0.176 h =-0.176 [e]
Hausman test	-0.01 t_c =-0.01 $\approx c^2_{(1)}$ [b]	-0.896 t_c =-0.04 $\approx c^2_{(2)}$ [b]
Nepal		
White test	6.522 t_c =6.522 $\approx c^2_{(5)}$ [a]	6.857 t_c =6.857 $\approx c^2_{(9)}$ [a]
Durbin-Watson test	1.015 d_c =1.015 [d]	-0.268 h =-0.268 [e]
Hausman test	0.02 t_c =0.02 $\approx c^2_{(1)}$ [b]	-0.00 t_c =-0.00 $\approx c^2_{(2)}$ [b]
Sri Lanka		
White test	9.333 t_c =9.333 $\approx c^2_{(5)}$ [f]	12.59 t_c =12.594 $\approx c^2_{(9)}$ [a]
Durbin-Watson test	1.96 d_c =1.96 [g]	-0.344 h =-0.344 [e]
Hausman test	0.00 t_c =0.00 $\approx c^2_{(1)}$ [b]	0.02 t_c =0.02 $\approx c^2_{(2)}$ [b]
Thailand		
White test	6.534 t_c =6.534 $\approx c^2_{(6)}$ [a]	13.71 t_c =13.707 $\approx c^2_{(10)}$ [a]
Durbin-Watson test	0.786 d_c =0.786 [c]	0.406 h =0.406 [e]
Hausman test	-0.02 t_c =-0.02 $\approx c^2_{(2)}$ [b]	0.25 t_c =0.25 $\approx c^2_{(3)}$ [b]

[a] Accepts the null hypothesis of no presence of heteroskedasticity.

[b] Accepts the null hypothesis stating that the two models compared (one estimation with the real price and the other with an "exogenous price") exhibit no difference => no price endogeneity.

[c] According to the Durbin-Watson bounds test, $d_c < d_{Lc}$, so we reject the null hypothesis => autocorrelation exists.

[d] According to the Durbin-Watson bounds test, $d_{Lc} < d_c < d_{Uc}$, thus the test is inconclusive re whether there is autocorrelation.

[e] The Durbin-Watson h test tests for autocorrelation in the presence of lagged dependent variables. The h statistic accepts here the null hypothesis of non autocorrelation.

f Rejects the null hypothesis of no presence of heteroskedasticity => estimate with other method than OLS.

[g] According to the Durbin-Watson bounds test, $d_c > d_{Uc}$, so we accept the null hypothesis of no autocorrelation.

APPENDIX 5
TIME-SERIES COUNTRY ANALYSES RESULTS

Table A7. Estimation results

	Conventional model	Myopic addiction model
Bangladesh	**(FGLS Prais-Winsten estimators)**	**(OLS estimators)**
Constant	9.831***	4.202**
	(1.94)	(1.982)
$\ln p_t$	-0.075	-0.081
	(0.172)	(0.104)
$\ln y_t$	-0.432*	-0.151
	(0.218)	(0.138)
$\ln C_{t-1}$	-	0.542***
		(0.152)
Indonesia	**(FGLS Prais-Winsten estimators)**	**(OLS estimators)**
Constant	-1.475	1.46
	(1.791)	(1.158)
$\ln p_t$	-0.285*	-0.319**
	(0.149)	(0.15)
$\ln y_t$	0.717***	0.32***
	(0.086)	(0.108)
$\ln C_{t-1}$	-	0.43**
		(0.166)
Nepal	**(FGLS Prais-Winsten estimators)**	**(OLS estimators)**
Constant	6.27	6.991
	(4.784)	(4.168)
$\ln p_t$	-0.543	-0.541
	(0.535)	(0.619)
$\ln y_t$	0.147	-0.397
	(0.449)	(0.283)
$\ln C_{t-1}$	-	0.676***
		(0.174)
Sri Lanka	**(Estimation with the White robust estimation of variance)**	**(OLS estimators)**
Constant	17.515**	14.671***
	(1.39)	(3.658)
$\ln p_t$	-0.779***	-0.662**
	(0.253)	(0.276)
$\ln y_t$	-0.769***	-0.65***
	(0.063)	(0.165)
$\ln C_{t-1}$	-	0.172
		(0.213)
Thailand	**(FGLS Prais-Winsten estimators)**	**(OLS estimators)**
Constant	4.313***	2.783***
	(0.721)	(0.82)
$\ln p_t$	-0.475**	-0.445*
	(0.192)	(0.225)
$\ln y_t$	0.391***	0.232**
	(0.093)	(0.093)
$\ln C_{t-1}$	-	0.441***
		(0.151)
Economic crisis dummy	-0.229***	-0.271***
	(0.056)	(0.058)

***, ** and * : Statistically significant at the 1%, 5% and 10% levels, respectively.

APPENDIX 6
POTENTIAL REVENUE FROM TOBACCO TAXES: SENSITIVITY OF KEY ASSUMPTIONS

In order to test the sensitivity of the assumptions used in the tobacco revenue simulation analysis, different scenarios of price elasticity (η_p), income elasticity (η_y), and income growth are explored using data from Thailand. First, two scenarios of price responsiveness (low: η_p = -0.3; high: η_p = -1.0) are compared to the baseline scenario (η_p = -0.75). Secondly, two scenarios of income responsiveness and income growth (low: η_y = 0 or income growth = 0%; high: η_y = 1.0 [0.75] and income growth = 6% [8%]) are compared to the baseline scenario (η_y = 0.5 and income growth = 4%). Table A8 presents the results.

Table A8. Potential revenue from tobacco taxes: Sensitivity of key assumptions

		Per capita consumption		Revenue gain (US$ million)	
		Constant prices	5% real increase	Annual	Cumulative*
Baseline scenario					
	2005	953	761	88	1 456
	2010	1 052	697	174	4 750
Price					
Low price responsiveness	2005	953	872	635	2 107
	2010	1 052	894	1 377	7 417
High price responsiveness	2005	953	705	316	1 116
	2010	1 052	605	564	3 446
Income					
Low income responsiveness	2005	846	683	390	1 382
	2010	846	572	693	4 249
High income responsiveness	2005	1 200	981	576	1 852
	2010	1 606	1 110	1 386	7 013

* From 2000

For all scenarios tested, the revenue gains from a 5 percent annual increase in the real prices of tobacco products remain fairly stable and are considerable. In most cases, the revenue gains are in excess of those of the baseline scenario. Even the lowest estimates suggest increased annual revenues of several hundred million US dollars.

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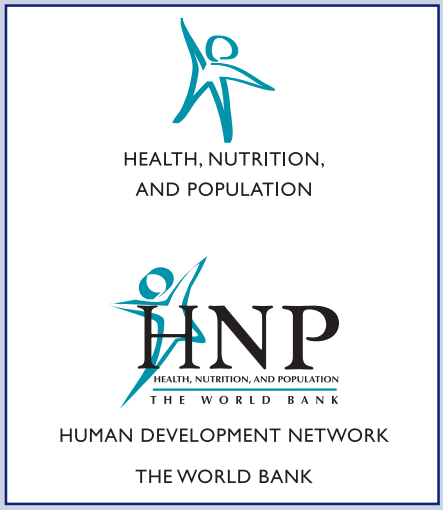

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