28902

HNP DISCUSSION PAPER

Economics of Tobacco Control Paper No. 15

An Economic Analysis of Tobacco Control in Thailand

Isra Sarntisart

October 2003

Tobacco Free Initiative
World Health Organization

HNP
HEALTH, NUTRITION, AND POPULATION
THE WORLD BANK

AN ECONOMIC ANALYSIS OF TOBACCO CONTROL IN THAILAND

ISRA SARNTISART

OCTOBER 2003

Health, Nutrition and Population (HNP) Discussion Paper

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ISBN 1-932126-45-7

Health, Nutrition and Population (HNP) Discussion Paper

ECONOMICS OF TOBACCO CONTROL PAPER NO. 15

AN ECONOMIC ANALYSIS OF TOBACCO CONTROL IN THAILAND

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

Abstract: Revenue from taxation of tobacco products accounts for more than 5 % of total government revenue in Thailand. The Thai tobacco industry is less significant: in 2000 it employed only 0.67 % of the total agricultural workforce, and only 0.11 % of all manufacturing workers. Until 1996, tobacco prices increased more slowly than prices of other consumer goods. After 1996 the trend reversed as tax/price policies were used to discourage smoking. Smoking prevalence is higher among men than women (50% and 3% respectively) and higher in rural than urban areas (26% and 18% respectively). Price and income elasticity of tobacco demand are analysed. They vary across income categories and between urban and rural areas. Overall, price elasticity is –0.39 and income elasticity is 0.70, similar to estimates for many other middle-income countries. Earlier studies that estimated health costs due to tobacco use are reviewed. Two main policy recommendations are made: to continue to use tax policy to reduce tobacco use and future health costs, which will also raise government revenue, and to enforce existing tobacco control measures better.

Keywords: Thailand, tobacco, tobacco revenue, tobacco tax, tobacco industry, cigarette, price, price elasticity, health cost, tobacco control policy.

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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.

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

10 October, 2003

FOREWORD

In 1999, the World Bank published *Curbing the epidemic: governments and the economics of tobacco control*, which summarizes the trends in global tobacco use and the resulting immense and growing burden of disease and premature death. By 1999, there were already 4 million deaths from tobacco each year. This number is projected to grow to 10 million per year by 2030, given present trends in tobacco consumption. 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 policies and interventions that have proved to be effective and cost-effective in reducing tobacco use in countries around the world.

Raising taxes to increase the price of tobacco products is the most effective way to reduce tobacco use and the single most cost-effective intervention. It is also the most effective way to persuade young people to quit or not take up 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 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. A 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. The team concluded 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. The team recommended that governments not forgo the benefits of tobacco tax increases because they feared the possible impact on smuggling. Rather, they should act to deter, detect and punish smuggling.

Much of the evidence presented and summarized in *Curbing the epidemic* was from high-income countries. However, the main battleground against tobacco use is now in low-and middle-income 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 advertising and promotion of tobacco products, ban smoking in public places, inform their citizens about the harm that tobacco causes and the benefits of quitting, and provide advice and support to help people quit.

In talking to policy-makers in developing countries, it became clear there was a great need for country-specific analytic work to provide a basis for policy making within a sound economic framework. The World Bank and WHO's Tobacco Free Initiative (as well as 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 this paper makes a valuable contribution to our understanding of the issues and likely economic impact of tobacco control. Our hope is that the information, analysis and recommendations contained herein will prove helpful to policy-makers and result in stronger policies that will reduce the unnecessary harm caused by tobacco use.

Joy de Beyer

Tobacco Control Coordinator
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ACKNOWLEDGEMENTS

The research team is indebted to many people, especially Narathip Chutiwongse, Emmanuel Guindon and participants of a round table discussion on tobacco, organized by the Centre for Health Economics (CHE) of Chulalongkorn University, Bangkok, who gave valuable comments and suggestions on this report. The team appreciates Taweesak Siripornpaiboon for his assistance in sampling design. Special thanks go to friends and officials at the National Statistical Office, the Department of Business Economics, Thailand Tobacco Monopoly, the Customs Department, the Excise Department, and the Office of the National Economic and Social Development Board, who provided data and information that were crucial to the completion of this report. For their editorial assistance, our sincere thanks are due to Steve Cannell and John Shimwell.

The authors are also grateful to the World Bank for publishing the report as an HNP Discussion Paper.

SUMMARY

Introduction

Tobacco plays many roles in the Thai economy. It provides over 5% of all government revenue, and is a source of income and employment. But it is also a major risk factor for many diseases, causing loss of life, productivity and imposing health care costs.

Previous studies of cigarette demand used data from around 10 years ago. Since then, cigarette consumption in Thailand has been affected by Thailand's membership of the World Trade Organization and ASEAN Free Trade Area, by the 1997 economic crisis and by policies designed to reduce tobacco use. These factors suggested the need for a more comprehensive and up-to-date analysis of the economics of tobacco use in Thailand.

The tobacco industry and government revenue from tobacco

Tobacco employment in agriculture and manufacturing is a negligible fraction of each and declining. During the past four decades, tobacco production and tobacco manufacturing in Thailand have grown more slowly than the overall economy. Cigarette production peaked in 1996–97 at around 48 thousand million cigarettes and had fallen to about 32 thousand million by 2001. The market is dominated by the state-owned Thailand Tobacco Monopoly (TTM), although competition has been increasing and imports have grown to about 5% of the market. In 1999, the total income of TTM and 15 private sector domestic tobacco companies was over baht 44,700 million and total declared profit was nearly baht 5,900 million (in late 2002, baht 1=US$0.02324).

In tobacco leaf and tobacco product trade, Thailand is a net importing country. Trade in tobacco leaves is much larger than trade in cigarettes. In 2000, cigarette imports were US$ 62.645 million and exports were US$ 11.629 million.

The Thai government collects revenue from tobacco in two ways. TTM contributes about 4% of annual government revenue in profits and taxes. Taxes on imported cigarettes contribute another 0.7%. In 2000, tobacco contributed about baht 40 thousand million to government funds.

Smoking prevalence and tobacco use

Expenditure on tobacco (almost all on manufactured cigarettes) has increased over the past 30 years although it represents a declining share of consumption expenditure. Tobacco prices increased at a slower rate than those of other goods until 1996, and then increased faster than the inflation rate as greater use began to be made of tax policy to reduce smoking.

Smoking prevalence in Thailand has declined over the past decade, although population growth has kept the number of smokers roughly constant at about 12 million. In 1999 the smoking rate was about 24% for the population aged over 11 years, higher in rural than urban areas. Smoking

is an overwhelmingly male activity: female smoking is still low and a very attractive potential new market for cigarette companies.

Heart disease, and all forms of malignant neoplasm are two of the three leading causes of deaths in Thailand. Smoking is a key risk factor for many of these diseases. Death rates from all forms of malignant neoplasm have risen steadily (except for a short-lived improvement in 1997). Mortality rates from heart disease rose steadily until 1996 and have since fallen. Pneumonia and other lung diseases and tuberculosis death rates are also increasing.

Prices, taxes and demand

Thais spend almost 3% of total expenditures on cigarettes. The response of demand for tobacco to price changes in Thailand is similar to other middle-income countries, with each 1% real price increase causing a fall in consumption of about 0.4%. Thus tax increases would reduce demand, but increase total tax revenue. Econometric analysis of elasticities by rural/urban and income groups indicates that a tax policy that increased prices would be more effective in reducing smoking among urban smokers than among rural smokers, and have the largest impact in reducing smoking among people with low incomes.

Since March 2001, excise tax on cigarettes has been 75% of the retail (tax-inclusive) price. The paper examined the effects of a hypothetical rise in the tax rate from 75% to 76% with similar rises for other tobacco products. Overall cigarette consumption would fall by 1.64%, with most of the fall in demand being among the lower income groups. Excise tax revenue would rise by nearly 4%. Despite lower value-added tax income and smaller TTM profits, there would be a total net increase in government revenue of more than baht 1 thousand million or about 2.5%.

Qualitative surveys based on interviews with smokers and examination of their cigarette packets and of 809 packets collected across the country found about 15% of packets without the warning in Thai that is compulsory for all cigarettes legally sold in Thailand. This suggest that consumption of illegally imported cigarettes is perhaps two or three times consumption of legally imported cigarettes. This represents a significant loss to the government treasury. However, the interviews with smokers suggested that brand loyalty and concern that contraband products are substandard would prevent much shift to contraband if prices were to rise further in future.

Enforcement of some anti-smoking laws is not fully effective. The ban on cigarette advertising appears to be flouted, especially in provincial areas (21% of smokers said they had seen advertisements, mostly for Marlboro cigarettes), and more than half of all smokers reported that they had, on occasion, smoked in public places where smoking is supposed to be banned.

Health care cost of smoking

The direct and indirect costs of treating lung cancer and chronic obstructive pulmonary disease, both strongly associated with smoking, were estimated. For 1999, this was computed at about US$ 6 million, approximately 0.1 of Thailand's total health care expenditure that year.

Policy recommendations

Excise taxes on tobacco products should be increased in order to reduce demand for smoking and increase government revenues. Most smokers support such increases.

Measures should be taken to prevent women, who by and large do not smoke, from being targeted as potential customers by tobacco manufacturers.

Tobacco-control law enforcement needs to be stepped up, especially with regard to smoking in public places, bans on advertising, and selling tobacco to minors.

1. INTRODUCTION AND OUTLINE

Tobacco plays many roles in the Thai economy. It is a source of income and employment of workers in tobacco cultivation, tobacco manufacturing and sales of tobacco products. It is also a major source of government revenue from tobacco monopoly profit, customs tariffs on imported tobacco and tobacco products, and excise tax and value-added tax (VAT) on local and imported products. It is part of household consumption and is a major cause of diseases that impair and shorten the lives of millions of smokers in Thailand and people exposed to second-hand smoke.

Because of these conflicting roles, tobacco policies have been at the centre of discussions among economists, health personnel and policy-makers. On the one hand, tobacco consumption should be reduced so that consumers will have more income for other purposes, disease and premature death averted and future health costs avoided. On the other hand, there is concern that less smoking would mean decreased revenue from tobacco taxes, adversely affecting the development activities these taxes finance. Moreover, some tobacco farmers and workers in tobacco-related industries might lose jobs or income, and have to seek alternative income sources.

In Thailand, a number of studies have provided a basis for policies to reduce tobacco use. These studies have analysed the demand for cigarettes and the health cost of smoking. However, studies on cigarette demand were based on data of around 10 years ago. Some do not provide satisfactory results. Methodologies employed by various past studies on health care cost of smoking are not comparable. Moreover, international agreements such as the World Trade Organization (WTO) agreements and the ASEAN Free Trade Area (AFTA) agreement have made the domestic market a target of multinational cigarette companies and have put pressure on tobacco policies. However, the 1997 economic crisis led to depreciation of the baht, and imported cigarettes became relatively more expensive. These changes point to a need for a more comprehensive and up-to-date analysis of tobacco control measures in Thailand, especially their impact on tobacco consumption by smokers in various income classes and age groups, and on tax revenue. It should also be noted that, at present, there has been no analysis of the impact of tobacco control on employment and trade in tobacco and tobacco products. Although these are important, they are not the focus of this study.

Following this introductory section, this report is organized as follows. Section 2 describes the role of tobacco in the Thai economy. This focuses on production, employment and government revenue from tobacco. Section 3 investigates trends in tobacco consumption, prices, smoking prevalence and the major causes of death of the Thai population. It also briefly discusses tobacco trade and smuggling, and policy efforts to reduce smoking. Section 4 analyses demand to estimate the overall responsiveness of cigarette demand to price and income changes, the distributive effect of price/tax increases and the effect on smokers in various age groups. This section also demonstrates how an increase in the rate of excise tax will affect smokers' demand for cigarettes and government revenue from cigarettes. Section 5 summarizes some important findings on the health cost of smoking-related diseases. It reviews Thai literature on the health care cost of smoking. Policy recommendation are offered in the final section. The methodology and data used in this study are explained in the Appendices.

2. DESCRIPTION OF THE THAILAND TOBACCO INDUSTRY

2.1 Tobacco production and trade

During the past four decades, the growth of tobacco production and tobacco manufacturing in Thailand has been slower than that of the overall economy. The share of tobacco has remained fairly constant at around 0.05% while the agriculture sector declined from nearly 40% in 1960 to slightly over 11% after 1995 (Table 2.1). The share of the manufacture of tobacco and snuff declined from more than 1% to around 0.7% while that of all manufacturing rose from 12.5% in 1960 to around 30% by the end of the 1990s.

Table 2.1. GDP growth at 1988 prices and structure at current prices by sector (percentage)

	1960	1970	1980	1990	1995	1996	1997	1998	1999	2000
GDP growth rate	–	8.0	6.9	10.4	9.3	5.9	–1.5	–10.8	4.2	4.4
Total share	100	100	100	100	100	100	100	100	100	100
Agriculture	39.8	25.9	23.2	12.8	11.2	11.1	11.2	12.7	11.2	11.4
Tobacco	–	–	–	–	0.03	0.04	0.05	0.05	0.05	0.04
Manufacturing	12.5	15.9	21.3	27.3	28.2	28.2	28.7	29.4	31.1	30.5
tobacco & snuff	1.81	1.18	1.13	0.79	0.59	0.59	0.72	0.71	0.65	0.73
Other	47.7	58.2	55.5	59.9	60.6	60.7	60.1	57.9	57.7	58.1

Source: Office of the National Economic and Social Development Board, Thailand.

Due to Thailand's openness to the world market, competition in the tobacco industry has been increasing. In 2001, the industry comprised the state-owned Thailand Tobacco Monopoly (TTM) and 15 private import companies, of which 12 were foreign ventures. The state-owned tobacco company produced around 32 thousand million cigarettes under 24 product brands while private companies imported as many as 63 brands. In 1999, the total income of TTM and the other 15 tobacco companies was well over baht 44,700 million and the total declared profit was nearly baht 5,900 million (in late 2002, baht 1 = US$ 0.2324).

The increasing trend in cigarette production was reversed after the onset of the 1997 economic crisis. TTM production had increased continuously before 1996, peaked at 47,752 million cigarettes in 1996–97 (Table 2.2). Since then, production has decreased. It dropped dramatically from 47,126 million cigarettes in 1997–98 to 34,569 million cigarettes in 1998–99. In 2000–01, total production went down to 31,795 million cigarettes. Tobacco leaf production fluctuated over the same period and went down to less than 56 million kilograms in 2000–01.

Table 2.2. Production of cigarettes (TTM) and tobacco leaf, Thailand, 1990-2001

Year	TTM cigarette production (million cigarettes)	Tobacco leaf production (kg)			
		Total	Virginia	Burley	Turkish
1990–91	38 237.22	67 076 491	28 899 226	23 121 959	15 055 306
1991–92	39 721.45	66 838 953	32 732 918	24 329 596	9 776 439
1992–93	39 593.12	83 700 510	35 720 681	33 922 899	14 056 930
1993–94	41 221.78	94 567 686	45 672 089	33 299 738	15 595 859
1994–95	44 544.10	63 526 715	24 006 514	29 316 086	10 204 115
1995–96	43 183.83	52 106 638	23 921 225	19 265 110	8 920 303
1996–97	47 751.79	68 374 209	25 926 870	29 912 031	12 535 308
1997–98	47 125.75	75 014 012	29 542 928	29 960 450	15 510 634
1998–99	34 568.73	74 275 810	30 424 981	35 088 961	8 761 868
1999–00	32 022.62	75 014 255	24 367 403	42 094 414	8 552 438
2000–01	31 795.23	55 723 446	21 416 809	28 414 703	5 891 934

Source: Thailand Tobacco Monopoly.

Thailand is a net importer of tobacco leaf and products. Trade in tobacco leaves is much larger than trade in cigarettes. In 1995, tobacco leaf imports were worth US$ 100.544 million while exports were US$ 58.198 million, for a net deficit of around US$ 42 million (Table 2.3). In 2000, the import and export figures went up to US$ 70.897 million and US$ 121.834 million; the deficit increased to nearly US$ 51 million. The cigarette trade deficit of US$ 35 million in 1995 (US$ 36.765 million imports and US$ 1.466 million exports) rose to more than US$ 51 million in 2000, when cigarette imports were US$ 62.645 million and exports were US$ 11.629 million. If manufactured cigarettes had been imported instead of tobacco leaves that were then used for domestic production of cigarettes, the overall tobacco trade deficit would have been even greater.

Table 2.3. Trade in tobacco and tobacco products, various years (US$ million)

Product	1995	1996	1997	1998	1999	2000
Net trade	–77.644	–27.159	–2.671	–28.418	–81.597	–102.096
Export	60.592	101.333	102.235	96.987	70.893	83.317
Tobacco	58.198	95.016	90.581	84.153	58.946	70.897
Cigarettes	1.466	4.523	9.385	11.467	10.468	11.629
Other	0.928	1.794	2.269	1.367	1.479	0.791
Import	138.236	128.492	104.906	125.405	152.490	185.413
Tobacco	100.544	94.688	79.816	99.089	113.601	121.834
Cigarettes	36.765	32.721	23.659	25.403	37.541	62.645
Other	0.927	1.083	1.431	0.913	1.348	0.934
baht/US$ rate	24.89	25.32	31.32	41.31	37.79	40.11

Source: Customs Department, Thailand.

2.2 Employment in the tobacco industry

The contribution of the tobacco industry to employment is small. In 2000, more than 33 million, or almost 50%, of 62 million Thais were in the labour force (Table 2.4). Agriculture was the biggest sector of employment, employing around 14 million people, of whom only around 0.67% or 94,486 persons worked in tobacco production. Another 5 million were employed in manufacturing, of which only around 0.11% or 4,925 persons worked in tobacco manufacturing, for the Thailand Tobacco Monopoly. There are no data on the contribution of tobacco trade and sales to the remaining 12.4 million labour force in other sectors. However, it is also very small.

Table 2.4. Labour force, by sector, Thailand, 1995–2000 (000s)

Year	Total labour force	Sector		
		Agriculture	Manufacturing	Other
1995	32 175	14 389	4 608	11 818
1996	32 324	14 137	4 651	12 378
1997	32 781	14 315	4 644	12 755
1998	32 496	13 571	4 577	12 122
1999	32 911	13 997	4 611	12 227
2000	33 394	14 000	5 005	12 442

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The importance of tobacco as a source of employment has been decreasing continuously. The number of TTM employees decreased from around 7,800 in 1985–86 to 4,925 in 1999–2000 (Table 2.5). Of these, around 40% were hourly workers. Tobacco employment was a tiny fraction of total manufacturing sector employment, which totalled 33 million and 16% of the total Thai labour force. The number of tobacco farmers, which had been more in earlier years, went down to around 150,000 in 1992–93 and fluctuated around 100,000 after that. In 1999–2000, the number of tobacco farmers was 94,486. This was a very tiny percentage of all farmers and farm workers, who constituted around 42% of the Thai labour force. However, it should be noted that while the total number of TTM employees and tobacco farmers decreased, employment in industries related to cigarette importation increased, by an unknown but probably very small number. These industries are part of other sectors whose share of the total labour force continuously increased during the past decades and reached 42% in 1999.

Table 2.5. Employment in tobacco cultivation and cigarette production, 1985–2000

Year	Total (persons)	Tobacco farmers (persons)	TTM employees (persons)
1985–86	n.a.	n.a.	7 820
1990–91	n.a.	n.a.	6 949
1995–96	106 442	100 053	6 389
1996–97	102 300	96 041	6 259
1997–98	120 724	114 749	5 975
1998–99	119 265	113 680	5 585
1999–2000	99 411	94 486	4 925

n.a. = not available. The total number is full-time equivalent.
Sources: Excise Department, Thailand and Thailand Tobacco Monopoly.

2.3 Government revenue

The Thai government derives its revenue from many sources. In 2000, total government revenue was baht 746,816 million or approximately US$ 18,619 million (Table 2.6). Income tax provided around one-third of the total revenue. The shares of major indirect taxes such as selective sales (excise and municipal) taxes and value-added tax were approximately 22% and 20% of total revenue, respectively. The remaining revenue came from import duties (11%), fiscal monopolies (2%) and other sources (12%). The revenue structure has changed since the 1980s and early 1990s, when more than 20% of revenue was derived from import tax.

Table 2.6. Thai Government revenue, by source, various years (million baht)

	1986	1990	1995	1996	1997	1998	1999	2000
Total revenue	170 025	411 652	777 286	853 201	847 696	717 780	713 079	746 816
Taxation:	154 202	385 742	711 098	785 797	762 286	633 599	632 626	679 017
Income taxes:	34 767	101 940	248 567	281 528	276 365	213 435	205 007	243 493
Personal	19 218	41 524	88 169	107 727	111 682	123 058	91 925	90 541
Corporation	15 549	58 658	157 160	170 178	159 717	85 114	101 941	142 097
Petroleum	–	1 758	3 238	3623	4 966	5 263	11 141	10 855
Indirect taxes:	119 435	283 802	462 531	504 269	485 921	420 164	427 619	435 524
Import duties[1]	31 106	93 218	127 389	121 783	94 813	60 928	73 355	85 081
Export duties	806	69	12	9	14	18	68	88
Business taxes	28 150	90 157	699	520	394	451	95	152
VAT[2]	–	–	142 955	180 911	185 942	176 392	157 721	154 181
Selective sales tax	46 332	72 210	161 170	173 737	175 159	158 908	167 986	165 316
Fiscal monopolies	3 040	5224	7 890	4 027	12 133	8 906	14 995	14 696
Royalties	2 098	2 934	4 233	5 056	6 471	8 771	7 601	12 186
Licences and fees	5 426	5 454	1 569	2 084	2 808	1 248	1 168	1 550
Other taxes	2 477	14 536	16 614	16 142	8 187	4 542	4 630	2 274
Sales and charge	2 906	4 761	7 809	8 626	8 710	9 422	25 598	10 403
Enterprise & dividend	5 936	12 031	36 796	45 697	57 694	35 846	37 806	34 471
Miscellaneous revenue	6 981	9 118	21 583	13 081	19 006	38 913	17 049	22 925

Source: Bank of Thailand.

1. From 1982, items listed under government revenue from import duties are adjusted in line with trade statistics.

2. Includes specific-business trade.

The significant contribution of the tobacco industry to government revenue consists of two parts. First, the Thailand Tobacco Monopoly, the only cigarette producer, has contributed around 3.5%–4.5% of government revenue. In 2000, this was slightly less than baht 34 thousand million (Table 2.7). Nearly 70% of this was from excise tax on cigarettes and other tobacco products. Another 15.65% was in the form of returns to government ownership in TTM. Another 8.6% was from value-added tax. The second part is tax revenue from imported tobacco and tobacco products, which has increased considerably over the past decade. In 2000, Thailand imported cigarettes with a total value of around US$ 62.645 million or around baht 2,513 million. The Thai government earned nearly baht 4,595 million from excise tax on these imported products.

Revenue from tariff and value-added tax was not reported. Based on the prevailing tax rates in 2000, tariff revenue should be around baht 503 million, and revenue from value-added tax should be around baht 533 million (Table 2.8). Thus, the Thai government's dependence on tobacco is fairly high. In 2000, the total government revenue from cigarettes was nearly baht 40 thousand million—more than 5% of total government revenue. Of this, more than baht 34 thousand million was tax revenue.

Table 2.7. Thai government revenue from TTM, 1993–2000 (million baht)

Year	All sources	Tobacco revenue from TTM					
		Total	TTM profit	Excise tax	VAT	Tariff	Others
1993	574 932	20 241	2 802	14 497	1 726	1 024	192
1994	680 337	25 329	2 954	18 862	2 174	1 115	224
1995	777 286	26 499	3 588	19 469	2 175	1 042	225
1996	853 201	29 583	3 448	22 733	2 543	597	260
1997	847 696	35 771	3 600	28 296	3 032	478	365
1998	717 780	35 450	4 658	25 816	4 037	512	427
1999	713 079	32 632	5 000	23 101	3 309	693	529
2000	746 816	33 910	5 310	23 540	2 916	480	1 664

Sources: Bank of Thailand, and Thailand Tobacco Monopoly.

Table 2.8. Thai government revenue from tobacco, 2000 (million baht)

Total	Revenue from TTM						Revenue from imports			
	Total	Tariff	Excise tax	VAT	TTM profit	Other	Total	Tariff*	Excise tax	VAT*
39 541	33 910	480	23 540	2 916	5 310	1 664	5 631	503	4 595	533

Note: * = estimated values. Tariff revenue is assumed to equal 20% of imported cigarette value. However, this implies excise tax revenue of around baht 10 100 million, which is around two times the actual figure. Revenue from local tax is not included. It could be as much as baht 1400 million.

Sources: Excise Department, Thailand and Customs Department, Thailand.

3. PREVALENCE AND CONSUMPTION

3.1 Trends in tobacco consumption and prices

Over the past three decades, expenditure on tobacco products has changed considerably. In 1970, Thai smokers spent over baht 3 thousand million on tobacco products (Table 3.1). This was equivalent to 3.69% of aggregate private consumption expenditure. Ten years later, while tobacco expenditure rose to baht 12 thousand million, its share of aggregate consumption expenditure dropped to 2.78%. The same trend continued, and by 1990 expenditure was up to around baht 27 thousand million while its share of private consumption expenditure had fallen to 2.18%. In the boom that began in the second half of the 1980s, tobacco consumption rose dramatically to around baht 43 and 48 thousand million in 1995 and 1996, respectively.

However, its share of private consumption expenditure dropped further to 1.91% and 1.63% in those years. The decrease in the share of tobacco expenditure could reflect a decrease in demand for tobacco or in tobacco prices or both, relative to other goods and services.

Table 3.1. Consumption expenditure at current prices, Thailand, various years (million baht)

	1970	1975	1980	1985	1990	1995	1996	1997	1998
Total consumption expenditure	108 049	229 477	515 018	800 288	1 440 335	2 642 277	2 977 900	3 096 332	3 029 984
Private consumption expenditure	92 429	198 514	433 585	657 365	1 234 981	2 229 259	2 510 293	2 622 594	2 529 279
Tobacco	3 414	6 340	12 066	17 413	26 945	42 536	48 490	53 670	52 327
General government expenditure	15 620	30 963	81 433	142 923	205 354	413 018	467 607	473 738	500 705

Source: Office of the National Economic and Social Development Board, Thailand.

At constant 1988 prices, consumption of tobacco products increased relatively continuously before 1980. In 1970, tobacco expenditure (baht 7.261 thousand million) represented a 2.27% share of total consumption expenditure (baht 320.483 thousand million). In 1980, with an average annual growth rate of around 9%, tobacco expenditure jumped to baht 17.353 thousand million and its share of total consumption expenditure of baht 607.226 thousand million went up to 2.86% (Table 3.2). The trend began to reverse in 1982 when the share dropped to 2.41% and fluctuated around 2.4% to 2.5% in the following two years. The decreasing trend continued in the second half of the 1980s and the 1990s. The average annual growth rate of tobacco expenditure over these periods was well behind that of expenditure on other goods. In 1998, tobacco consumption went down to baht 24.814 thousand million and its share of total consumption expenditure went down to 1.87%. The total consumption expenditure in that year was around baht 1484 thousand million.

Table 3.2. Consumption expenditure at 1988 prices, Thailand, various years (million baht)

	1970	1975	1980	1985	1990	1995	1996	1997	1998
Total consumption expenditure	367 510	502 494	714 164	874 451	1 282 879	1 834 327	1 971 392	1 945 503	1 741 626
Private consumption expenditure	320 483	439 772	607 226	723 199	1 110 935	1 601 525	1 710 852	1 692 861	1 484 088
… of which tobacco was	7 261	11 295	17 353	16 187	24 732	32 442	34 568	31 293	24 814
General government expenditure	47 027	62 722	106 938	151 252	171 944	232 802	260 540	252 642	257 538

Source: Office of the National Economic and Social Development Board, Thailand.

Between 1970 and 1996, tobacco products became relatively cheaper than other consumer goods. The tobacco price index, which was 47.02 in 1970, increased continuously to 100.00 in 1988 and 140.27 in 1996. At the same time, the price index of other consumer goods, which was 28.84 in 1970, increased to 146.73 in 1996. This slower increase in the prices of tobacco products

encouraged people to spend more on tobacco products, and pointed to an urgent need for measures to deter smoking, especially price increases.

After 1996, tobacco products became relatively more expensive. The tobacco price index rose from 140.27 in 1996 to 171.51 in 1997 and 210.88 in 1998 (Figure 3.1 and Table 3.3). Concurrently, the price index of other consumer goods increased from 146.73 in 1996 to 154.92 in 1997 and 170.43 in 1998. This increase in relative prices of cigarettes and other tobacco products decreased smokers' demand for tobacco products. Price policies to combat smoking were very active over this period.

Table 3.3. RI FRQVXP HUJRRGVDQGWREDFFRSURGXFW 3 UHLQGH[, Thailand, YDULRXV HDUV

Price index	1970	1975	1980	1985	1990	1995	1996	1997	1998
Consumer goods	28.84	45.14	71.40	90.90	117.17	139.20	146.73	154.92	170.43
Tobacco	47.02	56.13	69.53	107.57	108.95	131.11	140.27	171.51	210.88

Index base year is 1988.
Source: Author's calculation from the National Income Account of NESDB.

Figure 3.1. Price of tobacco products and other consumer goods, Thailand

Source: Table 3.3.

Almost all of expenditure on tobacco products is on manufactured cigarettes. Tobacco products consumed in Thailand consist of domestic cigarettes, imported cigarettes and various kinds of traditional tobacco products such as self-rolled cigarettes, *bai jak* and *ya chun*. The value share of these traditional products, which was 3.32% in 1980, has decreased continuously and reached 0.67% in 1995, fluctuating around 0.70% since then (Tables 3.4 and 3.5). Local cigarettes, cigarettes manufactured by TTM and imported cigarettes compete for the cigarette market share of more than 99% of the total tobacco product market. The share of TTM in the total tobacco product market was more than 95% of total expenditure on tobacco products during the pre-1995 period, but dropped continuously to less than 91% in 1995. After that year, the share of TTM increased continuously, reached 95% again in 1998, and decreased slightly to 94.30% in 1999.

It is important to note that these are value shares and are not the share of each category of tobacco product measured in physical units such as the number of smokers or the number of

cigarettes. Because of differences in tax rates and production costs and the nature of the products, the prices of manufactured, domestically produced and imported cigarettes are much higher than the prices of self-rolled cigarettes and other tobacco products. Consequently, the share of cigarettes and the share of smokers in volume terms could be much less than the value share. While its value share was more than 90%, in terms of the number of smokers, manufactured cigarettes are smoked by about half of all regular smokers. The other half of smokers roll their own.

Table 3.4. Tobacco consumption at current prices and tobacco products market shares, Thailand, various years

Product	1980	1985	1990	1995	1996	1997	1998	1999
Consumption (million baht)	12 066	17 413	26 945	42 536	48 487	53 670	52 327	48 482
Share (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Domestic cigarettes (%)	95.15	97.14	97.24	90.96	91.89	93.41	95.71	94.30
Imported cigarettes (%)	1.53	0.88	1.31	8.37	7.42	5.91	3.58	4.89
Other (%)	3.32	1.98	1.45	0.67	0.69	0.68	0.71	0.81

Source: Office of the National Economic and Social Development Board, Thailand.

Table 3.5. Population 11 years of age and over who smoked regularly, by type of tobacco product, Thailand, 1996, 1999 and 2001

Type	1996	1999	2001
Domestic cigarettes	54.9	45.5	46.0
Imported cigarettes	2.1	3.6	1.2
Self-rolled	42.3	50.6	52.7
Other	0.7	0.3	0.1

Note: the 2001 figures are based on population 15 years of age and over who smoked regularly.
Source: Health and Welfare Survey, National Statistical Office, Thailand.

3.2 Smoking prevalence

Changes in smoking prevalence indicate that Thailand has been partially successful in limiting the number of smokers. Smokers are defined as those who smoke regularly or occasionally. The percentage of smokers in the total population increased slightly from 27.31% in 1986 to 28.05% in 1988 and 28.38% in 1991 (Table 3.6). Then smoking prevalence dropped to 25.40% in 1993 and increased to 26.14% in 1996. The impact of the economic crisis that began in 1997 was found to be very significant. The Thai economy recorded negative growth rates in 1997 and 1998, and tobacco prices rose sharply over the same period (Table 3.3); the smoking rate dropped dramatically to 24.03% in 1999. However, while the smoking rate tended to decrease, the total number of smokers fluctuated around 12 million in the second half of the 1990s. The number of those who smoked regularly was also around 11 million.

Table 3.6. Smoking prevalence, Thailand, various years

Smoking prevalence	1986	1988	1991	1993	1996	1999
Population (million)	37.997	40.479	43.291	45.680	48.009	49.906
Smokers (million)	10.376	11.355	12.286	11.603	12.548	11.992
(%)	(27.31)	(28.05)	(28.38)	(25.40)	(26.14)	(24.03)
Regular smokers (million)	–	10.110	11.402	10.406	11.254	10.231
(%)		(24.98)	(26.34)	(22.78)	(23.44)	(20.50)
Occasional smokers (million)	–	1.245	0.884	1.196	1.294	1.761
(%)		(3.07)	(2.04)	(2.62)	(2.70)	(3.53)

Note: population 11 years of age and over.
Source: reports of Health and Welfare Survey, National Statistical Office, Thailand.

Based on the share of expenditure of tobacco products in total household consumption expenditure, the effectiveness of tobacco control measures appears to vary across income groups. Between 1990 and 2000, the share of tobacco products in the expenditure of households in the seven upper deciles decreased significantly. In the three lower deciles, the share increased or decreased slightly from 1.49%, 1.53% and 1.48% to 1.59%, 1.51% and 1.50%, respectively (Table 3.7). These changes could be because efforts to deter smoking have been more effective among smokers in the upper income deciles than smokers in lower income deciles, or because incomes in the upper groups have risen more relative to tobacco expenditures.

Table 3.7 Percentage share of expenditure for tobacco products in total household consumption expenditure, by income decile, Thailand, 1990 and 2000

		Income Decile									
Year	Total	1	2	3	4	5	6	7	8	9	10
1990	1.53	1.49	1.53	1.48	1.74	1.83	1.96	2.02	1.98	1.69	0.89
2000	1.08	1.59	1.51	1.50	1.44	1.81	1.61	1.68	1.42	1.15	0.53

Note: Income deciles are ranked in ascending order: decile 1 is the poorest and decile 10 is the richest.
Source: Reports of Household Socioeconomic Survey, National Statistical Office, Thailand.

The report of the 1999 Health and Welfare Survey raised concerns over the number and status of smokers in Thailand. In that year, nearly 12 million Thais were smokers. Of these, 10.231 million were regular smokers. The number of smokers was equivalent to around 19.45% and 24.02% of the total population and population 11 years of age and over, respectively. In comparison to the pre-1999 figures, the 1999 figures were smaller. However, while the percentage of regular smokers decreased over the period, the percentage of occasional smokers increased. This change seems to be favourable. But the success of smoking control could be over-reported: because of the anti-smoking campaign, smokers may be less willing to report their actual smoking habits.

People living in rural areas have a tendency to smoke more than those who live in urban areas (Table 3.8). In absolute terms, the number of smokers in urban areas was around 1.941 million while that in rural areas was 10.051 million. In relative terms, smoking tends to be higher in rural areas than in urban areas. Around 26% of rural Thais older than 11 years old smoked while only 18% of urban Thais in the same age category smoked. It should be added that the difference was

mainly caused by the rate of male regular smokers, which was approximately 22% in rural areas, but slightly over 15% in urban areas. The rate of smoking participation was much higher among males than females, irrespective of area. While one in two males smoked, only around 3% of Thai females smoked regularly or occasionally. If there are no effective preventive measures, female smoking could be a very attractive target for cigarette companies.

Table 3.8. Smoking prevalence by urban/rural, sex and smoking habit, Thailand, 1999 (1000 persons)

Smoking habit	Total #	Total (%)	Urban #	Urban (%)	Rural #	Rural (%)
Total	49 905.6	(100.00)	10 953.0	(100.00)	38 952.6	(100.00)
Smokers	11 991.7	(24.03)	1 940.7	(17.72)	10 051.0	(25.80)
Regular smokers	10 230.6	(20.50)	1 669.4	(15.24)	8 561.2	(21.98)
Occasional smokers	1 761.1	(3.53)	271.3	(2.48)	1 489.8	(3.82)
Non-smokers	37 913.9	(75.97)	9 012.3	(82.28)	28 901.6	(74.20)
Male	24 801.3	(100.00)	5 300.8	(100.00)	19 500.5	(100.00)
Smokers	11 247.4	(45.35)	1 826.6	(34.46)	9 420.8	(48.31)
Regular smoker	9 638.3	(38.86)	1 576.0	(29.73)	8 062.3	(41.34)
Occasional smokers	1 609.1	(6.49)	250.6	(4.73)	1 358.8	(6.97)
Non-smokers	13 553.9	(54.65)	3 474.2	(65.54)	10 079.6	(51.69)
Female	25 104.3	(100.00)	5 652.2	(100.00)	19 452.1	(100.00)
Smokers	744.3	(2.96)	114.2	(2.02)	630.2	(3.24)
Regular smokers	592.3	(2.36)	93.5	(1.65)	498.9	(2.56)
Occasional smokers	152.0	(0.60)	20.7	(0.37)	131.3	(0.68)
Non-smokers	24 360.0	(97.04)	5 538.0	(97.98)	18 821.9	(96.76)

Note: in this survey, urban means areas covered by Bangkok metropolis and municipal areas.
Source: report of the Health and Welfare Survey, National Statistical Office, Thailand.

Smoking prevalence increases with age, peaking around 35–39 years old at over 30% then dropping slightly (Table 3.9).

Table 3.9. Population 11 years and over, by age group and smoking habit, 1999 (000s)

Smoking habit	Total	Age group (years)								
		11–14	15–19	20–24	25–29	30–34	35–39	40–49	50–59	60+
Total	49 905.6	4 375.9	5 699.9	5 770.6	5 595.2	5 222.4	4 786.4	7 895.5	5 083.2	5 476.5
Smokers (%)	11 991.7 (24.03)	11.7 (0.27)	493.9 (8.67)	1 350.2 (23.40)	1 630.3 (29.14)	1 566.4 (29.99)	1 491.2 (31.15)	2 443.5 (30.95)	1 552.3 (30.54)	1 452.1 (26.52)
Regular smoker	10 230.6	10.9	359.5	1 056.2	1 386.5	1 311.9	1 285.3	2 162.8	1 378.7	1 278.7
Occasional smoker	1 761.1	0.8	134.4	294.0	243.8	254.5	205.9	280.7	173.6	173.4
Non-smoker	37 913.9	4 364.2	5 206.0	4 420.4	3 964.9	3 655.9	3 295.2	5 452.0	3 530.9	4 024.4

Source: report of the Health and Welfare Survey, National Statistical Office, Thailand.

3.3 Causes of death

Heart disease, and malignant neoplasms are among the 3 leading causes of deaths in Thailand. Tobacco use is an important risk factor for both. Death rates per 100 000 population from these causes increased during the early 1990s and then fell after 1996 (Table 3.11). While the contribution of heart diseases decreased, deaths caused by all forms of malignant neoplasm, pneumonia and other lung diseases, and tuberculosis increased and contributed to the increasing trend in the death rate, especially in the post-1996 period. In 2000, death caused by these diseases rose sharply to 92 per 100 000 population, while it was only around 61 in 1992. Smoking is a key explanatory factor for this increase.

Table 3.10. Death rates per 100 000 population, by cause of death, Thailand, 1992–2000

Cause	1992	1993	1994	1995	1996
Total	480	492	520	548	573
Malignant neoplasm, all forms	43.5	45.0	48.9	50.9	50.5
Heart disease	56.0	58.5	62.5	69.2	77.4
Accident and poisoning	48.5	52.7	61.5	61.5	62.0
Hypertension and cerebrovascular	16.9	16.4	15.7	16.1	15.6
Suicide, homicide/other injury	15.2	14.7	11.1	13.3	13.8
Pneumonia and other lung diseases	11.4	13.8	11.2	11.8	12.6
Nephritis, nephrotic syndrome and nephrosis	9.7	9.9	9.9	11.0	8.1
Diseases of liver and pancreas	13.3	13.0	13.0	12.9	12.4
Tuberculosis, all forms	6.3	6.1	5.9	7.0	7.7
Dengue haemorrhagic fever	–	–	–	–	0.5
Other	259.2	261.9	280.3	294.3	312.4

(continued)

	1996	1997	1998	1999	2000
Total	573	497	508	589	592
Malignant neoplasm, all forms	50.5	43.4	48.7	58.6	63.9
Heart disease	77.4	71.1	63.5	49.9	31.9
Accident and poisoning	62.0	49.0	35.5	48.5	52.6
Hypertension and cerebrovascular	15.6	13.3	10.3	15.6	18.9
Suicide, homicide/other injury	13.8	12.5	14.2	15.0	14.0
Pneumonia and other lung diseases	12.6	10.2	10.0	15.3	18.0
Nephritis, nephrotic syndrome and nephrosis	8.1	8.4	9.8	11.0	14.7
Diseases of liver and pancreas	12.4	10.4	9.4	10.4	10.9
Tuberculosis, all forms	7.7	6.1	7.0	8.6	10.1
Dengue haemorrhagic fever	0.5	0.5	0.6	0.2	0.2
Other	312.4	272.1	299.0	355.9	356.8

Source: Ministry of Public Health, Thailand.

4. PRICES, TAXES, AND THE DEMAND FOR TOBACCO PRODUCTS

4.1 Cigarettes and consumption demand

Past studies on cigarette demand

There are a limited number of studies on the demand for tobacco and tobacco products in Thailand. Supakorn (1993 in Isra, 1995) used a log–linear model and national-level data to analyse aggregate tobacco consumption. The study found that the demand for tobacco products was inelastic. The estimated price and income elasticities of demand were –0.666 and 0.359, respectively. This implies that each 10% increase in price (through an increase in tax rate) would decrease demand by under 7% and would increase total tax revenue. A 10% increase in income would lead to a 3.6% increase in demand. To counter the effect of rising income on tobacco product consumption, prices would need to increase by around 0.54 times the real rate of growth of the Thai economy.

Isra (1995) used a linear expenditure system and 1988 household level data to analyse demand for tobacco products. The study divided smokers by the level of per capita expenditure on tobacco products. Results showed that, on average, the price and expenditure elasticities of demand for tobacco products were –0.0926 and 0.1387, respectively. A 10% increase in price would lead to a less than 1% decrease in demand. Thus, an increase in tax revenue that followed a tax increase was found to be greater than that found by Supakorn. Moreover, the elasticity estimates indicate that, in order to freeze the demand for tobacco products, the increase in the prices of tobacco products should be around 1.5 times the real growth rate of the economy. The same study also estimated the elasticity of substitution between local cigarettes and imported cigarettes. The results indicated that a 10% change in the relative price of cigarettes from the two sources would lead to a 1.936% shift in demand from expensive cigarettes to cheaper cigarettes. The results of another study (Suchada, 1997) also pointed to a similar conclusion. Demand for cigarettes is very inelastic. An increase in tax rate will reduce cigarette consumption and increase tax revenue. Local and imported cigarettes are complementary products – consumers switch between them to some extent in response to price changes.

Another three studies worth mentioning are Mason et al. (1987 in Direk, 1989), Direk (1989) and Isra (1995). These studies also used household-level data and a linear expenditure system to analyse household demand. Beverages and tobacco products were aggregated in the same category. Estimates of the price elasticity of demand for the combined products from two of the studies were –0.979 and –0.828. These were significantly higher than the estimates derived in other studies. This was because of the inclusion of alcoholic and non-alcoholic beverages in the same category. Demand for beverages is believed to be more elastic than that for addictive products such as cigarettes and other tobacco products. The third study aggregated spending on cigarettes, alcohol and gambling. Income elasticity was found to be more than 1 for consumers in the bottom urban quintile and four lower rural quintiles while those of other quintiles were less than 1. The price elasticity was less than 1 for consumers in most quintiles, except those in the three lower rural quintiles.

Overall responsiveness

The present study used data from the household socioeconomic survey, 2000 (SES2000) and various price data sets (see details in Appendix 1) to analyse demand for cigarettes and other products. Hereafter, the term "cigarettes" means cigarettes and other tobacco products. Almost half (48%) of households spent some amount each month on tobacco products, the analysis focuses on these 11,968 households.

Looking at average expenditures for each consumer good, and as a percentage of total expenditure, puts cigarette expenditures in context. Average expenditure on food, housing, transport and communication, and education were the four highest categories. Each month, the average Thai spent around baht 1972.71 or US$ 46.42. Of this around 38% or baht 741.39 was spent on food. Of the remaining 62% that was non-food expenditure, baht 449.22 was expenditure on housing and domestic activity, baht 281.60 for transport and communication, baht 99.25 for education and baht 78.98 for clothing. Expenditure on non-essential goods accounted for nearly 8% of total consumption expenditure. Of this baht 60.08, baht 56.24 and baht 39.46 were for "bads" (goods that can harm health or family wellbeing)—alcoholic beverages, cigarettes and gambling—respectively. Expenditure on recreation was less than baht 16 per month. Only around baht 37 was left for goods such as gifts, social contributions, occupational expenses, charities and donation, and religious contributions.

Table 4.1. Average per capita expenditure, marginal budget share, committed level of expenditure and expenditure elasticity of demand, Thailand, 2000

Good	Average expenditure (baht)	Budget share	Committed expenditure (baht)	Expenditure elasticity (ε_i)
Total	1972.71	1.0000	909.32	–
Food	741.39	0.2048	492.38	0.5448
Clothing	78.98	0.0491	30.53	1.2276
Housing	449.22	0.2048	206.35	0.8993
Health care	56.15	0.0403	20.19	1.4159
Personal care	57.64	0.0192	37.00	0.6580
T'port and communication	281.60	0.3092	0.00	2.1659
Recreation	15.53	0.0179	0.00	2.2681
Education	99.25	0.0648	45.23	1.2873
Alcoholic beverages	60.08	0.0299	20.67	0.9822
Cigarettes	**56.24**	**0.0201**	**26.88**	**0.7049**
Gambling	39.46	0.0209	12.91	1.0454
Other non-foods	37.17	0.0190	17.19	1.0124

Source: author's estimates.

The expenditure elasticity of demand (ε_i) captures the change in expenditure on a good as income changes. Results show that a 1% increase (decrease) in income will lead to a 0.70% increase (decrease) in demand for cigarettes. By comparison, a 1% increase (decrease) in income will lead to a 0.54% increase (decrease) in demand for food and 0.98%, 0.90% and 0.66%

changes in demand for alcoholic beverages, housing, and personal care, respectively. Education and health care expenditures respond more strongly to income changes (ε_i =1.4 and 1.28 respectively), as do recreation (ε_i = 2.29), transport and communication (ε_i = 2.17) and clothing (ε_i = 1.23). Thus, during an economic boom, demand for these goods will grow at a relatively higher rate than that of the average of all other consumer goods. When the economy is in recession, the decrease in demand for these goods will be greater than that of the demand for other consumer goods.

In order to prevent expenditures on cigarettes rising as incomes rise, percentage increases in cigarette real prices should be around 1.8 times the rates of increase in smokers' incomes. This would prevent an increase in total demand as incomes rise, and also increase tax revenue. Smokers who quit or decrease their consumption in response to price increases will free up disposable income to reallocate to other goods. Smokers who continue to smoke the same quantities at higher prices will have less to spend on other goods, but the impact is modest, as cigarettes account for only 2% of total spending.

Price elasticity (ε_{ii}) is defined as a percentage change in the quantity purchased, divided by the percentage change in the price of the commodity. It has important policy implications. The responsiveness of cigarette demand to a change in cigarette price in Thailand is in the usual range for middle- and higher income countries (table 4.2). Each 1% increase in cigarette real prices will lead to a 0.39% decrease in cigarette demand.[1] This also implies that tax revenue will rise as a result of increases in the tax rate, even though consumption falls, because the fall in consumption is proportionately smaller than the tax and price increases.

Table 4.2 shows price elasticities for all 12 goods. Recreation, and transport and communication are highly price responsive, with price elasticities greater than 1. For the other 10 goods, a 1% increase in their own prices would reduce demand by between 0.36% and 0.77%, depending on the good. Although cigarettes are on the low end of the range of price elasticities, tax increases that increase prices are still a powerful policy tool to reduce cigarette consumption.

The cross price elasticity of demand (ε_{ij}) shows that almost every pair of goods is complementary ($\varepsilon_{ij} < 0$). A rise in the price of one good will reduce real income and, as a consequence, the demand for other goods. The impact of a 1% increase in cigarette prices on demand for other goods is generally low, a small fraction of one percent. The impact on demand for health care would be –0.025% and for education would be –0.023%. Food price changes would have the most significant impact on demand for other goods, because they absorb such a large share of all expenditures. A 1% increase in food prices will reduce demand for recreation, and transport and communication by about 0.60%, and would reduce demand for health care by –0.38% and demand for education by –0.34%.

[1] In the author's 2001 survey of 810 smokers, 32% of smokers said they would reduce their cigarette consumption if prices were to increase by 10%. The price elasticity estimated from this small survey was lower than the estimate using the national household survey data.

Table 4.2. Price elasticity and cross price elasticity of demand, Thailand, 2000

Good	1	2	3	4	5	6
Price elasticity						
1. Food	**–0.4383***	–0.0074	–0.0639	–0.0037	–0.0103	0.0130
2. Clothing	–0.3259	**–0.6784***	–0.1440	–0.0083	–0.0231	0.0294
3. Housing	–0.2387	–0.0122	**–0.5903***	–0.0061	–0.0170	0.0215
4. Health care	–0.3759	–0.0192	–0.1440	**–0.7729***	–0.0267	0.0339
5. Personal care	–0.1747	–0.0089	–0.0772	–0.0044	**–0.3671***	0.0157
6. Transport and communication	–0.5749	–0.0293	–0.2541	–0.0146	–0.0408	**–1.1158***
7. Recreation	–0.6021	–0.0307	–0.1661	–0.0153	–0.0428	0.0542
8. Education	–0.3417	–0.0174	–0.1510	–0.0087	–0.0243	0.0308
9. Alcoholic beverages	–0.2607	–0.0133	–0.1152	–0.0066	–0.0185	0.0235
10. Cigarettes	–0.1871	–0.0095	–0.0827	–0.0047	–0.0133	0.0169
11. Gambling	–0.2775	–0.0142	–0.1227	–0.0070	–0.0197	0.0250
12. Other non-foods	–0.2687	–0.0137	–0.1188	–0.0068	–0.0191	0.0242

Good	7	8	9	10	11	12
1. Food	0.0010	–0.0084	–0.0078	–0.0096	–0.0048	–0.0047
2. Clothing	0.0022	–0.0189	–0.0176	–0.0217	–0.0107	–0.0105
3. Housing	0.0016	–0.0138	–0.0129	–0.0159	–0.0079	–0.0077
4. Health care	0.0025	–0.0218	–0.0203	–0.0250	–0.0124	–0.0121
5. Personal care	0.0012	–0.0101	–0.0094	–0.0116	–0.0057	–0.0056
6. Transport and communication	0.0038	–0.0333	–0.0310	–0.0383	–0.0189	–0.0185
7. Recreation	**–1.2188***	–0.0349	–0.0325	–0.0401	–0.0198	–0.0194
8. Education	0.0023	**–0.7138***	–0.0184	–0.0228	–0.0112	–0.0110
9. Alcoholic beverages	0.0017	–0.0151	**–0.5436***	–0.0174	–0.0086	–0.0084
10. Cigarettes	0.0012	–0.0109	–0.0101	**–0.3925***	–0.0062	–0.0060
11. Gambling	0.0018	–0.0161	–0.0150	–0.0185	**–0.5727***	–0.0089
12. Other non-foods	0.0018	–0.0156	–0.0145	–0.0179	–0.0088	**–0.5544***

Note: * = own price elasticity.

Responsiveness by income class

Despite the damage caused by smoking, the implementation of policies to control or reduce smoking has been partly constrained by concerns over whether they would have an unfavourable distribution impact. An increase in cigarette price will decrease real income (unless smokers cut

back to avoid spending more on cigarettes or even quit). Consequently, demand for other goods would be reduced. This can be analysed by deriving the expenditure elasticity of demand for cigarettes, the price elasticity of demand for cigarettes and the cross price effect of an increase in the cigarette price on the demand for other goods by income class.

The expenditure elasticity of demand shows that the effect of an increase in consumption expenditure, hereafter income, is different across income classes (Table 4.3). Generally, the effect is positive, is higher in urban areas than in rural areas, and is higher for lower income groups than higher income groups. For each 1% increase income, urban smokers in the two bottom classes will increase expenditure on smoking by around 1.55% and 1.27%, more than the proportionate increase in their income. Thus, the shares of other consumer goods in their consumption expenditure are expected to decline slightly. In the case of urban smokers in the other three income classes, their smoking will increase by around 0.53%, 0.32% and 0.17%, respectively, with a small fall in the share of total income spent on cigarettes. Similarly, a 1% increase in the income of rural people will also lead to a less than 1% increase in smoking.

Table 4.3. The effect of a 1% increase in income on demand for cigarette and in cigarette price on demand for various goods, by income class

Class	Income	Price				
		Cigarettes	Food	Housing	Health	Education
Urban 1	1.5503	–1.0034	0.0001	0.0001	0.0001	0.0002
Urban 2	1.2733	–0.3554	–0.0203	–0.0108	–0.0344	–0.1131
Urban 3	0.5264	–0.1259	–0.0225	–0.0234	–0.0000	–0.1174
Urban 4	0.3241	–0.0981	–0.0112	–0.0344	–0.0136	–0.1527
Urban 5	0.1678	–0.0418	–0.0092	–0.0229	–0.0160	–0.0258
Rural 1	0.8399	–0.4866	–0.0091	–0.0114	–0.0143	–0.0212
Rural 2	0.1670	–0.0464	–0.0164	–0.0119	–0.0183	–0.0739
Rural 3	0.4511	–0.0280	–0.0052	–0.0025	–0.0017	–0.0359
Rural 4	0.9233	–0.1476	–0.0138	–0.0111	–0.0324	–0.0844
Rural 5	0.1533	–0.0686	–0.0051	–0.0206	–0.0167	–0.0087

Note: urban 1 and rural 1 are smokers in the bottom income class of urban areas and rural areas, respectively. Similarly, urban 5 and rural 5 are smokers in the top income class of the areas.
Source: author's estimation.

Concerning the distributive effect of a price increase, the elasticities for the different income groups in Table 4.3 indicate that price policy would be particularly effective in reducing smoking among urban smokers in the lowest two income groups, and on the poorest rural smokers. The lowest two urban income groups have a price elasticity of demand of –1.003 and –0.355 respectively, for the four upper urban income classes, price elasticities are –0.1259, –0.0981, and –0.0418. Thus, an increase in cigarette price (which could be brought about by a tax increase), would decrease smoking much more among the lower urban income groups than among higher income urban smokers. In the case of rural smokers, the responsiveness of smoking to an increase in cigarette price of the bottom income class (0.4866) is around 8 to 70 times those of smokers in the other rural income classes. So the increase in tax revenue that would occur with an increase in tobacco tax rates would be borne more by higher income urban smokers, and by

smokers in the upper four income quintiles in rural areas, whose consumption would change relatively little.

The cross price elasticity of demand estimated by income group (shown in the last 4 columns of Table 4.3), shows only very small effects of changes in cigarettes price on consumption of other goods. The impact of a 1% increase in cigarette price on the consumption of foods, housing, health care and education is negligible for the bottom urban class. The biggest effect is for education; a 1% increase in cigarette price will lead to a reduction in demand for education of just more than one eleventh of one percent among smokers in the three middle urban classes. The impact on expenditures by rural smokers on all basic needs categories is considerably smaller than for urban smokers. Cigarette prices rises would have very little impact on rural expenditures on food, housing, health care and education.

Responsiveness by age group

The sample is divided into six age groups: 8–17 years old, 18–29 years old, 30–39 years old, 40–49 years old, 50–59 years old, and 60 years old and older. They are 10-year age groups except 18–29 and 60+. The 8–17 years group was selected for two reasons. Survey results point out that some smokers start smoking as young as 8 years old, despite the fact that selling cigarettes to people younger than 18 years old is illegal under the 1992 tobacco control act.

Age-specific income elasticity of demand for cigarettes suggests that, all other things remaining constant, an increase in income will stimulate smoking among children, youths and especially those who are between 18 and 40 years old (Table 4.4). The responsiveness of cigarette demand to a 1% income change is positive and highest among smokers in the 30–39 years old age group (1.00%), followed by the 18–29, 8–18, 50–59 and 40–49 years old age groups, in descending order of size of the elasticity. The reverse is true when the economy is in recession.

Price can be an effective smoking control measure, especially among middle-aged and young smokers (Table 4.4). For the 30–39 years old age group, cigarette demand will fall by 0.46% in response to a 1% increase in price. In the 18–29 and 8–17 year old age groups, cigarette demand will decrease by 0.39% and 0.31%, respectively in response to each 1% increase in price. Price response in the other two age groups is a little lower at 0.25% and 0.29%.

Table 4.4. Effect of a 1% increase in income on demand for cigarettes and in cigarette price on demand for various goods, by age group

Age group	Income	Prices				
		Cigarettes	Food	Housing	Health	Education
8–17	0.6364	–0.3075	–0.0121	–0.0142	–0.0120	–0.0619
18–29	0.8365	–0.3880	–0.0123	–0.0132	–0.0094	–0.0278
30–39	1.0015	–0.4616	–0.0073	–0.0103	–0.0038	–0.0000
40–49	0.5109	–0.2447	–0.0090	–0.0249	–0.0266	–0.0306
50–59	0.6011	–0.2875	–0.0070	–0.0180	–0.0218	–0.0292
60 and over	0.0000	–0.0000	–0.0124	–0.0466	–0.1819	–0.0108

Source: author's estimation.

It is unusual and unexpected that the 30-39 year old age group is more price responsive that the younger groups. It is also notable that the 60 and over group appear to be completely unresponsive to price changes, despite the fact that elderly people also tend to have relatively low or fixed incomes that tend to make them more price responsive than people of working age.

The impact on demand for essential goods that an increase in cigarette prices would have is generally negligible, as the very small coefficients in Table 4.4 show. The only effect that is in the tenths-off-one-percent range rather than the hundredths of one percent range is for expenditures on health care by people 60 years and older.

4.2 Taxation, price structure and tax revenue

Cigarette taxation and price structure

Import tariffs

For locally produced cigarettes, purchase price equals factory price plus excise tax and value-added tax. For imported cigarettes, purchase price equals the sum of c.i.f. price, import tariff, excise tax and value-added tax. Based on a World Trade Organization commitment, the import tariff on cigarettes is 63% of c.i.f. prices or baht 83.99 per kilogram (whichever is higher) in 2001 and 62% of c.i.f. prices or baht 82.66 per kilogram in 2002 (Table 4.5). For cigarettes with tobacco imported from three ASEAN Free Trade Area (AFTA) member countries, customs tariff was set at 10% and 5% of c.i.f. prices in 2001 and 2002, respectively (Table 4.6). The three countries are Singapore, Indonesia and the Philippines. For cigarettes imported from other AFTA member countries, the rate has been 22.5% since 1 January 2001. In all cases, the tariff rates are supposed to be reduced gradually.

Table 4.5. Import tariff rates, WTO rates

Product	Ad valorem rate (%)		Specific rate (baht/kg)	
	2001	2002	2001	2002
Cigarettes with tobacco	63	62	83.99	82.66
Cigars	63	62	83.99	82.66
Others	63	62	83.99	82.66

Source: Thailand Customs Department.

Table 4.6. Import tariff rates for products imported from Singapore, Indonesia and the Philippines

Product	2001 (%)	2002 (%)
Cigarettes with tobacco	10	5
Cigars	15	10
Others	20	20

Note: since 1 January 2001, custom tariff rates for cigarettes, cigars and other products imported from other AFTA member countries are 22.5%, 45%, and 60%, respectively. Brunei also enjoys the same rate of custom tariff on other products.

Source: Thailand Customs Department.

Excise tax rates

The excise tax rate has been increased over the past decade. The same rate is applied to both locally produced and imported cigarettes. Between 12 October 1999 and 29 March 2001, the rates for cigarettes, cigars, and other tobacco products were 71.5%, 0.1% and 0.1%, respectively. Since 29 March 2001, the rate for cigarettes has been set at 75% of the post-tax price, i.e. including the tariff and excise tax (Table 4.7). The value-added tax is currently set at 7% of the price including the tariff and excise tax. The Provincial Administrative Organizations (PAOs) extract revenue from the retail trade margin of all sticks of manufactured and imported cigarettes. The rate of the local tax differs from PAO to PAO and can be as high as baht 0.05 per stick. In provincial areas—outside Bangkok—the rate is currently set at baht 0.0454 per stick. Since 7 November 2001, a health tax is applied on all sticks of manufactured and imported cigarettes. The tax is 2% and is on top of the excise tax.

Table 4.7. Excise tax rates, Thailand, 12 October 1999–present

Product	Ad valorem rate (%)		Specific rate (baht/kg)
	12 Oct99 - 29 Mar01	29 Mar01-present	
Cigarette	71.5	75	–
Cigar	0.1	0.1	120
Others	0.1	0.1	46.25

Source: Thailand Excise Department.

The structure of tobacco taxation can be complicated. Taxes can be specific rates, on physical quantities, usually set in nominal terms, and/or ad valorem rates, based on product values. The rate of excise tax is applied on the factory price or imported price that includes customs tariff and the excise tax—the excise tax rate is calculated as a percentage of the post-tax price. An excise tax rate that is cited as 75% of the retail price may be 300% of the factory price. Value-added tax is levied on the cigarette price after all other taxes and the profit margin have been included. The structure of cigarette purchase prices can be calculated by the following equation (tariffs are presented as fractions of unity).

$$P^{c} = \left(P^{0}(1+t_{r})\left(1+\frac{t_{e}}{1-t_{e}}\right)+M \right)(1+t_{v})$$

where

P^{c} = the purchase price of cigarettes

P^{0} = the factory price or import price of cigarettes

M = margin

t_{r} = tariff rate, which is zero for locally produced cigarettes

t_{e} = excise tax rate

t_{v} = value-added tax rate.

Table 4.8 demonstrates how cigarettes were taxed in 2002. Examples are based on two popular brands of cigarette, one a locally produced brand and the other an imported brand. The purchase prices are based on the actual purchase prices of cigarettes, baht 30 and baht 55 per packet, respectively. For all brands, factory and c.i.f. prices are assumed to be the same—baht 5 per

packet. Two important findings are, first, based on the WTO rate, the estimated trade margin on imported cigarettes (baht 17.40) is much greater than on local cigarettes (baht 6.83), and second, when the AFTA rate is applied, the trade margin on imported brands increased by baht 8.73 to baht 26.13. By changing country of origin, cigarette importers can earn a greater margin. Since the government controls cigarette prices, this means more profit or more resources for advertising and non-price promotion to increase shares of the total cigarette market.

Table 4.8. Hypothetical price structure of cigarettes, Thailand, 2002 (baht)

	Price and taxes	Local	Import (WTO)	Import (AFTA)
a	Factory price	5.00	–	–
b	c.i.f. price	–	5.00	5.00
c	Customs tariff	–	3.15	1.00
d	= *a* + *b* + *c*	5.00	8.15	6.00
e	Excise tax	15.00	24.45	18.00
f	Health tax	0.30	0.49	0.36
g	= *d* + *e* + *f*	20.30	33.09	24.36
h	Margin	6.832	17.402	26.132
i	Local tax	0.908	0.908	0.908
j	= *g* + *h* + *i*	28.04	51.40	51.40
k	Value-added tax	1.96	3.60	3.60
j + *k*	Purchase price	30.00	55.00	55.00

Note: factory price does not include excise tax. Health tax, which is 2% of the excise tax, is assumed to come from the marketing margin, but could, instead be passed on to consumers as an increase in the price.
Source: Author's calculation.

Taxation and impact on cigarette demand and government revenue

Elasticity estimations suggest that tax policies can be effective instruments for reducing smoking and raising revenue. Excise tax is preferred for many reasons. First, the rate on cigarettes can be changed easily in the light of policy objectives, without affecting prices/tax rates for other goods. Second, it is not constrained by any international agreements, so long as the same rate applies to imported and domestically produced cigarettes. Custom tariff rates and the value-added tax is less flexible. Changes in tariff rates are constrained by Thailand's commitment to the WTO. With some exceptions, the same value-added tax rate applies to all goods. Thus, a change in this rate will mostly affect consumer demand in terms of a change in real income. The following equation is a simplified version of the pricing equation Eq. 1 given above.

$$P^{c} = P^{0}(1+t_{r})\left(1+\frac{t_{e}}{1-t_{e}}\right)(1+m)(1+t_{v})$$
$$= K[1 + t_e/(1 - t_e)]$$

$$= K(1 + \tau) \quad \text{Eq. 6}$$

where
m = the rate of margin (as opposed to the margin itself as previously)
$K = P^0(1 + t_r)(1 + m)(1 + t_v)$
$\tau = t_e/(1 - t_e)$.

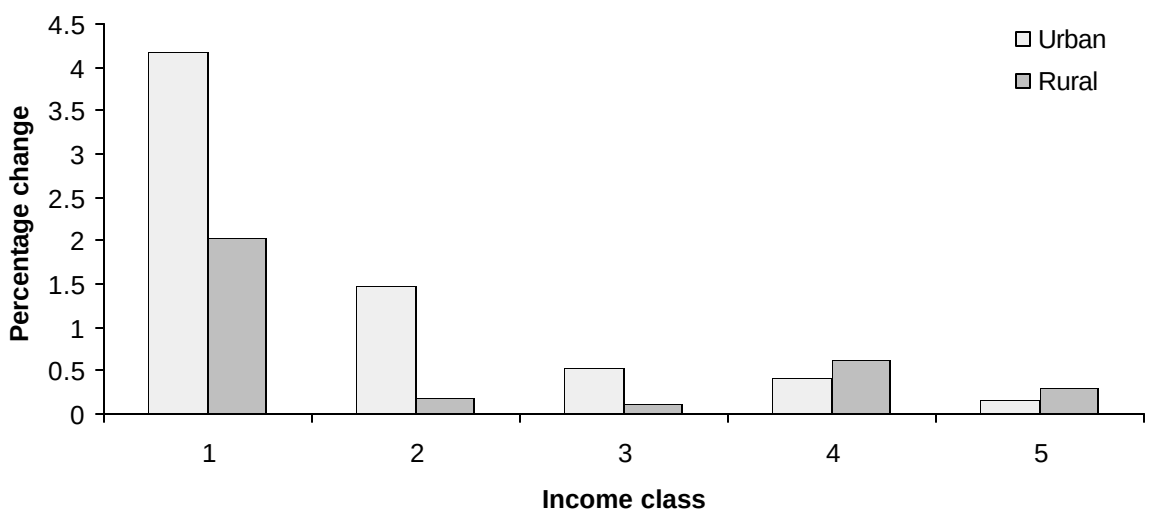
This study estimates the impact of a change in the rate of excise tax from 75% to 76%. This is equal to a 1.33% increase in the existing rate of excise tax. In terms of τ, this is equivalent to a 5.56% increase from 300% to 317%. The tax increase is assumed to be fully passed on to consumers as a price increase, and raises the retail price by 4.17%. The impact of the change on cigarette consumption by income groups *Q*, and on government revenue *T* can be estimated by the following equations.

$$\frac{dQ}{Q} = \frac{\varepsilon_{ii}\tau}{1+\tau}\frac{d\tau}{\tau}$$

$$\frac{dT}{T} = \left(1+\frac{\varepsilon_{ii}\tau}{1+\tau}\right)\frac{d\tau}{\tau}$$

Using the elasticity estimates presented above, the impact of an increase in the rate of excise tax from 75% to 76% would be as follows. Overall cigarette consumption would fall by 1.64%. With cigarette consumption in 2000 of around baht 50 thousand million and an average price of baht 30 per packet, this is equivalent to 27.3 million packets of cigarettes fewer. As noted, different price elasticities imply that impact will differ by income. For smokers in urban areas, from the poorest group (class 1) to the richest (class 5), cigarette consumption would be reduced by 4.18%, 1.48%, 0.53%, 0.41% and 0.17%, respectively. In the cases of smokers in rural areas, cigarette consumption would be reduced by 2.03%, 0.19%, 0.12%, 0.62% and 0.29%, respectively. Thus, an increase in excise tax rate will be successful in reducing cigarette consumption mainly in urban areas and among smokers in lower income classes.

Figure 4.1. The reduction of cigarette consumption due to the impact of an increasing in the rate of excise tax from 75% to 76%



Second, excise tax revenue would increase by 3.92%. The total revenue from the excise tax on cigarettes of around baht 28 thousand million in 2000 would rise by around baht 1103 million for the government. Of this, baht 923 million would be derived from excise tax on Thailand Tobacco Monopoly (TTM) cigarettes. Another baht 180 million would come from excise tax on imported

cigarettes. At the same time, revenue from value-added tax (which is levied on the price after the excise tax has been applied) would increase by around baht 87 million. Government revenue from TTM profits and tariffs would decrease by baht 87 million and baht 16 million, respectively. Following the decrease in total cigarette demand of around 27.3 million packets, local tax revenue would also decrease by around baht 23 million. Thus, the increase in the rate of excise tax from 75% to 76% would not only reduce cigarette consumption but also extract extra revenue of around baht 1064 million for the government (Table 4.9). In the long term, there would also be additional benefit in terms of health care cost savings. An approach to the health care cost of smoking is outlined in Appendix 4.

Table 4.9. Impact on government revenue, Thailand, 2000 (million baht)

Total net increase	Revenue from excise tax[1]		Increase in VAT revenue	Revenue from TTM profit		Decrease in tariff revenue	Decrease in local tax[2]
	Actual	Increase		Actual	Decrease		
1064	28 135	1103	87	5310	87	16	23

Notes: 1. TTM cigarettes shared around 83.67% of the total excise tax revenue; 2. Survey results show that smokers in provincial areas shared around 92.68% of total cigarette consumption.
Source: Author's estimation.

Third, it is very important to note that the above results are based on an assumption that the prices of *all* cigarettes and other tobacco products increase. In actual fact, the tax increase will affect only the price of TTM cigarettes and legally imported cigarettes. Some smokers of legally manufactured and imported cigarettes may switch to cheaper brands, contraband cigarettes, self-rolled cigarettes, traditional tobacco products and other tobacco products, the prices of which are not fully affected by the increase in tax rate. The actual decrease in demand for manufactured cigarettes could be more and the actual positive impact on government revenue could be less. This depends on the degree of switching and the degree to which the prices of contraband cigarettes, raw materials for self-rolled cigarettes, and other tobacco products adjust in response to the increase in the rate of excise tax.

The above discussion is based on an increase in excise tax rate from 75% to 76%. In reality, this is not the only choice. The government could decide to increase the excise tax rate by more. The table below summarizes the impact of an increase in excise tax rate from 75% to 76%, 77% and 80% (Table 4.10), assuming no switching to cheaper tobacco products such as contraband cigarettes, self-rolled cigarettes and *bai jak*.

It should also be noted that smokers are not very perceptive of tax increases. Survey results showed that only 67% of smokers recalled the most recent cigarette tax increase in 2001. The recall rate was higher in Bangkok city (82%) than in provincial areas (66%). Moreover, more than one-third and around one-quarter of smokers realized that reasons behind the increase were smoking control and tax revenue, respectively. An increase in tax rate was supported by around 52% of smokers (Table 4.11).

Table 4.10. The percentage impact of changes in the excise tax rate on cigarette demand and revenue from cigarettes by income group, Thailand

	Increase in excise tax		
	75% to 76%	75% to 77%	75% to 80%
Impact on overall demand	–1.64	–3.41	–9.81
Urban 1	–4.18	–8.72	–25.09
Urban 2	–1.48	–3.09	–8.89
Urban 3	–0.53	–1.09	–3.15
Urban 4	–0.41	–0.85	–2.45
Urban 5	–0.17	–0.36	–1.05
Rural 1	–2.03	–4.23	–12.17
Rural 2	–0.19	–0.40	–1.16
Rural 3	–0.12	–0.24	–0.70
Rural 4	–0.62	–1.28	–3.69
Rural 5	–0.29	–0.60	–1.72
Excise tax revenue	3.92	8.19	23.52

Note: The rates of decreases in revenue from TTM profit and local tax are equal to that of cigarette demand.
Source: Author's estimation.

Table 4.11. Opinions on the cause of the last cigarette price increase, Thailand, by region

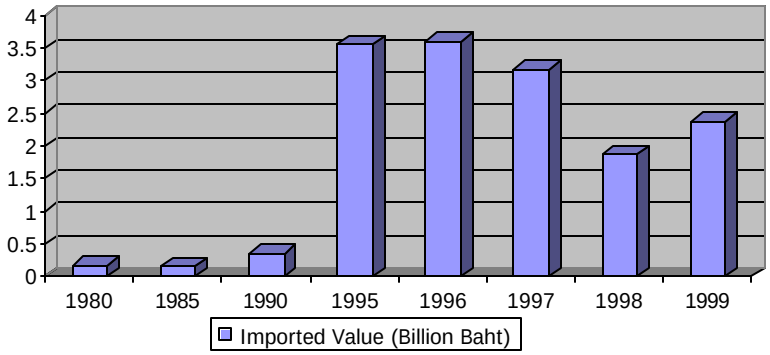
Reason for the price increase	Region					Total
	North (%)	North-east (%)	Central (%)	South (%)	Bangkok (%)	(%)
To raise more tax revenue	27.00	24.20	20.00	26.70	21.70	24.40
To reduce the number of smokers	31.50	38.30	34.00	30.80	38.40	34.00
To increase profit of cigarette companies	0.90	1.70	1.00	5.00	1.70	2.20
To match the increasing cost of production	3.60	7.50	8.00	7.50	5.80	6.60
Economic recession	8.10	5.80	5.00	–	9.20	5.00
There are too many smokers	4.50	5.00	2.00	3.30	5.00	3.90
Cigarettes are luxury goods	4.50	0.80	2.00	2.50	1.70	2.40
To adjust domestic prices to equal foreign prices	0.90	–	–	–	0.60	0.20
Other	18.90	16.70	28.00	24.20	15.90	21.30

Source: Author's survey results.

4.3 Tobacco and tobacco product trade and smuggling

The General Agreement on Trade and Tariffs ruling in 1990 that Thailand had to open its markets to imports has led to an influx of imported cigarettes. In the 1980s and the beginning of the 1990s, the value of imported cigarettes was less than baht 0.5 thousand million. Following the entry of international brands into the Thai market, the import value rose dramatically. In 1995 and 1996, Thai smokers spent more than baht 3.5 thousand million on imported cigarettes. Because of the economic contraction and currency depreciation that followed the 1997 crisis, the import value fell to baht 1.873 thousand million in 1998 and baht 2.370 thousand million in 1999 (Figure 4.3). Taking into account the depreciation of the baht, the drop in the real value of imported cigarettes would be more.

Figure 4.2. Value of imported cigarettes, Thailand, 1980–1999 (thousand million baht)



The effort to reduce cigarette consumption has been weakened by foreign cigarettes imports, and more especially by an inflow of contraband cigarettes. Interview results indicate that slightly more than 15% of smokers buy imported cigarettes. By brand, around 53% are L&M, followed by Marlboro (29.1%), Moore (9.9%) and Mild Seven (2.9%). Many of these American brand cigarettes (L&M, Marlboro and Moore) are produced in neighbouring (AFTA) countries, especially Indonesia, and thus enjoy lower rates of customs tariff. Mild Seven is a Japanese brand (Table 4.12).

Table 4.12. Cigarette market shares 2001, Thailand, by region (percentage)

Type	Total	Provincial areas	Bangkok
Thai	84.7	85.7	72.7
Imported	15.3	14.3	27.3
of which brand is	(100.0)	(100.0)	(100.0)
L&M	(53.4)	(52.8)	(57.1)
Marlboro	(29.1)	(27.8)	(37.5)
Moor	(9.9)	(11.1)	(1.8)
Mild Seven	(2.6)	(2.8)	(1.8)
Other	(5.1)	(5.6)	(1.8)

Source: survey results.

Official figures indicate that less than 5% of cigarettes smoked in Thailand are imported (Table 3.4). But the survey of smokers found that 15.5% of their cigarettes packages had warning labels in English or other non-Thai languages or no warning labels, and were probably illegally imported (Table 4.13). Contraband cigarettes seems to be more common in provincial areas than in Bangkok. If the small survey is representative, it suggests that consumption of contraband cigarettes is significant—perhaps three times that of legally imported cigarettes, i.e. about 13% of all cigarettes. This would make the actual tobacco trade deficit larger than the official figure.

Table 4.13. Warning labels and cigarette types, Thailand, by region

Label language	Total	Provincial areas	Bangkok
Thai	84.5	83.3	92.6
English	10.4	11.1	5.6
Other	5.1	5.6	1.9
Total	100.0	100.0	100.0

Source: Survey results.

Another survey of imported cigarettes was also conducted for this study in order to provide detailed information on the significance and sources of cigarette smuggling. The quantitative results of this survey are not statistically reliable. However, the qualitative results are indicative and should be very useful for policy-makers. In this survey, 809 cigarette packets were collected from all regions in Thailand. Of these, 229 were from the north, 45 from the north-east, 51 from the central region, 62 from the south and 422 from Bangkok. Around 46% of the imported cigarettes had no warning label in Thai and thus can be considered as contraband (Table 4.14). Among the contraband cigarettes, 18% had labels in English, suggesting that their sources were manufacturers for English-speaking countries. Around 8% had labels in other non-Thai languages. Surprisingly, the remaining 19% of the imported cigarettes had no warning label. It should be noted that Marlboro was the most common contraband cigarette, at around 58% of the packages collected that did not carry the mandatory Thai warning label. The contraband Marlboro had English warning labels and were mostly produced in the United States.

Table 4.14. Warning label languages on imported cigarettes, Thailand

Brand	Thai		English		Other		No label		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Marlboro	152	42.34	72	20.05	15	4.18	120	33.43	359	44.38
L&M	248	89.53	23	8.30	1	0.36	5	1.81	277	34.24
Other	40	23.12	54	31.21	48	27.75	31	17.92	173	21.38
Total	440	54.39	149	18.42	64	7.91	156	19.28	809	100.00

Source: survey results.

Customs valuation could also pave the way for tax evasion that lowers the price of and increases demand for imported cigarettes. Under the WTO, transaction prices should be used in customs valuation, unless there is sufficient evidence to prove that the declared prices of any imported item are not the actual transaction prices in the market (Table 4.15). The transaction prices include commission, brokerage, royalty and licence. This creates loopholes in cigarette taxation

and undermines the effectiveness of smoking control measures. Under-declaring the imported prices of cigarettes reduces the tax payable, and raises profits. Evidence suggests that the declared prices of imported cigarettes could be as low as 16% of customs prices. Given that many imported cigarettes come from AFTA member countries, from which imported products are taxed at lower rates, this issue becomes more complicated and requires further attention.

Table 4.15. Declared price and customs price ratios, Thailand, by import origin

Brand	Origin	Declared price–customs price ratio (%)	
		Minimum	Maximum
A	Philippines	21.82	50.84
B	Philippines	24.49	72.52
C	Malaysia	57.91	89.62
D	Malaysia	54.93	84.69
E	Malaysia	45.85	57.05
F	Indonesia	16.55	27.16
G	Indonesia	38.62	45.23

Note: Disclosure of brand-specific information is prohibited by law.
Source: Thailand Customs Department.

There are concerns that an increase in tax rate will not only reduce cigarette consumption but also induce more cigarette smuggling because it raises the potential profit to be made from contraband cigarettes. However, smoker survey results suggest that this may not be the case. Brand loyalty is significant among smokers. If prices were to rise by 10%, 93% of smokers of local cigarettes and 83% of smokers of legally imported cigarettes said they would not switch to other brands of cigarette. Only 1.5% and 1.8% of smokers of local cigarettes said that they would switch to imported and contraband cigarettes, respectively, while 12.6% of smokers of legally imported cigarettes would switch to local cigarettes. In 1999, total consumption of local cigarettes and legally imported cigarettes was worth around baht 45,718.82 million and baht 2,368.34 million, respectively. If the survey accurately and representatively predicts the actual behavior of smokers, assuming the same price elasticity for all smokers, a 10% increase in the prices of all legally produced or imported brands would reduce sales of local cigarettes by around baht 850 million from switching to contraband cigarettes, but increase sales of local cigarettes baht 263 million because of switching from legally imported cigarettes (Table 4.16). No respondent who smoked legally imported cigarettes said he would switch to contraband cigarettes.

Table 4.16. Percentage brand switching after a 10% increase in prices

Before \ After	Thai	Imported	Contraband	Other
Thai	93.10	1.50	1.80	3.70
Imported	12.60	82.90	0.00	4.50
Contraband	0.00	0.00	100.00	0.00
Others	3.00	0.00	0.00	97.00

Note: “others” includes snuff and no answer.
Source: survey results.

4.4 Smoking control measures: problems of law enforcement

In Thailand, a number of important measures have been designed to reduce smoking. These are the prohibition of advertisement of tobacco products, prohibition of smoking in various public places and prohibition on selling tobacco products to children aged under 18. While the measures have received wide public support, their success or failure depends on the extent of compliance and effective enforcement and the existence of loopholes.

Survey results show that these measures have not been fully effective. Nearly 21% of smokers had seen cigarette advertisements (Table 4.17). These were mainly advertisements on television (40%), through logos in various programmes. Another 12%, 9% and 8% saw signboards, magazines and stickers, respectively. It should be noted that violation was found to be more serious in the provincial areas than in Bangkok. Marlboro was the brand whose advertising was most frequently seen (nearly 78% of all cigarette advertisements). The term "advertisement" was self-defined by smokers, and that the question did not specify the time period during which the advertisement had been seen.

Table 4.17. Experience of cigarette advertisements, Thailand

Experience	Total	Provincial areas	Bangkok
No	79.1	78.5	87.5
Yes	20.9	21.5	12.5
Of which the medium was			
Television	47.0	47.4	40.0
Signboard	11.8	11.6	15.6
Magazine	9.1	8.4	24.4
Sticker	8.4	8.4	8.9
Showcase	6.0	6.3	–
Poster	5.2	5.3	4.4
Theatre	2.0	2.1	–
Other	10.4	10.5	6.7
Of which the brand was			
Marlboro	77.8	77.3	88.1
Krongthip	5.5	5.7	2.4
Falling Rain	4.6	4.5	4.8
Other	12.2	12.5	4.8

Source: Survey results.

Measures to prohibit smoking in public places are violated widely. About half of all smokers interviewed (54%) said they had smoked in no-smoking areas (Table 4.18). The degree of violation was slightly more in provincial areas (nearly 59%) than in Bangkok (less than 50%). Surprisingly, more than 23% of smokers reported their experience of smoking in areas in which measures should be enforced strictly, such as schools and other educational institutions and air-conditioned shopping areas. Another 17%, 12%, 10% and nearly 10% had smoked in trains, taxis, buses and theatres, respectively. Smoking in government offices was also reported by

around 14% of smokers in both provincial areas and Bangkok. Smoking in other no-smoking areas was also reported. However, the degree was not so significant.

Table 4.18. Percentage of smokers who had smoked in no-smoking areas, Thailand

No-smoking area	Total	Provincial areas	Bangkok
Bus	10.4	10.4	10.3
Taxi	11.8	12.2	11.8
Train	16.9	17.1	16.9
Boat	10.7	5.6	10.7
Aeroplane	0.8	0.9	0.8
Elevator	2.2	2.2	2.2
Theatre	9.5	9.8	9.5
School	23.2	23.3	23.2
Shopping area	23.2	23.5	23.2
Government office	13.9	14.4	13.9
Total	54.72	58.79	49.60

Source: Survey results.

Estimates of age at first smoking point to an urgent need to enforce measures to prohibit children smoking and to control cigarette selling to children age under 18 (Table 4.19). While average first-smoking age was found to be around 18 years old in all regions with a standard deviation of 4.8 years, the minimum first-smoking age in the north-east was as young as 7 years. Other regions also reported low figures—8 years old for Bangkok and the south, 10 years old for the central region and 11 years old for the north. Moreover, children smoking in smokers' households was also reported in all regions, especially the north and the Bangkok metropolis.

Table 4.19. Average age at first smoking, Thailand (years)

Region	Mean	Standard deviation	Minimum	Maximum
Total	18.14	4.83	7	56
North	17.88	5.21	11	43
Northeast	18.81	5.56	7	56
Central	17.94	4.42	10	38
South	18.01	4.34	8	32
Bangkok	17.67	3.49	8	35

Source: survey results.

5. HEALTH CARE COSTS OF SMOKING

5.1 Introduction

Cigarettes carry both benefits and costs for individuals and society. The benefits are the satisfaction and enjoyment that smokers receive from smoking. There are also incomes and profits to tobacco farmers, cigarette producers and retailers. Governments collect cigarette tax revenue and other revenues from cigarette production if they own manufacturing companies. The most significant cost of cigarette smoking is the cost of lost lives and productivity from disease and premature deaths from tobacco use, as well as the associated health care costs borne by patients and the government (net of health care costs that smokers would have incurred from other diseases if they had not smoked). There are also the costs associated with exposure to second-hand smoke, and the opportunity cost of using scarce income on cigarettes rather than on food or other things. Fire damage from lit cigarettes can also be substantial, and tobacco growing can have environmental costs through deforestation, pesticide use and soil degradation.

The few studies that have attempted to assess the health care cost of smoking in Thailand are reviewed in the next section. Methodologies and assumptions of these studies are discussed and results are compared. Based on the data and results of the studies, this section presents an estimate of the overall health care cost of smoking.

5.2 Smoking-related diseases

Results of epidemiological studies in many countries indicate that cigarette smoking directly or indirectly causes many diseases, both by substances in cigarettes and by destroying body resistance and increasing susceptibility to becoming ill. Thousands of studies in countries around the world have found that habitual smokers face especially heightened risk in three important groups of diseases. These are malignant neoplasms, cardiovascular diseases and respiratory diseases (Kunaluck, 1996). Details of these diseases are summarized in Appendix 3.

Smoking has also been found to be an important cause of other diseases. Data from the numerous studies around the world indicate that women's exposure to smoking and smoke poses grave risks to their own health and to their babies, before and after birth. Spontaneous abortion, pre-term births, low birth-weight full-term babies, and foetal and infant deaths all occur more frequently among mothers who smoke during their pregnancies (US Department of Health And Human Services 2001). In men, erectile dysfunction is strongly associated with smoking (Jeremy 1998).

In Thailand, the results of many studies also point to a relationship between cigarette smoking and disease. Theera (1994), based on the statistics of lung cancer patients who received treatments between 1967 and 1993, concluded that there was a significant relationship between smoking and lung cancer. Around 78% of his 1,750 lung cancer patients were smokers, most of them heavy smokers. The results of Sirikunya et al. (2000) also point to similar conclusions. Cigarette smoking is highly related to laryngeal cancer. Around 85% of laryngeal cancer patients

were smokers. Table 5.1 provides numbers of deaths and death rates for some of the main smoking-related diseases in Thailand, from 1996 to 2000.

Table 5.1. Number of deaths and death rate per 100 000 population, by smoking-related disease, Thailand

Disease	1996		1997		1998		1999		2000	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1. Malignant neoplasm of trachea, bronchus and lung	2 913	4.9	2936	4.9	3500	5.7	4220	6.9	5486	8.9
2. Malignant neoplasm of lip, oral cavity and pharynx	651	1.1	404	0.7	574	0.9	675	1.1	762	1.2
3. Malignant neoplasm of cervix uteri	380	0.6	318	0.5	408	0.7	672	1.1	871	1.4
4. Malignant neoplasm of stomach	388	0.6	245	0.4	365	0.6	458	0.7	648	1
5. Malignant neoplasm of bladder	105	0.2	74	0.1	84	0.1	146	0.2	202	0.3
6. Malignant neoplasm of larynx	98	0.2	62	0.1	59	0.1	125	0.2	171	0.3
7. Malignant neoplasm of pancreas	148	0.2	89	0.1	202	0.3	523	0.8	479	0.8
8. Other heart disease	42 962	71.9	40 556	67.1	36 355	59.4	25 695	41.7	13 406	21.7
9. Cerebrovascular disease	6 297	10.5	5962	9.9	4283	7	6631	10.8	8260	13.4
10. Hypertensive disease	3053	5.1	2054	3.4	2029	3.3	2987	4.9	3403	5.5
11. Acute rheumatic fever and chronic rheumatic heart disease	554	0.9	561	0.9	267	0.4	165	0.3	51	0.1
12. Ischaemic heart disease	2784	4.7	1870	3.1	2199	3.6	4849	7.9	6251	10.1
13. Pneumonia	6859	11.5	5532	9.1	5522	9	8645	14	8334	13.5
14. Respiratory tuberculosis	3445	5.8	2443	4	3150	5.2	4701	7.6	5941	9.6

Source: Health Statistic Department, Ministry of Public Health, 2000.

5.3 Health care cost of smoking

Cigarette smoking has a significant cost for smokers, their families and society. The cost of smoking can be both tangible and intangible. Generally, only the tangible components can be measured. The health care costs of smoking-related diseases can be classified into two types:

- *direct health care cost* such as the health service cost, treatment cost, transportation cost to hospital, food and medical cost

- *indirect health care cost* includes forgone income that patients would have earned if they had worked, had worked more efficiently, or had not died early because of the illness.

Two important principles can be used to estimate the economic cost of diseases: the human capital and the willingness to pay principles. The human capital principle estimates the present value of the expected lifetime income stream of a person. The willingness to pay principle asks people what they would be willing to pay to avoid illness, or "buy" additional years of life. (Further details on these two principles are provided in Appendix 4.)

5.4 Health care cost of lung cancer: a literature review

Wattana (1986) conducted research on economic loss suffered by cancer patients in order to estimate the loss to the economy caused by lung cancer. As Table 5.1 shows, the number of lung cancer cases is growing alarmingly in Thailand, most are caused by smoking. The human capital concept was used and the cost was evaluated by using the prevalence approach (see Appendix 4). Records of patients from the Central Chest Hospital, Chulalongkorn Hospital, Ratchavitee Hospital and the National Cancer Institute of Thailand between 1985 and 1986 were examined. Both inpatients and outpatients who had lung cancer at different stages were covered in the study.

The study divided the economic loss into two categories: direct economic loss, including the treatment cost of inpatients and outpatients; and indirect economic loss, which calculated the loss in future income due to the early death of the patients. As some information was not available, the cost could not be estimated separately for each stage of lung cancer; only the total cost of treatment was determined.

The study also collected information on lung cancer patients from the Statistics Department of the Ministry of Public Health. According to this information, in 1985 there were 22,313 patients with lung cancer, of whom 1,885 were inpatients and 20,428 outpatients. Of these, 1,093 patients—around 5%—of the patients died during the year, earlier than life expectancy.

The study found that the average health care cost for inpatients per person per day was baht 1,332.24, the average hospital stay for each person was 19.39 days, and the average cost for each patient per case was baht 25,600.24; the average age of the patients was 59 years. Outpatients would see a doctor 4.53 times in one year. The average health care cost per outpatient visit for medicines was baht 326.24. The average cost per person per case was baht 1,777.60, and the average age of the outpatients was 61 years old.

The direct economic loss in one year was found by calculating the numbers of inpatients and outpatients who had treatment within the year and multiplying it by the cost per patient. The study showed that the health care costs for inpatients was equal to baht 48,256,452 per year. The health care costs for outpatients was equal to baht 35,992,845 per year. This adds to total (gross) direct economic loss for the year of baht 84,249,297.

Indirect economic loss was also estimated. Data were not available to estimate the opportunity cost of time lost due to transportation and treatment, or the income lost due to illness of patients or time spent caring for them by relatives. The income forgone due to premature death was estimated by multiplying the total time lost in years by average annual income (and applying a

10% discount rate). The age range of the patients was between 25 and 64 years old. The loss of years was calculated by each age group, subtracting the average age at death from the life expectancy for that age group. The annual economic loss from early death was calculated at baht 201,692,305. Further details are provided in Appendix 5.

In sum, the total economic loss from lung cancer was estimated to be at least baht 286 million in 1985. This consists of health care cost for inpatients of baht 48 million, health care costs for outpatients of baht 36 million and loss of expected future income due to early death of baht 202 million.

Wanchai et al. (1991) focused on the treatment cost of smoking-related heart and lung diseases such as lung cancer, coronary heart disease and chronic obstructive pulmonary disease (COPD) caused by smoking. The human capital principle was also used in this study and the cost was evaluated using the prevalence approach (see Appendix 4). The records of lung cancer, coronary heart disease and COPD patients from the Srinakarint Hospital and Khon Kaen Hospital Centre between 1989 and 1991 were examined. Full records of 540 patients were used, selecting 90 patients with each disease from each hospital, and dividing the patients into three stages: first stage, middle stage and final stage. An invitation letter was sent to 464 of the patients for interviews, and 259 or 56% of patients responded. Based on the interviews with the patients or their relatives, 75% of the patients smoked.

The three stages were defined as follows:

- first stage: outpatients who came for treatment to the outpatient department at least three times a year.
- middle stage: patients treated as inpatients
- final stage: inpatients who were treated in intensive care.

The study divided the cost into direct cost, indirect cost and the cost of patients using clinic care and medicines from drug stores. Direct costs included health care services, beds, medical supplies and cost of operations. Indirect cost was based on the number of days the patients or family members were absent from work as a result of the illness.

The study showed that the average direct cost for lung cancer patients at each stage was baht 5777.85 per person per year. The average direct cost for coronary heart disease patients at each stage was baht 4186.58 per person per year, and the average direct cost for COPD patients at each stage was baht 16 388.03 per person per year. Therefore, the average direct cost for these three diseases at each stage was baht 8784.41 per person per year.

Based on interviews with patients and their relatives, the cost to patients of medications was estimated. The three diseases were evaluated together. The average cost of medicines that the patients bought from pharmacies was baht 386.70 per person per year. The average cost of medicines the patients bought at the clinics was baht 277.90 per person per year. These add to a total average cost for medications of baht 664.60 per person per year.

The cost of absence from work was also estimated from interviews with patients and their relatives. The three diseases were evaluated together. The average number of days of absence of

the patients or their relatives was 47, with an average loss in income per day of baht 116. Therefore, the average indirect cost was baht 5,452 per person per year.

Thus, the average total cost for the patients of these three smoking-related diseases was equal to baht 14,901 per person per year. This included the average direct cost of the treatment of the three diseases at each stage (baht 8,784.41), out-of-pocket spending on medicines (baht 664.60) and lost income (baht 5,452).

The prevalence of lung cancer in Thailand found in men is 25 per 100,000 and for women it is 12 per 100,000. Therefore, the approximate number of people with lung cancer in Thailand at the time of the study was 6,750 men and 3,300 women, 10,050 persons in total. The study found that 74.6% of the patients with one of the three diseases were smokers. Therefore, at the time of the study, there would have been approximately 7,500 smokers with lung cancer. As the average cost of the patients with the three diseases was about baht 15,000 per person per year, the annual loss from lung cancer of smokers was about baht 112,500 000 per year. Adding the other two diseases, the average cost was equal to baht 1,274,810,352 per year.

Theera (1994) attempted to estimate the economic loss from lung cancer caused by smoking. The human capital principle was used in this study, and the incidence approach was used to estimate the cost of treatment and the lung cancer patients' opportunity cost of work (see Appendix 4). In addition to this, the study evaluated the cost of smoking before illness.

Theera stated that lung cancer was the second most prevalent cancer found in males. The ratio of lung cancer patients to all cancer patients had increased from 4.8% in 1971 to 12.5% in 1990. Based on this trend, in 1993 there would have been 10,000 new lung cancer patients. The probability of these patients' recovering or living more than five years was only about 3.6%. Among the lung cancer patients in the study, 72% were heavy smokers (more than 20 cigarettes a day for at least 20 years), 6% were light smokers and 22% were non-smokers. Thus 7200 heavy smokers and 600 light smokers were predicted to become new lung cancer patients in 1993.

The total lifetime cost of smoking for all 7,800 smokers was estimated at baht 2,233,798,000. Heavy smokers averaged just over 24.8 cigarettes per day, and 36.6 years of smoking. Light smokers smoked half the number of cigarettes, but for the same average number of years. At 1993 prices (baht 0.85 per cigarette), the lifetime cost of cigarettes of heavy smokers and light smokers was estimated to be around baht 297,840 and baht 148,920 per person, respectively. With regard to income loss caused by illness, lack of data hampered an estimate. The study used the average annual income of a middle level government official in that year, baht 180,000, as the average income of the patient. Thus, the total income loss of 10,000 patients (included both smokers and non-smokers) was equal to baht 1,800,000,000 per year. Using the average income of a middle level government official as a proxy for the smokers' average income could bias the estimate up or down. On the one hand, the income of government officials is generally lower than market rates. On the other hand, smokers are generally from lower-income groups. And the ages of officials at the average government salary level may not correspond well to the age of lung cancer sufferers.

The study also estimated the medical cost using selected patients in Siriraj hospital from September 1988 to December 1993 (108 admissions) as the sample. The average medical cost was around baht 300,000 per person. This cost was for a public hospital, which was cheaper than a private one. The study analysed the cost by method of treatment. The breakdown by type of care and average cost per case was as follows: 2% of patients were treated by surgical methods (baht 40,000 per case), 7% by surgery and adjunctive treatment (typically chemotherapy) (baht 340,000 per case), 60% by chemotherapy and radiation (baht 300,000 per case), and the remaining 31% received supportive treatment (baht 150,000). The total medical cost was equal to baht 2,511,000,000.

Kunaluck (1996) attempted to estimate the economic cost of lung cancer caused by smoking using both the human capital and the willingness to pay principles. A survey was conducted to collect information on the social and economic backgrounds of lung cancer patients, their smoking behaviour, their willingness to pay, and hospital data including medical and material costs. The sample consisted of 288 patients from Siriraj Hospital and 78 patients from the National Cancer Institute who were selected by stratified random sampling.

The cost of lung cancer was estimated per incident, including cost since the beginning period of illness until recovery or death. Two categories of direct costs were collected: cost of treatment and transportation cost. Treatment cost included medical costs of baht 21,330 per person, labour costs of baht 6,369 per person, materials costs of baht 3,044 per person, equipment costs (i.e. depreciation) of baht 53 per person, and imputed building costs of baht 273 per person and land rent of baht 261 per person. Transportation costs for patients were baht 3571 per person, and for patients' relatives were baht 823 per person. The total direct cost was baht 35,724 per person.

The indirect cost consisted of baht 8,251 plus baht 3,030 per person for the opportunity cost of lost time spent by patients and by their relatives during transportation and treatment, baht 6,126 per person in income loss of patients and baht 1,303 per person income loss of patients' relatives. Thus, the total indirect cost was baht 18,710 per person.

From the results above, the annual cost of lung cancer was estimated to be baht 54,434 per person. The study also calculated the economic loss caused by lung cancer. From the value of cost in 1994, the value of cost in 1995 could be calculated (using an 11.5% rate of return). Assuming that there were 10 000 patients in 1995, there would be an economic loss of around baht 9,300 million.

The differences in the direct and indirect costs reported by the studies in Table 5.2 reflect their different approaches. Wattana and Wanchai used the prevalence approach, multiplying the number of patients by cost in one year. Theera and Kunaluck evaluated cost using the incidence approach, multiplying the number of new patients by the cost since the beginning of the illness until recovery or death. The advantages of the prevalence approach are that it has lower research costs and is faster than the incidence approach. The disadvantage is that it is does not capture costs of chronic diseases beyond the year under study. However, the incidence approach requires a reliable estimate of the number of new lung cancer patients who get the disease each year, which may be problematic.

Table 5.2. Summary of cost associated with lung cancer, studies in Thailand

Year of study	Title	Author	Sample size (persons)	Average direct cost (baht/person /year)	Average indirect cost (baht/person/ year)
1988	Economic loss in cancer patients	Wattana		25 600.24[a] 1 777.60[b]	184 530.92
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	5 777.85	5 452.00
1994	Cigarette smoking—lung cancer: life and economic loss	Theera	108	300,000	180,000
1996	Economic loss assessment of lung cancer caused by smoking	Kunaluck	366	35 724.00	18 710.00

Source: Various studies as noted in table.
Notes: a: inpatients b: outpatients. Indirect costs calculated over lifetime, discounted at 10%.

The cost definitions of each study also differ. In Wattana's study, the health care cost consisted of the medical cost as direct cost, and forgone earnings due to early death as indirect cost. In Wanchai's study, the health care cost included the medical cost as direct cost, income loss from work absence as indirect cost, and the cost to patients of clinic care and pharmacy-bought medicine. In Theera's study, the health care cost included the medical cost as direct cost and income loss from work absence as indirect cost. In Kunaluck's study, the direct cost included medical cost, labour cost, material cost, equipment cost, building cost and land rent. The indirect cost consisted of the opportunity cost of time loss due to transportation and the treatment process, income loss from the illness, and income loss of patients' relatives. Kunaluck's study also estimated the forgone earnings resulting from premature lung cancer mortality.

The data used in the studies of Wattana, Wanchai, and Theera tended to underestimate cost because they were collected from public hospitals, which are generally subsidized by the government. Kunaluck had more detailed cost information, such as medical cost and material cost, and thus reflected the cost better. Wanchai's study estimated the number of lung cancer patients attributable to tobacco use as the fraction of all lung cancer patients in Thailand who smoke. This method can overestimate cost because smoking is not the only cause of lung cancer. Population attributable risk factors – the fraction of disease cases that can be attributed to smoking (or other risk factors) have been estimated for some countries, and could be used instead. However, these may differ across population groups, so that PARS estimated for the US, UK or China only provide an approximation for Thailand.

5.5 Health care cost of coronary heart diseases: a literature review

Wanchai (1991) studied the treatment cost for smoking-related heart, chronic obstructive pulmonary disease (COPD) and lung diseases. The estimated average direct cost of coronary heart disease was baht 4,186.58 per person per year while the average direct cost of these three diseases caused by smoking was baht 8,784.41 per person per year. The average cost of patients using clinic care and drug store medicines was baht 664.60 per person per year. The average

indirect cost (absence from work) of these three diseases caused by smoking was baht 5,452 per person per year.

Although the prevalence of coronary heart disease in Thailand was not available, the death rate for heart disease was 50 per 100,000 persons. The study assumed that the death rate for heart disease meant the death rate by coronary heart disease. So the number of those who died by coronary heart disease was estimated to be 27,250 persons. The study showed that 75% of patients with one of the three diseases are smokers. Thus, there were 20,328 coronary heart disease patients in 1991 who were smokers. The average cost of these three diseases caused by smoking was baht 14,901 per person per year (included: direct cost, indirect cost and cost of patients using clinic care and pharmacy-bought medicine). So the cost of coronary heart disease patients was baht 302,907,528 per year.

Jayanton et al. (2001) estimated expenditure and quality of life lost due to chronic obstructive pulmonary disease (COPD) and coronary heart disease caused by smoking. The study collected data from 1 June to 30 November 1998 and used the principle of human capital to estimate the cost. A cross-sectional study was conducted in five provinces in five regions: Chiang Mai (north), Khon Kaen (north-east), Chon Buri (east), Songkhla (south) and Bangkok and its surrounding provinces.

The study population included male and female patients with a clinical diagnosis of COPD or coronary heart disease who had smoked for at least 5 years (in the case of coronary heart disease) or 10 years (in the case of COPD) and had attended hospitals as outpatients or were admitted as inpatients during the study period. The comparison group comprised the people who accompanied patient to hospitals who did not have any chronic diseases or disabilities (patient's relatives). They were matched with the patients according to sex, age and place of residence. Data were collected between June and December 1998, using a standard questionnaire and records containing data on personal and socio-demographic characteristics, history of smoking and of the disease, direct and indirect medical cost and other indirect costs. The direct medical cost included medical cost, materials cost, X-ray cost, laboratory cost, service cost and surgery cost. The direct non-medical cost included food cost, travelling cost and accommodation cost. The indirect cost was the income loss of patients and relatives due to illness. An instrument developed by WHO to assess quality of life (WHOQOL-BREF) was used to measure each subject's assessment of their quality of life. Each patient's expenses and the quality of life lost compared to the comparison group were analysed by various statistics. Multiple regression was also used in a multivariable analysis to adjust for relevant variables.

In this study, the average direct medical costs were calculated at baht 13,265.28 per person per year. The direct non-medical costs were baht 1,002.48 per person per year. The total direct cost of treatment associated with coronary heart disease that was estimated by using the geometric mean approach was baht 15,063.24 per person per year while the total direct costs of the comparison group were baht 284.28 per person per year. The indirect costs of treatment associated with coronary heart disease were estimated to be baht 669.36 per person per year, while the indirect costs of the comparison group were baht 24.48 per person per year. Thus, the total expenditure on treatment associated with coronary heart disease that was estimated using the geometric mean approach was baht 17,746.44 per person per year while the expenditure of

the comparison group was baht 351.12 per person per year. There were trends that decreased with age and the duration of illness, but increased with disease severity and in patients classified as having heart failure. Adjusting for sex, age, education, occupation and income differences, patients with coronary heart disease paid baht 14,767.06 per person per year more than the comparison subjects.

The prevalence of coronary heart disease in Thai people aged over 30 years was reported at 1.05% (Janphen 1996, quoted in Jayanton 2001), and the proportion of coronary heart disease due to smoking was 20.60% (Amornrat 1997, quoted in Jayanton 2001). In 2001, the number of Thai people aged over 30 was 26,290,174 persons (Department of Local Administration, 2001). Assuming an estimated economic loss from coronary heart disease of baht 14,767.06 per person per year, the estimated total expenditure of coronary heart disease patients in a year would have been 14,767.06 × 1.05% × 20.60% × 26,290,174 or baht 840 million.

The estimated economic losses due to coronary heart disease of the two studies were different. Jayanton (2001) estimated that in 1998 the economic loss due to coronary heart disease caused by smoking was baht 14,767 per person per year. Wanchai (1991) used the average cost of three diseases caused by smoking to estimate the economic loss due to coronary heart disease. The average cost of the three illnesses in 1991 from Wanchai's study was baht 14,901 per person per year. Adjusting to 1998 prices[2] gives baht 21,519 per person per year, which is higher than Jayanton's estimates.

Table 5.3. Summarizing the cost associated with coronary heart disease, studies in Thailand

Year of study	**Title**	**Author**	**Sample size** (persons)	**Average direct cost** (baht/person/year)	**Average indirect cost** (baht/person /year)
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	4 186.58	5 452.00
2001	Expenditure and quality of life lost due to diseases caused by smoking	Jayanton et al.	–*	15 063.24	669.36

Source: Wanchai et al (1991), Jayanton et al (2001).
* data not available.

There are many reasons to explain the differences between the two studies. Wanchai used the average cost of three diseases caused by smoking to estimate the economic loss from coronary heart disease. By contrast, Jayanton specifically estimated the cost for coronary heart disease patients.

The direct costs of these two studies were different because of different definitions of cost. In Wanchai's study, direct cost is only the medical cost but in Jayanton's study, direct cost included the medical and non-medical cost. The estimated direct cost in Wanchai's study was baht 4,186.58 per person per year and baht 12 663.85 per person per year Jayanton's study.

[2] CPI 1991= 100; 1998= 145.3.

The indirect cost estimates of the two studies were also different because of differences in the framework for estimation and cost definition. Wanchai's included only the income loss of patients due to illness but Jayanton also included the income loss of the patients' relatives. Wanchai's estimated value was baht 5,452 per person per year while Jayanton's estimated value was baht 352.52 per person per year. The large gap between the two estimated values was because Wanchai used open questions in his questionnaire. He asks the patients how many days were lost due to illness but he did not specify in what time period. Jayanton was more specific. For example, he asked how many days were lost due to illness in one year. Moreover, Wanchai estimated the average days lost due to three diseases caused by smoking and used the average number of days lost to these three diseases to estimate the indirect cost of coronary heart disease.

Both studies have weaknesses. First, the medical costs from public hospitals were used to estimate the medical costs. Because of subsidies that public hospitals receive from government, the real costs of treatment cannot be ascertained. Neither study estimates the income loss or other costs/benefits from premature mortality due to coronary heart disease, nor do they attempt to estimate what the medical costs would have been for patients from other diseases, if they had not smoked.

5.6 Health care cost of chronic obstructive pulmonary disease (COPD): a literature review

Wanchai (1991) estimated the average direct cost of COPD at baht 16,388.03 per person per year and the average direct cost of all three diseases caused by smoking was baht 8,784.41 per person per year. The average cost of patients using clinic care and drug store medicine was baht 664.60 per person per year, and the average indirect cost (absence from work) of these three diseases caused by smoking was baht 5,452 per person per year. Thus, the average cost of these three diseases caused by smoking was baht 14,901 per person per year (included: direct cost, indirect cost and cost of patients using clinic care and pharmacy medicine)

The prevalence of COPD patients in Thailand was 143.3 per 100 000 (Chitanondh 1991, quoted in Wanchai 1991). The Thai population in 1992 was 54 million. Thus, the number of COPD patients was estimated to be 77,382 persons, and 74.6% of them—57,727 persons—were assumed to be smokers. The cost of COPD patients in the study was calculated as the average cost of three diseases caused by smoking multiplied by the estimated number of COPD patients who were smokers; this was baht 860,190,027 per year.

Jayanton (2001) estimated the expenditure and quality of life of patients with COPD caused by smoking. From his study, the direct medical cost was baht 6,081.12 per person per year. The direct non-medical cost was baht 100.68 per person per year. Thus, the total direct cost of treatment associated with COPD estimated using the geometric mean approach was baht 6,457.80 per person per year, while the total direct cost of the comparison group was baht 65.04 per person per year. The indirect costs of treatment associated with COPD were estimated to be baht 217.32 per person per year while the indirect cost of the comparison group was baht 8.76 per person per year. The total treatment cost associated with chronic obstructive pulmonary disease estimated by using the geo-matrix mean approach was baht 7,656.72 per person per year

while the expenditure of the comparison group was baht 138.60 per person per year. There were no trends according to age, duration of illness or severity. After adjustment for sex, age, education, occupation and income differences, patients with COPD paid baht 7,520.65 per person per year more than the comparison group.

Table 5.4. Summarizing the cost associated with COPD, studies in Thailand

Year of study	**Title**	**Author**	**Sample size (persons)**	**Average direct cost (baht/person/year)**	**Average indirect cost** (baht/person/year)
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	16 388.0	5 452.00
2001	Expenditure and quality of life lost due to diseases caused by smoking	Jayanton et al.	–*	6 457.08	217.32

Source: Wanchai et al (1991), Jayanton et al (2001).
* data not available.

Table 5.4 shows the estimated health care cost due to COPD of the two studies were very different. Jayanton (2001) estimated the economic loss due to COPD caused by smoking at baht 7,520.65 per person per year in 1998. The direct cost for COPD patients from Jayanton (2001) was equal to baht 6,457.08 per person per year while the average cost for COPD patients in 1991 from Wanchai's study was baht 16,388.03 per person per year. Adjusted to 1998 values,[3] it was baht 23,811.81 per person per year, which is much higher than Jayanton's estimates. As with the other disease estimates, there are many reasons to explain the difference.

Wanchai used the average cost of the three diseases caused by smoking to estimate the loss due to COPD. By contrast, Jayanton estimated the cost of COPD patients specifically. Their definitions of direct and indirect costs differ. Wanchai's study assumed that the medical cost of COPD patients depended on the severity of disease, and estimated costs for first, middle and last stages of the disease; Jayanton assumed that the medical cost was constant for all stages of illness.

5.7 A re-estimation of the health care cost of smoking-related diseases

In this paper, the health care cost caused by smoking in Thailand in 1999 will be estimated using the results from previous studies, but using a prevalence approach rather than the incidence approach. This avoids the difficulty of having to estimate the number of new patients.

The estimation of the direct and indirect health care cost caused by smoking is based on the epidemiological concept of the percentage of population-attributable risk (PAR%), the percentage of prevalence of a disease in a population that is caused by a risk factor, in this case, by smoking.

[3] CPI 1991= 100; 1998= 145.3.

$$\text{PAR\%} = \left(\frac{P^e(RR-1)}{1+P^e(RR-1)} \right) \times 100$$

where P^e = proportion of exposed (smoking) population in total population and RR = relative risk for smokers compared to that for non-smokers

This equation is used to estimate the number of cases caused by smoking; multiplying the PAR% by total illness cases in 1999 in Thailand. Data on relative risk in Thailand is not available, so relative risks from China were used (Liu, Peto et al., 1998). The Chinese risk ratios are presented in Appendix 6.

In 1999 the sex ratio above 11 years old in Thailand was 49.68:50.32 (M:F). The average RR of the total population is equal to the sum of the RR for each sex weighted by its population share.

$$RR_{\text{total}} \text{ for lung cancer} = (2.72 \times 0.4968) + (2.64 \times 0.5023) = 2.68$$

$$RR_{\text{total}} \text{ for COPD} = (1.43 \times 0.4968) + (1.72 \times 0.5023) = 1.575.$$

Thailand's smoking prevalence in 1999 was 24.03%, hence PAR% for lung cancer was:

$$\frac{0.2403(2.68-1)}{1+0.2403(2.68-1)} \times 100 = 28.8\% .$$

This is much lower than the PAR for lung cancer in the USA and UK, where the great majority of lung cancer cases are attributed to smoking. In China, however, in rural areas, a large percentage of lung cancer cases are attributed to high exposure to indoor air pollution from cooking and heating fires (Liu at al 1998).

To estimate direct and indirect costs of lung cancer caused by smoking, this paper uses the direct and indirect costs of lung cancer from Kunaluck (1996) because they are considered more reliable than the other studies and cover more cost components. The estimated direct and indirect costs of lung cancer of baht 35,724 and baht 18,710 per person per year were adjusted to 1999 values,[4] to give baht 40,903.98 and baht 21,422.95 per person per year.

In 1999, the number of lung cancer patients of Thailand was 9,589 (Appendix 7). The PAR implies that 2,758 cases were caused by smoking. Consequently, the direct cost of lung cancer caused by smoking in Thailand in 1999 was baht 40,903.98 × 2,758 or baht 112,813,176.84. The indirect cost of lung cancer caused by smoking was equal to baht 21,422.95 × 2758 or baht 59,084,496.10. In sum, the total cost of lung cancer caused by smoking in 1999 was baht 171,897,672.94 (Table 5.5).

[4] CPI 1996= 100; 1999= 114.5.

Table 5.5. Estimated direct and indirect costs of lung cancer cases caused by smoking, Thailand, 1999

Number of lung cancer cases caused by smoking	Direct cost (baht)	Indirect cost (baht)	Total cost (baht)
2 758	112 813 176.84	59 084 496.10	171 897 672.94

Source: Author's estimate using cost data from Kunaluck (1996) and China PAR (Liu, Peto et al., 1998).

To estimate the direct and indirect costs of COPD caused by smoking, this paper uses the direct medical cost per person from Jayanton (2001), estimated at baht 6,081.12 per person for 1998. Adjusted to 1999 values,[5] the average direct medical cost was baht 6,099.97 per person. However, this direct medical cost does not include costs of labour, materials, equipment, buildings or land rent. This paper approximated these other costs by multiplying the direct medical cost of COPD by their percentage shares of total medical cost. Based on Kunaluck (1996), the percentages of labour cost, material cost, equipment cost, building cost, and land rent to total medical cost were 29.90%, 14.27%, 0.25%, 1.28%, and 1.22%. Therefore, the labour cost, material cost, equipment cost, building cost, and land rent were equal to 1,824, baht 870, 15, 78, 74 per person per year, respectively. Adding these gives an adjusted direct medical cost of COPD of baht 8,961 per person per year.

The direct non-medical cost and indirect cost of COPD were borrowed from Jayanton (2001). Adjusted to 1999 values, the direct non-medical cost of COPD and indirect cost of COPD were baht 101 and baht 218 per person per year. Consequently, in 1999, the total cost of COPD was baht 9,280 per person per year. Of this, baht 9,062 was direct cost and baht 218 was indirect cost.

PAR% for COPD is computed using the above formula, which gives a much lower PAR than for Western population groups:

$$\frac{0.2403(1.575-1)}{1+0.2403(1.575-1)}\times 100 = 12.14\%$$

Prevalence of COPD in Thailand is 143 per 100,000 (Chitanondh, 1991). Thus, there were 56 780 COPD patients in Thailand (calculated from the population over 20 years old, the same population with lung cancer). Thus, in 1999 there were 6894 cases of COPD caused by smoking. Consequently, in 1999, the direct cost of COPD caused by smoking of Thailand was baht 9062 × 6894 or baht 62 473 428 per year. And the indirect cost of COPD caused by smoking of Thailand was baht 6894 × 218 or baht 1 502 892 per year. In conclusion, the total cost of COPD caused by smoking in 1999 was baht 63 976 320.

[5] Inflation rate: 1999 = 0.31%.

Table 5.6. The direct and indirect costs of COPD cases caused by smoking, Thailand, 1999

Number of COPD cases caused by smoking	Direct cost (baht)	Indirect cost (baht)	Total cost (baht)
6894	62 473 428	1 502 892	63 976 320

Source: Author's estimate using cost data from Jayanton (2001) and Kunaluck (1996) and China PAR (Liu, Peto et al., 1998).

This paper does not estimate the health care cost of other diseases caused by smoking, because there are insufficient empirical data. However, the health care cost of other diseases may be estimated use the methodology above.

In conclusion, the author's estimates of the health care cost of lung cancer and COPD caused by smoking in Thailand are shown in Table 5.7 in terms of baht and US dollars in 2003.

Table 5.7. The health care cost of lung cancer and COPD caused by smoking, Thailand, 2003

	Total		Direct cost		Indirect cost	
	Bath	US$	baht	US$	baht	US$
Total	248 808 259.75	5 983 844.63	184 898 532.32	4 446 814.15	63 909 727.43	1 537 030.48
Lung cancer	181 323 766.67	4 360 840.95	118 999 343.07	2 861 937.06	62 324 423.60	1 498 903.89
COPD	67 484 493.08	1 623 003.68	65 899 189.26	1 584 877.09	1 585 303.82	38 126.60

Note: CPI 1998=100, 1999 =100.3; 2003 =105.8.
Average exchange rate US$ 1 = baht 41.58 (calculated from exchange rate in 1999 – 2003).

The health care cost in Thailand from lung cancer and COPD caused by smoking in 1999 was estimated at around baht 236 million. Thailand's total health expenditure in 1999 was around baht 239,892 million (National Economic and Social Development Board). Thus, the health care cost of the two diseases caused by smoking in 1999 was approximately 0.1% of Thailand's total health expenditure in that year.

Although the smoking-attributable cost of the two diseases estimated by this study is not great and the cost of other smoking-related diseases is not estimated due to insufficient data, it is still necessary to be concerned about the health care cost due to smoking in Thailand. Not only does smoking cause many diseases that lead patients to suffer and to waste their time and money on treatment, but also it leads to early death, which means benefit forgone. Moreover, if actual relative risks among the Thai people are more like those calculated for the US and UK than for China, then this estimate greatly understates true tobacco-attributable health care costs in Thailand.

6. POLICY RECOMMENDATIONS

Tobacco has played many conflicting roles in the Thai economy. Because of this, tobacco control policies have been debated by economists, health personnel and policy-makers. Advocates of the policies assert that policies to discourage smoking are crucial to avert the disease and premature deaths that result from smoking, and to counter the aggressive sales strategies of cigarette companies. Lower smoking rates also releases income for consumption of other goods and reduces future health care costs on smoking-related illnesses. At the same time, there has been concern that smoking reduction could adversely affect the employment and income of tobacco farmers and workers in tobacco-related industries and other development activities that could be funded by revenue from tobacco taxes.

Using tax increases to reduce smoking

The demand analysis shows that each 1% increase (decrease) in income will lead to a 0.70% increase (decrease) in demand for cigarettes. As incomes rise, so will cigarette consumption, unless tax policy is used to raise real cigarette prices and counter the income effect.

A price policy that increases the rate of excise tax will not only reduce smoking but also earn more revenue for the government. Based on the elasticity estimate (–0.3925), the impact of an increase in the rate of excise tax from 75% to 76% would be as follows. The price of cigarettes would rise by an estimated 4.17%. Overall cigarette consumption would fall by around 1.64%. Given cigarette consumption in 2000, this is more than 27 million packets of cigarettes. Tax revenue would increase by 3.93%, earning nearly baht 1 billion for government revenues. In addition to this, in the long term, there will be additional benefits in health care cost savings. The different price elasticities among smokers in different income classes and age groups imply that the increase in excise tax rate will be more successful in reducing cigarette consumption of smokers who live in urban areas, are from lower income classes and are 30 to 40 years old.

However, if tax rates on other tobacco products such as self-rolled cigarettes and *bai jak* are not increased by the same proportion, some smokers are likely to switch to other tobacco products, diluting the positive health impact. The rates of excise tax on these tobacco products have been very low and should be increased.

There are concerns that an increase in the tax rate will induce more cigarette smuggling. Survey results suggest that the consumption of contraband cigarettes is significant and could be much larger than the official figure for imported cigarettes. Even though most smokers of local cigarettes and legally imported cigarettes said they would not switch to other types of cigarette; the survey results suggest that, following a 10% increase in the prices of all legally produced and imported brands, contraband cigarettes might gain around baht 850 million at the expense of local cigarette producers and legal cigarette importers. This points to an urgent need to combat smuggling of contraband cigarettes.

It should be noted that a cigarette price increase will lead to a small decrease in real income of smokers who do not quit or cut back their consumption. This means a small adverse impact on demand for and tax revenue from other goods.

There are many other reasons to support the use of tax policy to increase the price of cigarettes. Survey results show that only two-third of smokers recalled the most recent increase in 2001. The recall rate was higher in Bangkok metropolis than in provincial areas. More than one-third and around one-quarter of smokers realized that reasons behind the increase were smoking control and tax revenue, respectively. Despite the impact on their cigarette expenditures, the majority of smokers supported the increase in cigarette tax rate.

In sum, if the government wants to do more to reduce smoking, policy-makers could consider a national health campaign to coincide with a sharp rise in the rates of tax on cigarettes and other tobacco products. Public information and high prices can do much to deter new smokers and encourage established smokers to cut back or quit. A sharp rise in the prices of all tobacco products is likely to have a significant "shock" effect on smokers, although large rises can also generate public resistance. Regular increases (for example, increases of at least 5% over and above the inflation rate each year, as recommended by WHO) should be considered.

Tobacco accounts for over 5% of all government revenues. In addition to revenue from all cigarette taxes, the Thai government also raises revenue from Thailand Tobacco Monopoly (TTM) profits. Although these revenues will continue for the foreseeable future, and are likely to continue to increase with tax rate increases, in the longer term, the government should prepare to be less reliant on tobacco revenue.

Further attention is warranted to the valuation of imported cigarettes. Under-valuation reduces evades tax, and lowers the price of, and increases demand for, imported cigarettes. There are at least two incentives to under-declare the imported prices of cigarettes. Cheaper imported cigarettes could be an effective means to penetrate domestic markets and increase demand. And lower valuation that reduces tax liability could raise profits and increase resources for advertising.

Other anti-smoking measures need to be enforced better

The rate of smoking participation in Thailand is high among males but low among females. Thus, special preventive measures are needed, as women are often carefully targeted by cigarette producers. In many countries, smoking rates among young women are rising and are higher than among young men, which is a very worrying trend (GYTS data, various countries and years).

Millions of Thais still smoke regularly or occasionally. Among many smoking control measures, warning labels have been used to educate smokers about the health consequences of smoking. The effectiveness of this measure in reducing tobacco consumption depends in part on the recall of smokers of messages on the labels. Survey results suggest that "Smoking causes lung cancer" has the best recall, following by "Cigarettes seriously damage health", "Smoking harms your family", "Smoking causes erectile dysfunction", and "Smoking causes emphysema". However, around 11% of smokers could not recall any of the messages on the labels.

Stronger enforcement of measures designed to reduce smoking is needed. These are the prohibition of advertisement of tobacco products, smoking in certain public places and selling of cigarettes to children age under 18. One in five smokers has seen cigarette advertising, especially on television, through drama and logos on various programs. Many smokers also admit to having smoking in public places where smoking is prohibited, with the extent of violation more in provincial areas than in Bangkok. One out of every four said they had smoked in areas in which measures should be enforced strictly such as schools, other educational institutions and air-conditioned shopping areas. A significant number of smokers have smoked in trains, taxis, buses, theatres and government offices, and continue to do so. The right of non-smokers, especially children, to live in a smoke-free environment needs to be protected.

Estimates of age of first smoking point to an urgent need to enforce measures to control child smoking and cigarette selling to children under 18. In the north-east, the age at which smokers said they had their first cigarette was as low as 7 years old. In other regions, the figures were also low—8 years old for Bangkok and the south, 10 years old for the central region, and 11 years old for the north.

APPENDICES

Appendix 1. Methodology and data

Methodology

The model for the estimation of consumer demand in this study is the linear expenditure system (LES), which is based on utility-maximizing behaviour of consumers subject to budget constraints. The strength of the LES lies on its two desirable properties of consumer demand, additivity and homogeneity. Its weakness is based on its restriction on a Geary–Stone utility function that assumes a linear Engel function, rules out inferior goods and treats savings as an exogenous factor.

The LES assumes that the consumer has utility-maximizing behaviour and that total expenditure is exogenously determined. The total expenditure is allocated in two steps. First, at a given set of prices, the consumer consumes each good at a level called the committed level. Second, the consumer distributes the remaining expenditure in such a way that utility will be maximized. The unit of analysis in this study is a per capita basis—household consumption and expenditure are equally shared by members of a household. The consumer's behaviour can be explained by Equations A1 and A2. First-order conditions of utility maximization subjected to a budget constraint lead to Equation A3, which is used in the estimation of consumer demand parameters in a system of $n - 1$ demand equations.

Maximize $$U = \Pi(Q_i - \gamma_i)^{\beta i} \qquad \text{Eq. A1}$$

Subject to $$\Sigma P_i Q_i = E \qquad \text{Eq. A2}$$

$$P_i Q_i = P_i \gamma_i + \beta_i (E - \Sigma P_i \gamma_i) + u_i \qquad \text{Eq. A3}$$

where

U = utility

$i = 1, 2, 3, \ldots, n$

Q_i = consumption level of good i

γ_i = the consumer's committed consumption level of good i

β_i = the marginal expenditure of good i out of additional expenditure

E = consumer's consumption expenditure

P_i = the price of good i

u_i = a disturbance term

$Q_i \geq \gamma_i \geq 0$ for all i

$1 \geq \beta_i \geq 0$ for all i

$\Sigma\beta_i = 1$

$\Sigma u_i = 0$.

Estimation of a system of demand equations is used in this study. The strength of this method is based on the fact that a substitution between different consumer goods is allowed in order that consumers' utility will be maximized. This is very important, especially when addictive goods are considered (Lanchaste, in Weeden, 1983).

Based on LES, Lluch and Williams (1975) show that the expenditure elasticity, price elasticity and cross price elasticity can be estimated by Equations A4–A6.

$$\varepsilon_i = \beta_i / w_i \qquad \text{Eq. A4}$$

$$\varepsilon_{ii} = \varepsilon_i[\Phi - w_i(1 + \Phi\varepsilon_i)] \qquad \text{Eq. A5}$$

$$\varepsilon_{ij} = -\varepsilon_i w_j(1 + \Phi\varepsilon_j) \qquad \text{Eq. A6}$$

where $w_j = P_j Q_j / E$ and $\Phi = -1 + \Sigma P_j \gamma_j / E$.

Demographic background of consumers

The incorporation of demographic effects in demand analysis is well discussed by Pollak and Wales (1978) and Barnes and Gillingham (1984). The general model, as discussed above, does not include any demographic variables. This is called pooled estimation. It is estimated on a sample in which observations with different demographic profiles are combined, and the demand parameters are constrained to be equal across demographic profiles. Alternatively, demographic variables can be incorporated into the model by making the model parameters either explicit or implicit functions of the demographic variables. In a general case, all parameters are allowed to vary freely across demographic profiles. This is called generally unpooled estimation. In this study, it is applied by dividing consumers into 10 income classes but cannot be applied to smokers of difference ages in the same household. An alternative is a more complicated unpooled estimation that constrains the functional relationship between the parameters and demographic profiles.[6] In this study, the committed expenditure for cigarettes is assumed to depend on the age of the smoker. Because of an aggregation problem, the relationship between cigarette demand and the age of smokers in terms of the marginal budget share (β) is too complicated to model. Equation A7 demonstrates how consumption demand of two age groups, adult and child, can be modelled and estimated.

[6] Barnes and Gillingham (1984) divide this constrained relationship into three types: demographic translating, demographic scaling and a combination of demographic translating and scaling.

$$PQ = P(R^a\gamma^a + R^c\gamma^c) + (R^a\beta^a + R^c\beta^c)[E - \Sigma P(R^a\gamma^a + R^c\gamma^c)] \qquad \text{Eq. A7}$$

where

R^a = ratio between the number of adults in the household and household size

R^c = ratio between the number of children and household size

γ^a = an adult's committed level of consumption for good *i*

γ^c = a child's committed level of consumption for good *i*

β^a = marginal budget share for good *i* of an adult

β^c = marginal budget share for good *i* of a child

PQ = per capita expenditure for good *i*

E = per capita household consumption expenditure,

Σ is summed over all goods.

For estimation purposes, the committed levels of consumption of non-tobacco products are assumed to be equal across age groups.

Household consumption data

Two sets of data used in examining the impact of changes in price and income on the consumption of cigarettes and other tobacco products are the household socio-economic survey (SES) of the Thai National Statistical Office (NSO), and the consumer price data sets of the Department of Business Economics in the Thai Ministry of Commerce.

The SES began in Thailand in 1957 under the name of household expenditure survey. A subsequent survey was carried out in 1968–69, and repeated every five years. After the 1986 survey, the NSO intensified the survey to every two years. An extra SES was conducted in 1999 in order to gather information on the post-crisis conditions of households. The 2000 survey, SES2000, used in this study is the most recent survey. The number of households sampled in SES2000 was 24,747. Of this, 48.36% or 11,968 households spent part of their expenditure on cigarettes and other tobacco products.

The SES provides detailed information of households' total income, total expenditure, expenditure on various consumer goods and services, size, composition and other socioeconomic characteristics. However, there is no detailed information on individual smoking behaviour such as expenditure on cigarettes, contraband cigarettes, reasons for smoking or violation of smoking control measures. Prices of various consumer goods bought by sampled households are also not available. A weight is attached to each observation drawn from a stratified two-stage sampling technique.

Based on per capita household income, the present study divides households into 10 classes, five urban and five rural. Households with no expenditure for cigarettes and other tobacco products are not included. The characteristics and sample size of smoker households in these 10 classes are presented in the following table.

Table A1.1 Characteristics of households, by income class, Thailand, 2000

Income class	Per capita household expenditure (baht/month)			Household size	Sample size
	Mean	Minimum	Maximum		
Urban 1	1119.90	364.00	1 582.00	5.25	1856
Urban 2	1948.83	1585.00	2 357.00	4.77	1442
Urban 3	2813.08	2358.00	3 343.00	4.52	1192
Urban 4	4085.36	3348.00	5 111.00	3.79	958
Urban 5	8554.89	5114.00	55 973.00	3.72	783
Rural 1	752.11	217.00	993.00	5.55	1359
Rural 2	1168.50	994.00	1 370.00	4.53	1240
Rural 3	1580.08	1371.00	1 824.00	4.40	1231
Rural 4	2209.00	1825.00	2 733.00	4.13	1095
Rural 5	4191.94	2738.00	47 861.00	3.74	812

Source: calculated from SES 2000.

In order to analyse the income and price responsiveness of smokers by age group, this study opts for an indirect estimation rather than a direct estimation. This indirect estimation assumes that the committed level of expenditure (γ) and the marginal budget share (β) are dependent on the age of the smokers. Thus, they can be estimated from the consumption behaviour of smoker households containing people of different ages. The division of smokers into six age groups is based on survey results and Thai regulations on the sale of cigarettes. Survey results show that the first age of smoking could be as young as 7 or 8 years old, even though Thai regulations do not allow anybody younger than 18 years to buy cigarettes. The age groups are 8+ to 18, 18+ to 30, 30+ to 40, 40+ to 50, 50+ to 60, and 60 years and over. An estimation of these parameters directly from individual smokers in different age groups is constrained by the limited number of samples in the survey.

Household expenditure on more than 50 goods and services are grouped into 12 categories. These are: food; clothing and footwear; housing and furnishing; health care; personal care; transport and communication; recreation; education; alcoholic beverages; cigarettes and other tobacco products; gambling; and other non-foods.

The definition of food is straightforward. It includes rice, other cereal products such as flour, bread and noodles, all kinds of meat and fish, all kinds of fruit, green vegetables, and all other foods including prepared food, meals taken home and non-alcoholic beverages.

Other consumer goods are defined as follows. Clothing and footwear consists of cloth and clothing, including school uniform, and footwear. Housing and furnishing includes house rent,

housing operations, textiles, house furnishing, minor and major equipment, furniture, cleaning supplies, electricity, cooking gas, wood, kerosene, batteries, light bulbs, lamps, matches and water. Health care includes all medical services and medical supplies. Personal care comprises all personal care items, and personal care services. Transport and communication includes local transportation, travelling out of the area, telephones, paging, telegraphs, facsimiles, postage, envelopes, ink, pens, pencils and other stationery. Recreation includes admission to fairs, amusement parks, sports stadiums, theatres and museums, gardening, sightseeing, and sport and recreational equipment such as radio and television. Education includes school fees, textbooks, school equipment, fees for special lessons, pocket money for children going to school and other educational expenses. Cigarettes include snuff and other tobacco products. The definitions of alcoholic beverages and gambling are self-explanatory. Gifts, social contributions, occupational expenses, ceremonial expenses, charities, religious contributions, donations and insurance premiums are included in other non-foods.

Price data

The price data consist of nine data sets: one for the Bangkok metropolitan area, four for urban areas in the north, the north-east, the south and central regions, and four for rural areas in each of the four regions. The prices of more than 250 goods and services are included in each data set. Thus, there are nine price indexes for each good and service. The data sets allow different prices across regions and communities (urban and rural areas), although they still assume a single commodity price in each regional urban and rural area. In absolute terms, these price data sets may not be the actual prices faced by the sampling households. In relative terms, these price data sets are expected to reflect regional price differences. This is preferable to assuming a single price for each consumer goods across areas and regions. It should be noted that data on prices of gambling and other non-foods are not available. Moreover, the prices of legally produced lottery tickets and cigarettes are controlled and are the same in every region. Therefore, regional differences in the prices of these goods are the aggregation of prices of different brands and are found to be minor.

The aggregation of the prices of more than 250 consumer goods and services is carried out in three steps. First, Bangkok is used as a numeraire or base price for all consumer goods and services. This is equivalent to choosing a unit of every good and service so that its Bangkok price is 1. Second, prices in other regions are then normalized by Bangkok prices. Third, the resulting relative prices are aggregated by consumption weights provided by the Department of Business Economics, Ministry of Commerce, so that the group relative prices are comparable with the 12 consumer goods and services groups, as classified by this study.

A general aggregation formula is presented by the following equation.

$$R_r = \Sigma H_{ri}(P_{ri}/P_{0i}) \qquad \text{Eq. A7}$$

where

R_r = the aggregated relative price of any good in region r

H_{ri} = the share of good *i* in the consumption expenditure of household living in region r

P_{ri} = the price of good *i* in region r

P_{0i} = the price of good *i* in Bangkok.

The average regional relative prices of these goods by urban/rural division and income class are summarized in the following table.

TableA.1.2. Average regional relative prices, by income class, Thailand

Household category	Food	Clothing	Housing	Health care	Personal care	Transport
Whole country	0.9490	0.6342	0.7719	0.7193	0.6904	1.4474
Urban 1	1.0775	0.9621	0.7917	0.8929	0.9911	1.3974
Urban 2	1.0532	0.9840	0.8227	0.8839	0.9820	1.2800
Urban 3	1.0392	0.9920	0.8556	0.8952	0.9805	1.2127
Urban 4	1.0244	0.9983	0.8996	0.9236	0.9855	1.1312
Urban 5	1.0211	0.9971	0.9193	0.9402	0.9888	1.1126
Rural 1	0.9265	0.5422	0.7461	0.6733	0.6143	1.5358
Rural 2	0.9191	0.5425	0.7465	0.6692	0.6144	1.4965
Rural 3	0.9260	0.5428	0.7571	0.6709	0.6097	1.4948
Rural 4	0.9252	0.5427	0.7611	0.6699	0.6103	1.4686
Rural 5	0.9193	0.5421	0.7584	0.6683	0.6164	1.4371

(Continued)

Household category	Recreation	Education	Alcoholic beverages	Cigarettes	Gambling	Other non-foods
Whole country	0.8191	0.7004	0.5131	0.9817	1.0000	1.0000
Urban 1	1.0806	0.8560	1.0867	1.0294	1.0000	1.0000
Urban 2	1.0930	0.8822	1.0697	1.0137	1.0000	1.0000
Urban 3	1.0889	0.9038	1.0587	1.0059	1.0000	1.0000
Urban 4	1.0624	0.9360	1.0368	1.0031	1.0000	1.0000
Urban 5	1.0503	0.9476	1.0314	1.0030	1.0000	1.0000
Rural 1	0.7425	0.6585	0.3683	0.9771	1.0000	1.0000
Rural 2	0.7468	0.6482	0.3699	0.9772	1.0000	1.0000
Rural 3	0.7556	0.6461	0.3696	0.9703	1.0000	1.0000
Rural 4	0.7639	0.6386	0.3707	0.9674	1.0000	1.0000
Rural 5	0.7701	0.6306	0.3726	0.9683	1.0000	1.0000

Source: calculated from the consumer price data sets of the Department of Business Economics, Ministry of Commerce.

Based on these data, LES parameters are estimated. The estimates of parameters in the model are summarized in Tables 7.5–7.22 at the end of this Appendix.

Field surveys

The main purpose of field surveys was to collect information to supplement the household consumption data of SES2000. This is information such as age at first smoking, reasons for smoking, tobacco and cigarette smuggling, and the violation of smoking control measures.

A total of 810 smokers were sampled and interviewed between 26 September and 8 December 2001. Of these, 111 samples were from Chiang Mai in the north, 120 samples from Khon Kaen in the north-east, 120 samples from Chumphon in the south, 100 samples from Chon Buri in the central region and 359 samples from metropolitan Bangkok. A weight was attached to each observation drawn from a stratified sampling technique. The weight was 0.0892 for Bangkok and 0.9108 for other regions.

The background of these samples is as follows. More than 97% of the samples were males and less than 3% were female. The average age of these smokers was 37.5 years. The average age was highest for the north-east (39.67 years), followed by the south (38.06 years), the north (37.77 years), central region (35.10 years) and metropolitan Bangkok (33.97 years). The majority of smokers had educational backgrounds not more than lower secondary level. Only around 7.6% had had university education.

TableA1.3. Age of samples, by region, Thailand

Region	Mean	Standard deviation	Minimum	Maximum
Total	37.49	12.42	13	77
North	37.77	13.64	17	70
North-east	39.67	12.32	13	69
Central	35.10	10.52	17	70
South	38.06	12.93	17	74
Metropolitan Bangkok	33.97	10.64	16	77

Source: survey results.

Table A1.4. Education background of samples, by region, Thailand

Educational background	Total (%)	Region (%)				
		N	NE	C	S	Bangkok
Lower than lower elementary	1.9	1.8	1.7	1.0	3.3	0.0
Lower elementary	25.5	19.8	29.2	27.0	28.3	17.3
Upper elementary	18.2	17.1	17.5	23.0	15.0	20.6
Lower secondary	17.5	10.8	22.5	19.0	17.5	16.7
Upper secondary, vocational or diploma	28.7	40.5	21.7	22.0	31.7	24.5
Bachelors degree and higher	7.6	9.0	6.7	7.0	4.2	20.1
Others	0.6	0.9	0.8	1.0	0.0	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: survey results.

Table A1.5. Estimates of model parameters, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.2048	139.5300	518.8373	250.4700
Clothing	0.0491	60.9260	48.1331	54.1090
Housing	0.2048	122.8300	267.3225	132.9600
Health care	0.0403	50.2090	28.0699	58.8690
Personal care	0.0192	80.1590	53.5897	139.2800
Transport	0.3092	123.4600	0.0000	0.0123
Recreation	0.0179	46.9150	0.0000	0.0001
Education	0.0648	79.1410	64.5757	46.3420
Alcoholic beverages	0.0299	44.2690	40.2806	30.1900
Cigarettes	0.0201	60.7380	27.3801	80.3890
Gambling	0.0209	29.9950	12.9147	19.3670
Other non-foods	0.0191	n.a.	17.1901	30.5340

Source: Author's estimates

Table A1.6. Estimates of model parameters, urban class 1, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.3937	49.7300	233.4173	37.5500
Clothing	0.0400	20.9880	0.0001	0.0075
Housing	0.2284	27.0980	134.4440	19.2270
Health care	0.0292	6.6347	6.0050	2.7859
Personal care	0.0262	16.1860	24.4570	30.7050
Transport	0.0926	19.3500	9.9490	5.8681
Recreation	0.0021	3.8162	0.8210	1.9783
Education	0.0851	24.0470	2.0802	1.3405
Alcoholic beverages	0.0191	5.6538	11.7924	8.9792
Cigarettes	0.0439	25.6400	0.0001	0.0031
Gambling	0.0273	17.8280	0.0000	0.0007
Other non-foods	0.0124	n.a.	0.0021	0.0030

Source: Author's estimates

Table A1.7. Estimates of model parameters, urban class 2, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.3130	16.2190	720.6003	95.3710
Clothing	0.0196	2.0970	54.3700	18.7880
Housing	0.0938	5.8622	467.6406	78.3750
Health care	0.0252	5.0139	26.2216	15.9160
Personal care	0.0000	0.0000	72.0360	165.6800
Transport	0.1474	10.7930	103.5917	26.4720
Recreation	0.0119	2.8818	3.2696	2.7795
Education	0.2506	25.8230	0.0000	0.0000
Alcoholic beverages	0.0000	0.0000	50.0542	37.4200
Cigarettes	0.0505	8.1252	51.7795	23.8560
Gambling	0.0881	19.2160	0.0000	0.0000
Other non-foods	–0.0001	n.a.	18.9025	12.1210

Source: Author's estimates

Table A1.8. Estimates of model parameters, urban class 3, Thailand

Good *i*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.2383	9.7952	1037.0976	97.2840
Clothing	0.0499	5.3684	70.7533	22.0110
Housing	0.1438	8.0314	615.4369	83.2700
Health care	0.0000	0.0000	72.6262	43.8140
Personal care	0.0311	8.6735	68.9232	50.5170
Transport	0.1735	10.3460	212.6931	34.1270
Recreation	0.0092	2.0352	19.0393	13.4700
Education	0.1903	13.1940	88.4916	10.9790
Alcoholic beverages	0.0420	3.4543	76.5783	18.3010
Cigarettes	0.0215	3.1336	98.6784	40.2480
Gambling	0.0923	12.9980	0.0000	0.0000
Other non-foods	0.0081	n.a.	29.2941	12.8320

Source: Author's estimates

Table A1.9. Estimates of model parameters, urban class 4, Thailand

Good *i*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.1088	4.5031	1419.1042	87.5650
Clothing	0.0471	7.3856	51.6846	10.7020
Housing	0.2278	10.5260	855.0946	51.8740
Health care	0.0087	0.9976	94.4920	15.3660
Personal care	0.0147	2.5237	124.7019	32.9980
Transport	0.2594	16.8220	251.4762	21.0580
Recreation	0.0195	2.6569	31.4620	6.5053
Education	0.2255	16.1810	0.0000	0.0000
Alcoholic beverages	0.0242	3.1919	112.1693	18.5270
Cigarettes	0.0131	1.8762	142.7547	31.3910
Gambling	0.0411	7.2814	28.6546	7.3358
Other non-foods	0.0102	n.a.	44.3809	15.9530

Source: Author's estimates

Table A1.10. Estimates of model parameters, urban class 5, Thailand

Good *i*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.0933	15.8000	2086.2970	97.0650
Clothing	0.0755	14.5300	246.9927	11.8840
Housing	0.2107	23.9410	1593.6064	66.7390
Health care	0.0223	3.4702	451.6900	21.9540
Personal care	0.0131	9.7217	186.8142	41.1710
Transport	0.4313	30.9290	1130.1699	24.2220
Recreation	0.0376	11.2180	70.6289	7.2550
Education	0.0655	12.0410	607.9676	31.0980
Alcoholic beverages	0.0348	9.7748	192.5156	16.7690
Cigarettes	0.0043	3.0996	172.6859	41.7070
Gambling	0.0108	3.9635	70.7617	8.0760
Other non-foods	0.0008	n.a.	82.0021	20.1700

Source: Author's estimates

Table A1.11. Estimates of model parameters, rural class 1, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.4016	36.3220	229.4013	36.3170
Clothing	0.0339	5.2563	21.4962	7.2072
Housing	0.2346	26.0330	104.7962	21.4590
Health care	0.0274	7.2166	8.0021	5.5760
Personal care	0.0265	15.4900	24.2596	29.5410
Transport	0.1003	15.5580	2.3351	2.2945
Recreation	0.0035	6.9381	0.0000	0.0001
Education	0.0933	20.3470	0.0000	0.0000
Alcoholic beverages	0.0209	5.0879	15.6959	5.7530
Cigarettes	0.0183	7.0812	9.3159	13.8990
Gambling	0.0259	15.0130	0.0000	0.0000
Other non-foods	0.0137	NA	0.0000	0.0000

Source: Author's estimates

Table A1.12. Estimates of model parameters, rural class 2, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.3561	21.2290	474.8041	46.3440
Clothing	0.0722	5.9216	42.8580	7.6857
Housing	0.1293	6.9941	325.9469	48.4360
Health care	0.0233	3.3213	41.0163	17.0610
Personal care	0.0306	13.5470	50.9339	39.5650
Transport	0.1040	9.9610	50.9996	29.0730
Recreation	0.0000	0.0005	6.1024	14.1810
Education	0.1724	14.3240	17.4674	2.5823
Alcoholic beverages	0.0274	5.3052	67.6753	26.2840
Cigarettes	0.0037	0.6884	27.2338	26.7630
Gambling	0.0642	7.6215	0.0000	0.0001
Other non-foods	0.0167	n.a.	6.6203	5.7486

Source: Author's estimates

Table A1.13. Estimates of model parameters, rural class 3, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.0825	5.2982	727.8125	320.0800
Clothing	0.0304	3.6423	165.8686	75.1620
Housing	0.0218	1.8392	478.2969	198.6800
Health care	0.0017	0.1788	76.0367	62.0760
Personal care	0.0065	2.0995	89.2477	121.0100
Transport	0.0411	2.8268	118.2439	92.9530
Recreation	0.0000	0.0000	9.5846	25.8640
Education	0.0654	8.8070	130.5078	60.8210
Alcoholic beverages	0.0041	0.6137	121.2201	51.5940
Cigarettes	0.0121	2.6597	44.8244	67.3170
Gambling	0.7258	59.3850	0.0000	0.0005
Other non-foods	0.0088	n.a.	24.6165	38.5430

Source: Author's estimates

Table A1.14. Estimates of model parameters, rural class 4, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.2018	12.7390	848.6152	163.7400
Clothing	0.0494	5.5495	170.2242	49.3960
Housing	0.0952	5.9646	588.8873	114.1400
Health care	0.0406	3.3237	103.3069	33.9570
Personal care	0.0187	4.6574	102.9210	63.2540
Transport	0.1879	18.5500	181.9531	73.7820
Recreation	0.0005	1.4763	17.6770	21.1320
Education	0.1548	14.8560	109.7256	19.3550
Alcoholic beverages	0.0170	3.0149	167.2108	44.2310
Cigarettes	0.0270	6.0315	55.5860	47.0600
Gambling	0.1547	17.3600	0.0000	0.0001
Other non-foods	0.0523	n.a.	84.8794	37.5000

Source: Author's estimates

Table A1.15. Estimates of model parameters, rural class 5, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.0545	7.9506	1114.7585	93.6260
Clothing	0.0200	4.9393	352.5757	35.1940
Housing	0.1740	12.8940	678.3941	29.9850
Health care	0.0230	4.6469	133.3332	12.0570
Personal care	0.0072	6.3169	135.2104	51.5560
Transport	0.6518	37.5780	0.0000	0.0004
Recreation	0.0049	2.3664	50.8027	13.3440
Education	0.0121	3.0713	264.0950	28.3610
Alcoholic beverages	0.0166	4.8145	243.6409	24.1530
Cigarettes	0.0041	2.1404	102.6777	38.4420
Gambling	0.0219	7.3446	56.3115	14.8150
Other non-foods	0.0100	n.a.	169.2861	22.1280

Source: Author's estimates

Table A1.16. Estimates of model parameters, age 0–8 years, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.3001	67.6480	554.0845	164.8200
Clothing	0.0301	12.6930	61.6084	34.5410
Housing	0.2387	47.6990	313.9984	73.4020
Health care	0.1084	44.3340	37.6112	25.1800
Personal care	0.0324	45.5690	58.0888	109.1100
Transport	0.0842	15.2440	36.8619	12.9460
Recreation	0.0100	12.5430	0.2037	0.3653
Education	0.0964	41.6900	76.3526	39.7400
Alcoholic beverages	0.0000	0.0000	52.2382	35.0170
Cigarettes	0.0118	15.1410	15.9528	9.5883
Gambling	0.0321	21.1870	15.6428	22.2270
Other non-foods	0.0559	n.a.	20.3563	26.8030

Source: Author's estimates

Table A1.17. Estimates of model parameters, age 8+–18 years, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.2263	67.4440	554.0845	164.8200
Clothing	0.0243	11.9390	61.6084	34.5410
Housing	0.1604	43.8410	313.9984	73.4020
Health care	0.0170	9.4129	37.6112	25.1800
Personal care	0.0206	41.5340	58.0888	109.1100
Transport	0.3040	54.8780	36.8619	12.9460
Recreation	0.0000	0.0000	0.2037	0.3653
Education	0.1549	67.5600	76.3526	39.7400
Alcoholic beverages	0.0289	19.6720	52.2382	35.0170
Cigarettes	0.0181	26.9190	15.2178	10.7030
Gambling	0.0456	26.5890	15.6428	22.2270
Other non-foods	–0.0002	n.a.	20.3563	26.8030

Source: Author's estimates

Table A1.18. Estimates of model parameters, age 18+–30 years, Thailand

Good *I*	β_i		γ_i	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.2590	138.4300	554.0845	164.8200
Clothing	0.0662	67.2320	61.6084	34.5410
Housing	0.1687	87.9460	313.9984	73.4020
Health care	0.0150	19.3140	37.6112	25.1800
Personal care	0.0232	80.2090	58.0888	109.1100
Transport	0.2973	103.4800	36.8619	12.9460
Recreation	0.0198	33.5650	0.2037	0.3653
Education	0.0783	68.2360	76.3526	39.7400
Alcoholic beverages	0.0423	54.9230	52.2382	35.0170
Cigarettes	0.0238	56.4970	49.5151	34.8630
Gambling	0.0046	5.1711	15.6428	22.2270
Other non-foods	0.0017	n.a.	20.3563	26.8030

Source: Author's estimates

Table A1.19. Estimates of model parameters, age 30+–40 years, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.1729	106.1900	554.0845	164.8200
Clothing	0.0574	55.7670	61.6084	34.5410
Housing	0.1492	72.2110	313.9984	73.4020
Health care	0.0068	9.3005	37.6112	25.1800
Personal care	0.0185	58.4360	58.0888	109.1100
Transport	0.4912	162.1600	36.8619	12.9460
Recreation	0.0111	22.8050	0.2037	0.3653
Education	0.0000	0.0000	76.3526	39.7400
Alcoholic beverages	0.0405	57.9200	52.2382	35.0170
Cigarettes	0.0286	69.6210	51.4275	31.2640
Gambling	0.0140	15.2800	15.6428	22.2270
Other non-foods	0.0100	n.a.	20.3563	26.8030

Source: Author's estimates

Table A1.20. Estimates of model parameters, age 40+–50 years, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.1552	50.7610	554.0845	164.8200
Clothing	0.0172	11.7520	61.6084	34.5410
Housing	0.2596	80.8900	313.9984	73.4020
Health care	0.0346	26.0100	37.6112	25.1800
Personal care	0.0117	31.3440	58.0888	109.1100
Transport	0.3384	72.0240	36.8619	12.9460
Recreation	0.0213	27.8380	0.2037	0.3653
Education	0.0704	41.9340	76.3526	39.7400
Alcoholic beverages	0.0092	7.6832	52.2382	35.0170
Cigarettes	0.0146	28.0190	27.3017	10.8260
Gambling	0.0425	28.3220	15.6428	22.2270
Other non-foods	0.0254	n.a.	20.3563	26.8030

Source: Author's estimates

Table A1.21. Estimates of model parameters, age 50+–60 years, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.1278	50.4320	554.0845	164.8200
Clothing	0.0000	0.0000	61.6084	34.5410
Housing	0.1980	55.0750	313.9984	73.4020
Health care	0.0300	17.8880	37.6112	25.1800
Personal care	0.0076	16.2560	58.0888	109.1100
Transport	0.4038	84.4340	36.8619	12.9460
Recreation	0.0698	78.4140	0.2037	0.3653
Education	0.0711	41.0690	76.3526	39.7400
Alcoholic beverages	0.0253	23.8300	52.2382	35.0170
Cigarettes	0.0171	26.4980	26.2749	13.6880
Gambling	0.0250	15.7470	15.6428	22.2270
Other non-foods	0.0244	NA	20.3563	26.8030

Source: Author's estimates

Table A1.22. Estimates of model parameters, age over 60 years, Thailand

Good *I*	β_i		γ_I	
	Mean	*t* statistic	Mean	*t* statistic
Food	0.1638	50.3060	554.0845	164.8200
Clothing	0.1513	67.8390	61.6084	34.5410
Housing	0.3718	101.2400	313.9984	73.4020
Health care	0.1815	84.4890	37.6112	25.1800
Personal care	0.0187	33.7380	58.0888	109.1100
Transport	0.0000	0.0000	36.8619	12.9460
Recreation	0.0000	0.0000	0.2037	0.3653
Education	0.0191	10.7220	76.3526	39.7400
Alcoholic beverages	0.0309	20.9300	52.2382	35.0170
Cigarettes	0.0000	0.0000	23.1650	15.5090
Gambling	0.0000	0.0000	15.6428	22.2270
Other non-foods	0.0628	n.a.	20.3563	26.8030

Appendix 2. Questionnaire

Location_____*Amphoe*_____Province_____

Interviewer_____Date of interview_____

Section 1: general interviewee data

1. Sex ( ) Male ( ) Female

2. Age _____ years old

3. Education level

( ) Under grade 4 ( ) Grade 4

( ) Grade 6 ( ) Secondary school

( ) High school or diploma

( ) Bachelors degree ( ) Masters degree or higher

4. Occupation

( ) Unemployed/housekeeper ( ) Student

( ) Government official ( ) Private company employee

( ) Freelance ( ) Own business

Do you have any income from working?

( ) No

( ) Yes. Please specify _____ baht/month or _____ baht/day

5. Number of persons in your household _____ persons including

Adult (age over 18) ___ persons that are ___male(s) and ___ female(s)

Children (age under 18) ___ persons that are ___ male(s) and ___ female(s)

Total ___/___smokers that are ___/___ male(s) and ___/___ female(s)

6. Income of household _____ baht/month

7. Do you have any persistent disease conditions?

( ) No. ( ) Yes. Please specify _____

If yes, do you have any health care costs for those diseases?

( ) No. ( ) Yes. Please specify _____ baht/month

8. Your home town _____

If you immigrated from another *amphoe*, please specify the reasons why you immigrated to this *amphoe*?

_____.

Section 2: smoking data

9. When did you first smoke? ___ years old

10. Why did you smoke? Please specify _____

11. How did you get your first cigarette?

( ) bought ( ) friend ( ) parents

( ) other relative ( ) stole. From whom? _____

12. Quantity of smoking in the first 3 months _____ stick(s)/day

13. Source of smoking expenditure in the first 3 months of smoking

( ) All bought by yourself ( ) Most bought by yourself

( ) Most bought by others ( ) All bought by others

14. Which type of cigarette did you smoke first?

( ) Thai cigarette ( ) Legally imported cigarette ( ) Illegally imported cigarette

15. Have you continued to smoke the same type of cigarette as the one you first smoked?

( ) No, because _____

( ) Yes, because _____

16. Now you usually smoke ___ stick(s)/day

17. Now, you get the cigarettes from

( ) buying ___ cigarette(s)/day that cost ___ baht/day

( ) friends ___ cigarette(s)/day

( ) parents ___ cigarette(s)/day

18. In the case of buying by yourself, have you ever seen the warning label on the packet?

( ) No

( ) Yes. Please specify the warning that you can remember best

_____

19. Do you have any brand of cigarette that you usually smoke?

( ) No

( ) Yes. Please specify _____.

20. Most cigarette types that you have smoked are

( ) Thai cigarettes ( ) legally imported cigarettes

( ) Contraband cigarettes

21. Where do you usually buy cigarettes?

( ) from cigarette stands ( ) from convenience/grocery stores

( ) from supermarkets ( ) Others

22. Have you ever quit smoking?

( ) No

( ) Yes. About ___ month(s) and smoked again because _____.

Now, do you think that you want to quit smoking?

( ) No, because _____.

( ) Yes, because _____.

23. The price of cigarettes that you usually smoke is ___ baht/packet

24. What do you think is the reason behind the government policy to increase cigarette prices?

( ) to raise more tax revenue ( ) to reduce the number of smokers

( ) to increase the profits of cigarette companies ( ) high cost of production

( ) Other. Please specify _____

25. Do you know when the most recent cigarette excise tax increase was?

( ) No (answer question 28)

( ) Yes. Please specify _____

26. Was it a good idea to increase in cigarette excise tax last time?

( ) No, because _____

( ) Yes, because _____

27. After the increase in cigarette excise tax at that time, how did it affect your smoking behaviour?

( ) decreased smoking by about ___ cigarette(s)/day

( ) smoking the same amount that smoked before the tax increase

( ) increased smoking by about ___ cigarette(s)/day

28. How should the government use the revenue from cigarette taxes?

( ) to cure the illnesses caused by smoking ( ) to campaign against smoking

( ) to develop the country ( ) for educational activities.

( ) for public health activities.

29. If there is a 10% increase in cigarette prices, how will it affect your smoking behaviour?

( ) decrease smoking about ___ cigarette(s)/day

( ) increase smoking about ___ cigarette(s)/day

( ) smoking the same amount as before the tax increase

( ) quit smoking

30. If there were a 10% increase in cigarette prices from now, would you switch to another cigarette type?

( ) No (answer question 31) ( ) Yes

If yes, you will change to

( ) Thai cigarettes. Please specify the brand name _____

( ) Legally imported cigarettes. Please specify the brand name _____

( ) Contraband cigarettes. Please specify the brand name _____

( ) Other. Please specify the type

Section 3: health protection for non smokers

31. Have you ever seen any cigarette advertising?

( ) No (answer question 32) ( ) Yes

If yes, please specify the advertisement source _____

Please specify the brand name of the cigarettes _____

Please specify the details of that advertisement _____

32. During the past year, have you ever smoked in the following places? (please V if you have ever smoked in those places and X if you have never smoked in those places)

Place	**Have/have not**
Buses (both with and without air conditioners) and air-conditioned bus terminal buildings.	
Taxis (both with and without air conditioners) including school bus	
Trains (both with and without air conditioner)	
Boats including boats with air conditioners	
Domestic aeroplanes	
Elevators	
National museums, art museums, libraries, exhibition halls or indoor	

stadiums that have air conditioners

Nursery schools, schools or university buildings

Restaurants, cafeterias or shopping centres with air conditioners

Public areas of hospitals, government offices or banks

For interviewer

1. Can I take a look at your cigarette packet?

( ) No (end of the interview) ( ) Yes

2. Type of cigarette

( ) Thai cigarettes (end of the interview) ( ) Imported cigarettes

Specify the brand name of imported cigarette _____

4. Does it have a warning label?

( ) No (end of the interview) ( ) Yes.

If yes, please specify the language of the warning

( ) Thai. Please specify _____

( ) English. Please specify _____

( ) Other language

Appendix 3. Detailed information for smoking-related diseases

Malignant neoplasm group consists of

Lips, oral cavity and pharynx cancer: 80% of them caused by smoking.

Oesophagal cancer: 79% of it caused by smoking.

Pancreatic cancer: 28% of it caused by smoking.

Laryngeal cancer: 79% of it caused by smoking.

Trachea, bronchus, lung cancers: 86% of them caused by smoking.

Cervix uteri cancer: 31% of it caused by smoking.

Urinary bladder cancer: 42% of it caused by smoking.

Kidney and other unspecified urinary organ cancers: 35% of them caused by smoking.

Stomach cancer.

Cardiovascular disease group consists of

Rheumatic heart disease: 17% of it caused by smoking.

Hypertensive disease: 19% of it caused by smoking.

Ischaemic heart disease: 24% of it caused by smoking.

Other heart disease: 20% of it caused by smoking.

Cerebrovascular disease: 19% of it caused by smoking.

Atherosclerosis: 41% of it caused by smoking.

Aortic aneurysm: 5% of it caused by smoking.

Other arterial disease: 43% of it caused by smoking.

Respiratory disease

Respiratory tuberculosis: 29% of it caused by smoking.

Pneumonia: 28% of it caused by smoking.

Chronic bronchitis and emphysema: 82% of them caused by smoking.

Asthma: 25% of it caused by smoking.

Chronic obstructive pulmonary disease: 82% of it caused by smoking.

Appendix 4. Detailed information for health care cost estimating principles

The human capital principle assumes that investments in health, education and training build "human capital" for which there are returns earned through incomes that are higher than they would be at lower levels of education, training or poorer health. The value of each individual is estimated on the basis of their future productive ability. It is usually calculated as the present value of the expected income that each individual can earn in a working life. This approach divides the social cost of illness in three ways:

- *Forgone earnings*: the income or the output that would have been generated if the patients had not stopped working before usual retirement age as a result of diseases

- *Medical expenditure*: the health service cost that each patient and the society (government) has to pay for treatment. Other associated expenditures (such as transport to get health care, foregone earnings of family members to care for the patient) are sometimes (and should be) added as well.

- *Psychological cost*: the depressive cost of the illness of patients and their families. This is difficult to estimate in terms of money and is usually ignored in this approach.

This approach has both advantages and disadvantages. The major advantage of this approach is that the values can be easily estimated in terms of money. The disadvantages are that this approach does not take into account the psychological cost and other non-monetary costs as costs of illness. Moreover, a discount rate has to be assumed in order to calculate the present value of future income and cost.

The human capital approach to the economic cost of diseases can take two forms: the prevalence approach and the incidence approach.

The prevalence approach is a static approach that studies a group at a point in time. With this approach, it is possible to compare the health conditions of a sampling group at a specific time, with a different time or different group. Health care cost assessment using the prevalence approach calculates both direct and indirect health care costs in a static manner, for the current period. It assesses the mortality cost at death. The advantages of this approach are a shorter study period and a low study cost. However, the disadvantage of this approach is that people with chronic diseases haw health care costs that typically persist beyond the study period. Studies that consider multiple periods need to guard against double counting.

The incidence approach, unlike the prevalence approach, is a dynamic approach that studies the sampling group over a longer period, such as one year. This approach seeks to measure the number of new lung cancer patients in one year. Health care cost assessment using the incidence approach calculates both direct and indirect health care costs from the time that a disease first manifests itself until the patient recovers or dies. The longer study period, higher study cost and complexity are disadvantages of this approach.

The willingness to pay principle is the approach that estimates how much an individual would be willing to pay to reduce the risk of illness or death. In this approach, the value of a human life is measured on the basis of the amount of money that individuals say they would be will pay to reduce the risk of illness or death. There are a number of problems with this approach, including the ability of people to assess realistically how an illness would impact their life. This approach requires care in the way that questions are framed and asked, the methodology of estimation, size and quality of samples, questionnaire and data analysis.

The most important advantage of the willingness to pay approach is that while the human capital approach can be used to estimate only medical cost and forgone earnings, this approach can be used to estimate not only medical cost and forgone earnings but also psychological costs. The weak point of this approach is that data usually come from hypothetical situations not reality. Thus, complicated questions or questions that are too short could confuse interviewees, and answers may be biased. Moreover, the willingness to pay differs for, and depends on, the income situation of each person. Thus, any difficulty individuals may have in predicting their loss may lead to biased results.

Appendix 5. Detailed information for estimating economic loss from early death of lung cancer patients: Wattana's study (1986)

Table 0.23. Number of lung cancer deaths and economic loss from early death patients: 1985

Age group	Number of lung cancer deaths (persons)	Time lost[1] (years)	Economic loss[2] (baht)
25–29	10	454.12	3 382 171
30–34	14	539.42	4 736 598
35–39	31	1111.43	10596 019
40–44	49	1555.69	16 649 217
45–49	92	2875.79	30 755 118
50–54	125	2967.15	40 009 497
55–59	165	3047.70	50 120 098
60–64	160	2643.14	45 352 587
Total	**646**	**15 454.44**	**201 692 305**

Source: 1. Calculated by multiplying the number of lung cancer death by average age expectancy by age group.
2. Calculated by multiplying time loss by average income per year and using 10% as a discount rate.

Appendix 6. Detailed information on relative risks in China

Table A6.1. Relative risks for major diseases in China (men aged 35 and above)

Cause of death (ICD-9)	RR (SE)		All China	
	Urban	Rural	RR(SE)	PAR(%)
Lung cancer (162)	2.98	2.57	2.72	52.3
Oesophageal (150)	2.06	1.57	1.61	27.9
Stomach (151)	1.36	1.35	1.35	18.1
Liver cancer (155)	1.39	1.41	1.40	20.2
All cancer (140–208)	1.62	1.48	1.51	24.6
COPD	1.57	1.41	1.43	22.6
TB (011, 012, 018)	1.42	1.17	1.20	11.3
Stroke (430–9)	1.18	1.17	1.17	10.0
IHD (410–4)	1.28	1.28	1.28	14.7
All deaths	1.29	1.22	1.23	13.0

Source: Liu B, Peto R et al., 1998. *British medical journal*, 317(7170):1411–22.

TableA6.2. Relative risks for major diseases in China (women aged 35 and above)

Cause of death (ICD-9)	RR (SE)		All China	
	Urban	Rural	RR(SE)	PAR(%)
Lung cancer (162)	3.24	1.98	2.64	19.4
Oesophageal (150)	1.65	1.28	1.34	2.8
Stomach (151)	1.30	1.13	1.17	1.7
Liver cancer (155)	1.49	1.12	1.22	2.4
All cancer (140–208)	1.67	1.21	1.37	4.0
COPD	2.51	1.50	1.72	9.3
TB (011, 012, 018)	1.56	1.25	1.29	2.8
Stroke (430–9)	1.11	0.88	0.97	–
IHD (410–4)	1.37	1.22	1.30	4.1
All deaths	1.40	1.14	1.23	2.7

Source: Liu B, Peto R et al., 1998. *British medical journal*, 317(7170):1411–22.

Appendix 7. Estimated number of lung cancer patients in Thailand, 1999

Table A7.1. The number of lung cancer patients, Thailand, 1999

Age	Prevalence of lung cancer per 100 000		Population structure in 1999 (persons)		Lung cancer patients in 1999 (persons)		
	Male	Female	Male	Female	Total	Female	Male
0–4	–	–	2 654 330	2 608 074	–	–	–
5–9	–	–	2 717 478	2 678 370	–	–	–
10–14	–	–	2 717 478	2 718 438	–	–	–
15–19	–	–	2 892 981	2 816 339	–	–	–
20–24	0.6	0.5	2 921 187	2 830 188	31.68	14.151	17.527
25–29	1.5	0.9	2 826 281	2 723 500	71.91	24.512	47.394
30–34	2.9	1	2 614 588	2 569 573	101.52	25.7	75.823
35–39	7.5	3.1	2 362 235	2 397 131	191.48	74.311	117.168
40–44	12.7	6.9	2 127 974	2 162 204	319.45	149.192	170.253
45–49	23.2	13.3	1 758 196	1 830 414	651.35	243.445	407.901
50–54	45.1	23.9	1 339 268	1 416 708	942.60	338.593	604.009
55–59	72.2	36.1	1 114 202	1 218 434	1244.31	439.855	804.454
60–64	137.7	54.1	948 209	1 058 811	1878.50	572.817	1305.684
65–69	193.3	64.8	693 704	804 105	1861.99	521.06	1340.93
70–74	195.9	88.1	438 617	513 943	1312.04	452.784	859.251
75 +	156.7	49.1	439 546	596 694	981.75	292.977	688.769
All	849.3	341.8	30 620 906	30 943 074	9588.56	3149.40	6439.16

Source: Prevalence of lung cancer of Thailand in 1993 is from Thailand Cancer Institution.
Population structure is from Department of Local Administration.

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The Economics of Tobacco Control sub-series is produced jointly with the Tobacco Free Initiative of the World Health Organization. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and should not be attributed in any manner to the World Health Organization or to the World Bank, their affiliated organizations or members of their Executive Boards or the countries they represent.

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ISBN 1-932126-45-7

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