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DEMAND ANALYSIS OF TOBACCO CONSUMPTION IN MALAYSIA

Nabilla A.M. Al-Sadat, Ph.D.

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Principal Investigator

Nabilla A.M. Al-Sadat

Department of Social and Preventive Medicine, University of Malaya, Malaysia

Research team members

Hana Ross (RTI); Zarihah Zain (MOH); Haniza M A (NIH);
Syed Al-Junid (UKM); Mohamed Izham Mohamed Ibrahim (USM)

Statistical Consultant

Sharifah Latifah Abdul Kadir (UM)

Mentor

Frank Chaloupka (University of Illinois at Chicago)

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Executive summary

Objectives: To estimate the price and income elasticity of cigarette demand as well as the impact of cigarette taxes on cigarette demand and cigarette tax revenue in Malaysia.

Methods: Using published time-series data on cigarette excise tax, cigarette prices, per capita income and tobacco control measures from 1990 through 2004, we estimated the impact of price and income on cigarette demand in Malaysia. The time series error-correction model (ECM) was used and the regression model was subjected to a battery of tests to assure that our model specification is correct.

Results: The long-run and short-run price elasticities of cigarette demand were calculated to be -0.38 and -0.13, respectively. This means a 10% increase in price will result in a 3.8 % reduction in consumption of cigarettes in Malaysia in the long-run if tobacco tax increase is constantly made annually. Income is positively related to cigarette consumption: 10% increase in real income increases cigarette consumption by 10%. A simulation model reveals that an increase in cigarette excise tax from the current level of RM 1.60 (US$ 0.42) per pack to RM 2.00 (US$ 0.53) per pack in 2006 would increase the average cigarette price by 5.9% and reduce the consumption in that year by 2.25%, or by 445,737,729 sticks of cigarettes. This reduced consumption would translate to between 174 and 179 fewer tobacco related deaths per year among the adult population. At the same time, the government would collect additional RM 437 million (US$ 116 million) in cigarette excise taxes, or 23% more compared to what it will otherwise collect in 2005.

Conclusion: Demand analysis shows that taxation is an effective method of reducing consumption while increasing revenue for the government in Malaysia.

Introduction

Globally, tobacco use has reached epidemic proportions. First global status report published by the World Health Organization (WHO, 1996) in 1996 showed that there had been an increase in prevalence of tobacco use in the world from 1970-1992. While the prevalence of smoking has been falling in the high-income countries over the past two decades, cigarettes have attracted a rising number of consumers in low-income and middle-income countries (Gajalakshmi et al., 2000). Malaysia is not an exception to this trend (NHMS, 1986 and 1996).

Tobacco is the fourth most common risk factor for disease worldwide. Smoking causes many chronic disease such as lung cancer, other cancers, as well as chronic respiratory and cardiovascular diseases. Currently, tobacco accounts for about 4 million deaths per year worldwide, about one in ten of all adult deaths (Gajalakshmi et al., 2000). Tobacco is among the leading causes of death in Malaysia where smoking accounts for 25% of all deaths (Chua, 1996).

The economic costs of tobacco are equally devastating. In addition to the high public health costs of treating tobacco related diseases, tobacco kills people at the height of their productivity, depriving families of breadwinners and nations of a healthy workforce. Tobacco users are also less productive when they are alive due to the increased sickness. The world tobacco market was estimated to produce an annual global loss of $200 billion, with about one-third of the loss occurring in developing countries (RITC, 2003). Moreover, tobacco and poverty are inextricably linked. Many studies have shown that in the poorest households in some low- income countries, as much as 10% of household expenditure is on tobacco (Efroymson et al., 2001). This means that these households have less money to spend on basic items such as food, education and health care. Tobacco, therefore, can lead to malnutrition, premature death and can also exacerbate poverty.

The majority of current smokers became addicted during their teenage years. Youth typically underestimate the risk of addiction and the health consequences of smoking (Kessler, 1995). In addition, the average age of smoking uptake seems to be falling, particularly in developing countries where cigarettes became a symbol of modern lifestyle (Gajalakshmi et al., 2000; Efroymson et al., 2001). Youth smoking is an acute problem in Malaysia where as much as 60% of young people from certain socio-economic background smoke (Zulkifli, 1997).

Government interventions can reduce the negative consequences of tobacco use. One of the most successful strategies successfully applied by many countries in the world is cigarette tax increase. A growing body of research evidence shows that demand for tobacco, while inelastic, is nevertheless affected by its price. (Salojee,1998, Ranson, 1999). Young and the poor are particularly responsive to and are affected by price increases (Chaloupka, 1997).

Studies found that 10% increase in cigarette prices can reduce cigarette consumption in the short term by 4% in high-income countries, and by 8% in low and middle-income countries (Prabhat Jha et al, 1999). Even though most countries fall into this range of responsiveness, some countries or regions may exhibit different price sensitivity due to their cultural or social background. In addition, having a country-specific estimate of responsiveness to cigarette tax is useful for planning purposes since the impact of a tax increase on tax collection can be predicted with higher degree of precision. This study is the first to estimate the responsiveness of Malaysians to higher cigarette prices. It demonstrates how cigarette excise tax policy can be used to curb tobacco epidemic in Malaysia, predicts the impact of higher cigarette taxes on future mortality and estimates the impact of this policy on the state tax revenue.

Background and literature review

Tobacco industry in Malaysia

Malaysia is a developing nation facing the prospect of a rapidly rising social costs of tobacco. It is recognized as one of the more mature cigarette markets in South East Asia with sales of approximately 20 billion sticks per annum. With a 70% market share, British American Tobacco (BAT) is the undisputed leading tobacco company in Malaysia. Other major players are Phillip Morris International (PMI) and Japanese Tobacco International (JTI). Best-selling brands include international trademarks such as Dunhill, Marlboro, Salem and Benson & Hedges. Although the tobacco industry tends to fare better than other sectors during economic downturns, the global slowdown combined with progressive tax increases has caused the Malaysian cigarette market to contract by around 10% in 2001 from the previous year.[1]

The tobacco industry was unregulated and unorganized in its early years but has developed into a significant industry heavily regulated and protected by the National Tobacco Board (NTB) which was established in 1973. It is part of the Ministry of Primary Industries and it controls licensing while providing assistance to tobacco farmers such as counseling and advice, plus R&D for the improvement of the quality of tobacco produced. According to the 2002 estimates of this Ministry, 16,000 hectares of land were harvested for tobacco in 2001. In early 2005, a RM [2] 10.5 million (US$ 2.78 million) remuneration package in interest free loans and grants was awarded to tobacco growers in Kelantan. (The Star, 18-03-2005)

Ministry of Primary Industries (2002) reported that 8,460 tons of non-manufactured tobacco was produced in Malaysia in 2001, about 0.2% of the world total production. Kelantan, a poor northern state governed by a political party opposed to the ruling federal government, had 70% of the production and 75% of the farmers or 15,300 families involved in tobacco farming. Malaysia's cigarette production increased from 17.8 billion sticks in 2000 to 19.3 billion sticks in 2001, accounting for about 0.3% of world production. Malaysia imported 1.5 billion sticks (0.2% of global imports) and exported 2.1 billion sticks (0.2% of global exports) in the same year. Import and excise duties on tobacco products earned the government RM 1.05 billion (US$ 278 million) in 2001 as compared to only RM 372 million (US$ 98 million) in 1990 (Ministry of Primary Industries, 2002).

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[1] www.tobacco.org/articles/country/malaysia

[2] RM is a symbol for Malaysian currency Ringgit. 1 US Dollar = 3.78 Ringgit (2005)

Tobacco consumption

Smoking prevalence in Malaysia is increasing. In 1996, 24.8% out of 32,991 participants (18 years of age and older) in a National Health and Morbidity Survey identified themselves as smokers (NHMS, 1996). The same survey carried out in 1986, but looking at population 15 years of age and older, showed prevalence rate of 21.5 % (NHMS, 1986).

Smoking is much more prevalent amongst men than amongst women. Male and female smoking prevalence in 1996 were 49.2% and 3.5%, respectively. Although the national surveys showed a reduction in female smoking rates from 4% in 1986 to 3.5% in 1996, World Tobacco Market File (2000) estimated that there was in fact a rise in the number of female smokers (from 4% in 1985 to 5% in 1995). This source also predicted that smoking amongst Malaysian females would rise further in the coming years.

Youth smoking is an acute problem in Malaysia. The Ministry of Health estimates that the smoking rates amongst adolescent boys and girls, aged 12 to 19, are 30.7% and 4.8%, respectively (Rosemawathi, 2000). However, there are studies which have found smoking rates amongst Malaysian youth ranging from 30% to 60% (Zulkifli, 1997).

2005 data show that a pack of 20 cigarettes (Benson & Hedges) in Malaysia costs 7% of average daily income of employee in manufacturing sector [3]. Thus, the addiction to cigarettes diverts scarce resources away from many basic family needs such as education and nutrition. This leaves families with a smoker vulnerable to malnutrition which causes further health expenditure.

Tobacco control policy

Malaysia enacted the Control of Tobacco Products Regulations (CTPR) in 1993, under the Food Act of 1983. The regulations were officially implemented in May 1994. Although they have been amended a number of times, these regulations remain the primary legislative mechanism used to control tobacco in Malaysia.

CTPR addresses the following areas:

1. Smoking restrictions in public places
2. Tobacco advertising and promotions

[3] Authors' calculation based on the average price of Benson & Hedges (20 sticks) at RM 6.44/pack, the average salaries and wages per employee in manufacturing sector at RM 1,697/month as reported in Economic and Financial Data for Malaysia. Bank Negara Malaysia. 16 September 2005. http://www.bnm.gov.my/index.php?ch=111

3. Ceilings for nicotine and tar levels
4. Ban on cigarette vending machines
5. Ban on smoking for minors
6. Specifications of tobacco product packaging sizes

As of 2004, smoking is banned in government offices, in schools, amusement centers, shopping malls, theatres, hospitals and clinics, air conditioned restaurants (75% of floor area must be designated as non-smoking), religious institutions and public transport. Smoking is also banned on all domestic airline flights and flights to Singapore.

In 1995, the National Fatwa Council announced an Islamic religious decree that çSmoking is Haram (forbidden)é. Islam is the religion of the majority of Malaysian population and this action had stirred public debate in the newspapers for several months. However, Islamic authorities have not attempted to implement the Fatwa and continue to focus their activities mostly on educating the public about the harm of smoking.

Malaysian government totally bans all forms of tobacco advertising including at points of sale. However, this law is not strictly enforced and cigarette manufacturers manage to work around these regulations by using various brand stretching techniques such as advertising on clothing, using popular brand names for names of travel agencies and restaurants, etc.

The Ministry of Health has been delivering anti-smoking messages since early 1970ûs, but most of these educational campaigns were small and uncoordinated with other tobacco control activities until early 1990ûs. Since then the Ministry of Health began to cooperate with schools and non- governmental organizations such as the Malaysian Medical Association and consumer associations on these campaigns. Articles on smoking and health now appear regularly in the media. Smoking cessation programs are organized by the Action on Smoking and Health (ASH Malaysia), academic institution, religious groups and consumer associations. Information on the dangers of passive smoking to mothers is distributed through pamphlets, posters as well as in health talks. In 2004, the Prime Minister launched a 5-year multi-million dollar campaign known as “Tak Nak” or “Say No”, whose main target are Malaysian youths and is centered on mass media campaign. This campaign has received many unfavourable comments from the public as well as the policy makers. It is yet to be studied whether this campaign has been effective in addressing the issue of smoking among the Malaysian youths.

Malaysia does not yet have a clear tobacco tax policy. There have been several cigarette tax increases in the past decade, but their main purpose was to raise government revenue. Some aspects of the tobacco tax policy are driven by economic interests of tobacco farmers and cigarette producers.

Despite these concerted efforts to curb smoking, tobacco control policies and their implementation still lag behind neighboring countries such as Singapore and Thailand. There is a lack of effective coordination among the agencies in charge of tobacco control, which leaves clear violations of CTPR often unpunished. Malaysia signed the Framework Convention on Tobacco Control (FCTC) in 23 September 2003 and eventually ratified FCTC on 16 September 2005. This officially commits the Malaysian government to develop, legislate and implement its own national tobacco control laws based on the FCTC provisions. This would provide the public health community in Malaysia with a powerful instrument to demand enforcement of the existing tobacco control policies and adoption of new policies aiming at curbing tobacco epidemic in the country.

Cigarette tax in Malaysia

Cigarette tax is collected from cigarette manufacturers or cigarette importers. Until 2004, taxes were levied according to their weight. The tax regime changed in 2005 when Malaysia adopted specific excise tax per stick. This has several advantages over the previous regime. It is easier to administer since it requires only counting the sticks without weighting them. Specific tax is also harder to avoid by making cigarettes lighter as was possible under the previous tax regime. The only disadvantage of the new tax is that its value can be eroded by inflation, which was also the case of weight based tax. This flaw can be addressed by indexing the tax for inflation, which the new tax regulation had failed to accomplish.

There are two different tax structures for domestic and imported cigarettes. As of October 2005, locally produced cigarettes sold in Malaysia are levied the excise tax of RM 0.08 (US$ 0.02) per stick. There is no excise tax on imported cigarettes, but they are subjected to an import tax. For cigarettes imported from non-ASEAN [4] countries, this tax is RM 0.20 (US$ 0.05) per stick in October 2005. Cigarettes imported from ASEAN countries are levied RM 0.10 (US$ 0.03) import tax per stick. Both domestic and imported cigarettes are subjected to 25% sales tax added on top of the factory value with excise tax (domestic) or on top of custom declared value (imported). The excise tax on locally produced cigarettes, which represent over 95% of the market, represents only about 25% of retail price. This is far below the tax level in some of Malaysia's neighboring countries. In Thailand, for example, the cigarette excise tax represents 75% of retail price.

Imported tobacco leaves are exempted from taxes for licensed manufacturers and locally produced cigarettes have the same tax treatment

[4] Association of Southeast Asian Nations (ASEAN)

Table 1: Import, Excise and Sales Tax 1990 - 2005

Year	Import tax (non ASEAN countries) RM/KG or RM/stick	Import tax (ASEAN countries) RM/KG or RM/stick	Excise tax (local cigs) RM/KG or RM/stick	Sales tax %
1990	85	85	13	15
1991	135	135	14	15
1992-1997	162	162	29	15
1998-2000	180	180	40	15
2001-2002	216	216	48	25
2003	259	108	58	25
2004	200	100	58	25
2005*	0.20	0.10	0.08	25

* Specific tax per stick was introduced

independent of whether they are made from domestic or imported material. Exported cigarettes and tobacco leaves are not taxed. These policies are aimed to boost manufacturing of finished product and to make Malaysia a hub of cigarette manufacturing for export to ASEAN countries and Asia (Ministry of Primary Industries Malaysia, 2000). Relatively high import duties on tobacco products also help to protect domestic producers from foreign competition.

Malaysia had several cigarette tax increases from 1990 to 2003 (Table 1). All of them applied to both domestic and imported cigarettes. The most noticeable among the 1991, 1992, 1998, 2000, 2001 and 2003 tax increases were the 100% increase of excise tax in 1992 and the 40% increase in excise tax in 1998. It is important to realize that these increases started from a very low excise tax rate. Therefore, the per unit tax increase in monetary units was much smaller. For example, the 100% excise tax increase in 1992 resulted only in 17% increase in real cigarette prices. The tobacco sales tax was increased from 15% to 25% in October 2000.

As a member of the ASEAN Free Trade Agreement (AFTA) and the World Trade Organizations (WTO), Malaysia continues to reduce its import barriers, particularly tariffs. The tariff reduction on cigarettes imported from ASEAN countries began in 2003. In 2005, the tariff rate on these cigarettes was half of the tariff rate on cigarettes imported from non-ASEAN countries. According to the schedule, the tariff on AFTA member imports will be almost eliminated by 2010.

Since 1994, Malaysian government has stepped up its effort to improve

tax collection from domestic cigarette manufacturers and to prevent internal tax evasion. At the same time, the government began to assess the scale of illegal cigarette smuggling.

Tobacco smuggling is estimated to account for 10% to 18% of the total domestic market, mainly involving kretek cigarettes from Indonesia which sell at half the price of ùwhiteû cigarettes (World Tobacco File, 2000; Merrriman et al. 2000). This costs the Malaysian government from RM 133.6 million (US$ 35.3 million) to RM 263.9 million (US$ 70 million) in lost excise taxes per year. Tobacco industry estimates of smuggling problem are higher. Their study claims that smuggled cigarettes represent 20% of total consumption, about 5,274 million sticks per year (BAT, 2003). This amount of smuggling would translate into RM 421.9 million (US$ 111.6 million) lost of excise tax revenue per year.

In 2003, the government announced new measures aimed to reduce cigarette smuggling. It increased its enforcement effort on the borders and introduced the use of security tags for each pack of locally manufactured cigarettes and banderol (special stickers) affixed to imported cigarettes that indicate tax was paid.

Impact of cigarette taxes on smoking behavior

Cigarette taxation is undoubtedly one of the most effective methods to combat smoking behavior. Higher tobacco taxes, translated into higher real cigarette prices, will lead to a decline in smoking prevalence (by reducing smoking initiation and increasing smoking cessation), reduced cigarette consumption among those who continue to smoke even after the price increase. Research indicates that the price elasticity of demand for cigarettes in high-income countries is, on average, -0.4% among adults (Chaloupka et al, 2000). This means that when prices increase by 10%, total consumption of cigarettes decreases by 4%. An even larger effect can be expected among countries and socio-economic groups with lower levels of income, and among youth (Chaloupka et al, 2000). Particularly for established smokers, the effect of a permanent increase in price will be greater in the long run than in the short-run, because it takes longer for a person addicted to nicotine to change his/her behaviour (Chaloupka, 1991).

The impact of a cigarette tax change will depend on how it translates into the final cigarette prices, on the cigarette prices relative to other goods, the size of the tax change relative to the initial price, the average income of the smoking population, and on the price of a close substitute e.g. price of tobacco used for roll-your-own (RYO) cigarettes. For a cigarette tax to have a sizable effect on smoking rates, it should be sufficiently large and impact final cigarette prices so it will have a significant impact on the consumer

budget. However, the impact of higher cigarette taxes can be reduced if taxes on cigarette substitutes do not follow the same trend, because some cigarette smokers will be motivated to switch to the RYO cigarettes (Paersch, 2003). Empirical evidence shows that higher taxes will reduce cigarette consumption even under the presence of cigarette smuggling (Merriman, 2000).

The relatively low responsiveness of the market to change in cigarette price (i.e. low price elasticity of cigarette demand) implies that a tax increase will lead to higher tax revenue. Research evidence has supported that contention in many countries (Townsend, 1998). A mathematical model of tax revenue and price elasticity (Merriman, 2002) shows that in a country like Malaysia where cigarette tax represent about 30% of the final price, 1% of tax increase will lead to 0.58% to 0.97% revenue increase for price elasticity ranging from -1.4 to -0.1.

There are numerous studies focusing on price elasticity of cigarette demand in developing countries. However, only few low- and middle-income countries have their country specific estimates of price responsiveness of the cigarette market. The lack of data and/or research capacity is often the reason why this information is not available.

A study from South Africa (Van Walbeek, 2000) used time-series data on cigarette consumption (expressed in millions of packs per year), real cigarette prices for the period 1970 to 1998, controlling for real personal disposable income and the population size. The regression equation is estimated using the Engle-Granger (EG) two-step procedure (Engle and Granger, 1987) and a linear functional form. In the first step the author estimates a long-run equation, where the data are in levels. In order to avoid spurious regression, the resulting residuals are tested for stationarity. The second step estimates the error-correction model (ECM), based on the long-run co-integrating relationship (Engle and Granger, 1987). Results indicate that cigarette prices are an important determinant of cigarette consumption and that the price elasticity changed during the 29 years analyzed by this study. The price elasticity decreased significantly during the 1970s and 1980s, due to the decrease in the real price of cigarettes. However, since the early 1990s the price elasticity increased from around -0.4 to its current levels of around -1.0. The study also investigated the impact of excise changes on consumption and total government revenue. The analysis shows that the government can increase its revenues from tobacco taxes by at least an additional R 300 million[5] if the government were to increase the tax to 50% of the retail price. Such tax increase would decrease cigarette consumption by nearly 30%.

A study from Thailand (Isra, 2003) calculated price and income

elasticities of tobacco demand using data from the household socioeconomic survey, 2000 (SES 2000) and various measures of cigarette prices. The study found that these elasticities vary across income groups and between urban and rural areas. As expected, lower income population demonstrated higher price sensitivity to cigarette prices compared to higher income groups. Price responsiveness was lower in the rural areas compared to the urban areas. This may reflect the easiness of substitution towards rustic tobacco, which is higher in the rural areas. The average price elasticity of cigarette demand was -0.39. Average income elasticity of cigarette demand was 0.70. These estimates are similar to estimates for many other middle income countries.

Hu and Mao (2002) estimated price elasticity of the demand for cigarettes in China using published statistics from 1980 through 1997. They found that the price elasticity in China was -0.54 and that 10% increase in cigarette tax per pack (from the current 40% to 50% tax rate), the central government tax revenue would twice exceed total losses in industry revenue, tobacco farmers' income, and local tax revenue. In addition, between 1.44 and 2.16 million lives would be saved by this tax increase.

A study from Indonesia (Marks, 2003) estimates that price elasticity of cigarette demand range between -0.59 and -0.67. The study uses time series macro-level data and applies a simple economic analysis that relates changes in cigarette consumption, income, real cigarette prices and population growth. However, this methodology must assume income elasticity of cigarette demand in order to calculate price elasticity. The author concludes that the level of cigarette taxation in Indonesia (36.6% of retail price) is below the levels that would maximize revenues. He estimates that the revenue maximizing level is about 55% of retail price.

An unpublished study of price elasticity from Vietnam (Eozenou, 2001) used cross sectional household survey data (Vietnam Living Standard Survey 1998) to estimate the price elasticity of cigarette demand. The author follows a methodology developed by Deaton (1997) which applies framework of an Almost Ideal Demand System to analyze households' consumption using a model for the simultaneous choices of quantity and quality. The direct price elasticity for the cigarette demand based on this study is -0.53. The income elasticity of the cigarette demand is +0.34. However, the author recognizes the weakness of their estimates, which did not take substitution towards alternative forms of tobacco consumption into account due to lack of data on other forms of tobacco.

[5] R is a symbol for South African currency Rand. 1 US Dollar = 6.4 South African Rand (2005)

Data from Malaysia indicate that taxes on cigarettes have been effective in reducing tobacco use. According to a statement by the Malaysian Tobacco Company (The New Straits Times, 1999) the Malaysian cigarette market declined by 7.4% for the first six months in 1999, following price increases in the last quarter of 1998. A similar experience was reported when the cigarette excise tax was doubled in 1992. In the following year the value of the market contracted by 4.4% and the sales volume fell even more (World Tobacco File, 2000). However, a more precise estimate of population responsiveness to cigarette prices has not been available in Malaysia.

Study objectives

The goal of this research project is to estimate the impact of tobacco prices and tobacco taxes on cigarette consumption in Malaysia (price elasticity). This estimate is important for policy makers since it demonstrates to what extent a cigarette tax increase reduces consumption of a harmful product, cigarettes, and how this reduced consumption affects government tax revenue.

In addition to price elasticity, our study will also estimate income elasticity of cigarette demand and the impact of higher cigarette taxes on future tobacco related mortality and government revenue.

We hypothesize that higher cigarette taxes passed on to consumers in the form of higher cigarette prices, significantly reduce cigarette consumption in Malaysia. We also expect that higher income will lead to higher demand for cigarettes, all things being equal.

Several countries in the region have already estimated the impact of cigarette tax policy on cigarette consumption. Until now, Malaysia has been lacking this type of information.

We hope that our study will provide sufficient evidence for policy makers in Malaysia to realize the importance of cigarette taxation policy as the most important tool for curbing tobacco epidemic among the population of Malaysia.

Data sources and methodology

Our analysis is based on secondary aggregate time series data from the following sources:

- Department of Statistics
- Department of Customs
- Ministry of Primary Industries
- Ministry of Finance

Data used for this study are summarized in Table 2.

Aggregate data on excise tax and import duties collected by the government from 1990 to 2004 was used to calculate consumption of cigarettes in Malaysia. Using the information on the excise tax and import duty rates per kg, we determined consumption of both domestic and imported cigarettes in kg per year. To convert the weight amount to number of cigarettes, we assumed that each kg of cigarettes is equal to 1100 sticks6. The per capita consumption was calculated by dividing the total consumption (in sticks) by the size of adult population (defined as population 15 years of age and older). This variable served as the dependent variable in our demand model.

Time series data on cigarette prices during the period 1990 - 2004 came from the official government statistics. The Department of Statistics provided tobacco consumer price index (CPI) which represents the costliness of all tobacco products sold in Malaysia taking into account general inflation. The index is based on monthly surveys of prices of various cigarette brands and other tobacco products in randomly selected stores across the country. Price of each cigarette brand is then weighted according to the popularity of the brand based on monthly household expenditure surveys. In addition to the tobacco CPI, we have obtained monthly prices of Benson & Hedges cigarette brand. These prices are collected each month in randomly selected shops all over the country by the Department of Statistics. The prices of Benson & Hedges brand were adjusted for inflation using the general consumer price index (CPI). Benson & Hedges together with Dunhill, Marlboro and Salem was among the four most popular cigarette brands in Malaysia in 2002 (AC Nielsen, 2001).

Our model of cigarette demand controls for the impact of income and population structure on the cigarette consumption. We measure income by real GDP per capita. Given the sex difference in smoking behavior in Malaysia, we included a ratio of male/female population 15 years and older.

[6] We used the same conversion rate as the Department of Customs.

Table 2: Cigarette Consumption, Cigarette Prices and Real Income in Malaysia, 1990 - 2004

Year	Consumption (# sticks/person)	Tobacco CPI	Real Price Benson & Hedges (RM)	Real GDP/capita (RM)
1990	1476	54.76	3.40	8292
1991	1679	57.66	3.42	8504
1992	1034	62.57	3.52	8610
1993	1554	73.33	4.00	8887
1994	1456	77.82	4.11	9110
1995	1549	79.79	4.04	9398
1996	1579	82.05	4.02	9762
1997	1607	83.74	3.97	9977
1998	1179	87.77	3.95	8576
1999	1393	97.31	4.26	8642
2000	1360	100.02	4.31	9000
2001	1175	107.11	4.56	9027
2002	1278	114.70	4.79	9397
2003	1335	117.70	4.87	9895
2004	1402	131.97	5.37	10588
Mean	**1404**	**88.55**	**4.17**	**9178**
(Std)	**(181.57)**	**(22.73)**	**(0.55)**	**(651.01)**

Tobacco control measures other than cigarette tax increase are also important determinants of cigarette consumption. We created a dichotomous indicator capturing introduction of tobacco control policies and other important events such as the launch of anti-tobacco campaign. This indicator is equal to one for 1993, 1995, 1997, 2003 and 2004, zero otherwise. The tobacco control events in those years are described in Table 3 below.

Other possibility to capture tobacco control environment would be to create an index that would have the value of one for 1993 - 1994, value of two for 1995-1996, value of three from 1997 - 2002, etc. Such index would imply a persistent impact of tobacco control measures/events over time. However, this would not be a correct assumption for Malaysia, because tobacco control policies are often not enforced. However, each change in public policy is publicized and debated in the media. Our dichotomous indicator captures the impact of those public discussions.

To estimate the demand for cigarettes, we used the following conventional model and linear functional form:

$$Y_{st} = \alpha + \beta_0 X_{pt} + \beta_1 X_{gt} + \beta_2 X_{rt} + \beta_3 X_{tct} + \varepsilon \quad (1)$$

Where Y_{st} = aggregate consumption of cigarette per capita

X_{pt} = real cigarette price (measured either by tobacco CPI or by real price of Benson & Hedges)

X_{gt} = real GDP per capita

X_{rt} = male to female population ratio

X_{tct} = dichotomous indicator of a TC event

The aggregate time series data were analyzed by STATA statistical software.

We estimated two versions of this model. One version used tobacco CPI as a measure of price, the other version used real price of a specific brand Benson & Hedges. Estimating the two versions of the model allowed us to determine to what extent are our estimates of price elasticity sensitive to different price measures.

The model was subjected to a battery of tests to verify its correct specification. First, we tested whether the model omits any important independent variable. If an important variable is omitted from a model, regression estimates are biased including the

Table 3: Tobacco Control Events, 1990 - 2004

1993	Control of Tobacco Products Regulations 1993 adopted; first of the World No Tobacco Day.
1995	Smoking declared Haram (forbidden by religion).
1997	Control of Tobacco Products Regulations amended to include ban on smoking for minors and to expand smoke-free areas to service counters. Air-conditioned restaurants must have designated 75% of floor area as non-smoking.
2003	Malaysia signed the Framework Convention on Tobacco Control (FCTC); new customs laws to curb illegal tobacco products introduced; launch of 1st anti smoking campaign related to Ramadan; introduction of security marks
2004	Launch of national antismoking campaign; Control of Tobacco Products Regulations amended to include total ban on all forms tobacco advertising including at points of sale; expansion of smoke free areas to include religious institutions

standard errors of the coefficients and their corresponding t-values. Our Ramsey regression specification error test determined that our model does not suffer from an omitted variable bias.

Since our model describes the performance of the whole economy, there is a chance that the market clearance price is determined by the interaction of both demand and supply sides of the market. In that case, price would be endogenously determined and OLS estimates would be biased. We employed Hausman's test to determine whether price is exogenous or endogenous. Both our model passed the Hausman's test: the null hypothesis that price is exogenous couldn't be rejected. Therefore, we can assume that both our price variables are exogenously determined and that our model can be estimated using Ordinary Least Squares (OLS) method. The exogenous property of our price measures suggests that the cigarette supply curve in Malaysia is perfectly elastic and that cigarette price is determined exogenously by costs of production (determined by both the domestic and the world market) and cigarette taxes. This is consistent with the theory of open economy and perfect competition.

Time-series data can be stationary (constant mean and variance independent of time), trend-stationary (constant variance around a deterministic time trend) or non-stationary (stochastic time trend; variance increases with sample size). Non-stationary time series can lead to spurious regression, which confuses long-term relationship such as correlation over time with causal relationships.

We used STATA statistical software to apply the Dickey-Fuller test for unit root to test for stationarity of our time series. The Dickey-Fuller test is more robust compared to the Phillips-Perron test for stationarity. We applied a 10 percent level test for all variables.

First, we perform the test in levels, which tests for unit root, beginning with each variable lagged once. Since the series for consumption and price variables did not show any trend and had a non-zero mean, we included only a constant and not a linear time trend in the test specification. The time series for income fluctuated around a zero mean and therefore we did not include either constant or a time trend in the test specification.

For our measure of consumption the null hypothesis was rejected, the variable is integrated at zero order I (0), it is stationary.

For the tobacco CPI variable, the real price of Benson & Hedges and income, the null hypothesis of stationarity was rejected, but these variables were integrated at first order I (1). They are stationary in their first differences.

In order to avoid spurious regression, the residuals of our models were tested for stationarity. We found that the residuals are in fact stationary and that OLS model can be estimated. We applied Engle-Granger two-step method, which estimate both long-run and short-run relationship in the tobacco market.

The first step was to estimate a long-run equation without time trend - equation (1). However, the t-values in this model estimating a long-run relationship are inflated because the data are not stationary. Therefore we have also estimated significance using the Walt test. Given that a co-integrating relationship exists, we estimated an error-correction model (ECM), the second step of the Engle-Granger method. Deviations from the long-run equilibrium tend to partially revert to the equilibrium position in the following period. The ECM is based on stationary data (in this case, first differences) and includes the lagged residuals (of the long-run relationship) as an explanatory variable.

Coefficients from the ECM represent relationship in the short-run demand. Coefficient on the lagged residual indicates how much (in %) of the deviation from long-run equilibrium will be compensated for in the following time period. It measures the speed of convergence to the long run equilibrium. Since the variables are stationary, the usual t-test is applicable for testing coefficients' significance.

Further, we have tested residuals from the short-run equation for autocorrelation (serial correlation). OLS estimates are unbiased, consistent, but inefficient in the presence of autocorrelation. Our first-order autocorrelation calculated the Durbin-Watson (DW) statistic. If DW=2, there is no serial correlation, if DW=0, there is positive serial correlation, and if DW=4, there is negative serial correlation. Our DW statistics were 1.7 and 1.8 for the two model specification, respectively. We concluded that there is no serial correlation present in our model.

The test for heteroskedasticity revealed that there can be a problem with heteroskedasticity in the model using real prices of Benson & Hedges. We have corrected this problem by estimating the White robust standard errors.

We used the coefficient estimate to calculate price and income elasticities. Long-run price elasticity is derived by multiplying the relevant price coefficient by the fitted values of price and dividing by the fitted values quantity from the long-run co-integration equation. Income elasticity is calculated similarly, but using income coefficient and the income fitted values. Short-run elasticities are calculated using coefficients from the short-run ECM equation and the means of variable representing consumption, price and income.

Rusults

Table 4 and Table 5 summarize our results from the long-run and the short-run equations, respectively.

Table 4: Long-run equation for cigarette consumption

Dependent variable consumption (Yst)	Price = tobacco CPI		Price = Benson & Hedges	
Independent variables	Coefficient	t-value	Coefficient	t-value
Price (Xpt)	-6.06**	-2.20	-237.83*	1.90
Income (Xgt)	0.15	1.28	0.15	1.16
Population ratio (Xrt)	2135.88	0.40	425.86	0.08
Tob. control policies (Xtct)	75.03	0.61	96.97	0.76
Constant	-1691.10	-0.31	531.55	0.10
	Adj. R2 = 0.1733		Adj. R2 = 0.0964	
Long-run price elasticity	-0.382		-0.707	
Long-run income elasticity	+1.003		+0.993	

Notes:
* - 10% level of statistical significance determined by two-tailed test
** - 5% level of statistical significance determined by two-tailed test
Walt test for price and income variables in both models revealed the same level of significance as the t-test.

Table 5 : Short-run equation for cigarette consumption

Dependent variable consumption (Yst)	Price = tobacco CPI		Price = Benson & Hedges	
Independent variables	Coefficient	Robust t-value	Coefficient	Robust t-value
Price (Xpt)	-32.10*	-1.86	-953.21*	-2.27
Income (Xgt)	0.20**	5.32	0.26**	5.54
Population ratio (X_{rt})	2561.85	0.33	431.81	0.06
Tob. control policies (X_{tct})	19.33	0.20	18.21	0.19
Residual (-1)	-0.89**	-2.33	-1.11**	-2.46
Constant	-1103.08	-0.18	1038.99	0.13
	Adj. R^2 = 0.3380		Adj. R^2 = 0.3898	
Short-run price elasticity	-0.126		-0.096	
Short-run income elasticity	+0.024		+0.030	

Notes :
* - 10% level of statistical significance determined by two-tailed test
** - 5% level of statistical significance determined by two-tailed test

Coefficients of both price and income have the expected signs[7]. The impact of price is statistically significant in all models with at least 10% level of significance. The impact of income is statistically significant at 5% level in the short-term model. The impact of tobacco control measures is not significant. This is probably due to their limited enforcement and high social acceptability of smoking.

The coefficients on the lagged residual of the long-run equations are -0.89 and -1.11 for the tobacco CPI and the price of Benson & Hedges, respectively. This indicates that, on average, about 89 or 111% of the deviation from long-run equilibrium will be compensated for in the following year. In comparison to some other macro-economic relationships (Harris, 1995) this is a large speed of adjustment. Thus, deviations from equilibrium are unlikely to persist for long time.

We do not control cigarette smuggling - in this sense we overestimate the impact of price on cigarette demand since some of the measured reduction in consumption is actually substitution towards smuggled cigarettes.

The long-run price and income elasticities based on the model with tobacco CPI are -0.382 and 1.003, respectively. The model using Benson & Hedges prices estimated the long-run price and income elasticity of -0.707 and 0.993, respectively. Higher price elasticity in the model controlling for price of a specific brand can be expected, because it captures substitution towards other cigarette brand. Increasing price of one cigarette brand will lead not only to reduced cigarette consumption overall, but also lower consumption of that brand if prices of other brands are not increased to the same degree and at the same time.

Based on the ECM, the short-run price and income elasticities in the model with tobacco CPI are -0.126 and 0.024, respectively. The short-run price and income elasticities in the model with Benson & Hedges prices are -0.096 and 0.030, respectively. As expected, long-run elasticities are greater than short-run elasticities, which is a typical phenomenon for addictive product such as cigarettes.

Results for price elasticity of cigarette demand allow us to predict the impact of a cigarette tax increase. For the purpose of this analysis we will assume that the import duties will remain unchanged and that the excise tax on cigarette will increase from the 2005 level of RM 0.08 per stick or RM 1.60 per pack of 20 sticks (US$ 0.02/stick or US$ 0.42/pack) to RM 0.10 per stick or RM 2 per pack (US$ 0.03/stick or US$ 0.53/pack), which is a 25% increase in tax.

[7] The different magnitude of price coefficients is due to different units of measurement: one is an index and the other is measured in currency units (see Table 2).

First, we need to predict the impact of a tax increase on average cigarette prices, because our elasticity estimates reflect responsiveness to cigarette prices. According to both 2001 (AC Nielsen, 2001) and 2005 (ITC, 2005) surveys, the most popular cigarette brand in Malaysia was Dunhill. This brand captures about 42% of the cigarette market according to 2005 ITC survey. The price for this brand as reported in March 2005 was RM 4.50 (US$ 1.19) for a 14-pack (Leong, 2005). This corresponds to RM 6.43 (US$ 1.70) for a 20-pack. Our price data for Benson & Hedges indicate that the corresponding price for this brand was very similar to Dunhill at that time, RM 6.44. The excise tax represents RM 1.60, or 25% of this price. The proposed tax increase of 25%, or RM 0.40 (US$ 0.11) per pack, would increase price of Benson & Hedges brand to RM 6.84 (US$ 1.81), or by 6.2%. Given that these brand represents the most frequently consumed cigarettes in Malaysia, we can assume that 25% increase in excise cigarette tax will lead to an average price increase of domestic cigarettes by 6.2%[8].

According to 2004 statistics, about 4.73% of the cigarette market consists of imported cigarettes. These cigarettes are levied an import duty, but not an excise tax. Therefore, only 95.27% of the tobacco CPI will feel the impact of excise tax increase. Tobacco CPI would increase by 5.9%. Applying the price elasticity -0.382, we can predict that 25% increase in excise cigarette tax will result in 2.25% reduction in cigarette consumption in long-run. This will represent a reduction of about 31 to 32 cigarette sticks per person per year, or 445,737,729 fewer cigarette sticks in Malaysia in one year.

Research shows that for every stick of cigarette per person not being smoked, there will be 0.0248 decrease in lung cancer mortality per 100,000 adults aged 35-69 years old in 20 years (Gajalakshmi et al., 2000). Assuming that the current population growth of 2.8% will continue for the next 20 years, there will be 14.17 million people in the 35-69 age category by 2026. Therefore, a 25% cigarette tax increase in 2006 will reduce 109 to 112 premature deaths[9] caused by lung cancer among that population cohort just in one year by 2026.

Gajalakshmi et al., 2000 study also found a relationship between lung cancer and overall tobacco related mortality: for each lung cancer death per 100,000 adults aged 35-69, there are 1.6 deaths in the same population caused by all smoking related diseases. Therefore, a 25% cigarette tax increase in 2006 will result in 174 to 179 fewer tobacco related deaths among the adult population (aged 35-69) in one year by 2026.

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[8] This also assumes that the tobacco industry will pass all of the tax increase on consumers.

[9] 0.0248 * 31 = 0.7688; 0.7688*141.7 _ 109; 0.0248 * 32 = 0.7936; 0.7936*141.7 _ 112

In addition to reducing premature deaths, this tax increase would also increase government revenue from excise cigarette taxes. If the cigarette tax remains unchanged between 2004 and 2006, Malaysia would consume 24,099,096,784 sticks, or 1,204,954,839 packs of domestic cigarettes[10] in 2006 taking into account the population growth and assuming no change in per capita consumption. The sale of these cigarettes would generate RM 1,928 million in collected excise taxes with RM 0.08 (US$ 0.02) per stick tax. According to our calculation, an increase in cigarettes tax to RM 0.10 (US$ 0.03) per stick will reduce the cigarette consumption in Malaysia by 445,737,729 cigarette sticks per year. Therefore, there would be only 23,653,359,055 cigarette sticks consumed in 2006. Sale of this number of cigarette would generate RM 2,365 million (US$ 625.66 million in cigarette tax revenue in 2006. This is an increase of RM 437 million (US$ 116 million[11]), or 22.7% over what will be otherwise collected in 2006 with the current cigarette tax rate.

[10] Only domestic cigarette sales is relevant for this calculation since the excise tax is imposed only on domestic cigarettes.

[11] We used the exchange rate US $1 = RM3.78

Discussion

This study contributes to the national tobacco control policy development and fiscal budget planning with the first ever estimated cigarette demand model specific to the Malaysian market. This study will also contribute to tobacco control literature and development of further simulation studies and expanded research on impact to trade agreement and health care expenditures. Our estimate of price elasticity based on our aggregate time series data and the preferred model specification indicates that 10% increase in cigarette prices will result in 3.8% decline in cigarette consumption. This estimate is comparable to results from neighboring countries based on micro-level data such as Thailand (price elasticity -0.39; cross section data; Isra, 2003) or Vietnam (price elasticity -0.53; Eozenou, 2001). Our model could not test whether there was a change in price elasticity of cigarette demand over time, because our time series data covers only 15 years as opposed to 29 years in Van Walbeek (2000) study.

We estimated that the income elasticity of cigarette demand in Malaysia is +1.0. This means that 10% increase in income in Malaysia will lead to 10% increase in cigarette demand. This is comparable to the estimate from other middle income countries. Thailand study (Isra, 2003) estimates the income elasticity of cigarette demand of +0.70, South Africa study (Van Walbeek, 2000) yields the income elasticity of +0.92. These estimates suggest that the income effect in these countries is quite strong since a change in income results in almost proportional change in cigarette consumption in the same direction. Therefore, it can be expected that the tobacco epidemic in Malaysia will spread with the income growth if no stringent tobacco control measures are taken.

Simulation of a future excise tax increase from RM 0.08 to RM 0.10 per stick predicts 5.9% increase in the average price of cigarettes and 2.25% reduction in cigarette consumption. We estimate that the tax increase could save from 174 to 179 persons from tobacco related deaths and increase the government tax revenue by RM 437 million (US $116 million). World Bank (1999) estimates that a modest increase of 10% in cigarette tax would lead to an increase of almost 7% revenue. According to this estimate, the proposed 25% tax increase in Malaysia should lead to 17.5% increase in tax revenue. A mathematical model of tax revenue and price elasticity (Merriman, 2002) predicts that a country with 30% cigarette tax and price elasticity -0.4, parameters similar to Malaysia, will increase its tax revenue by 22% if tax is increased by 25%. Our model predicts that a 25% tax increase in Malaysia will result in 22.7% increase in cigarette tax revenue. This is almost identical

to the predictions of the mathematical model and slightly higher compared to the WB general prediction.

Cigarette tax increase in Malaysia will result in a win-win situation: an improved public health and an increase in government resources. Ideally, these newly obtained resources would be used to help smokers to quit since they come from those who have the most difficulty to give up the smoking habit. They can be also used to support tobacco farmers to switch to alternative crops.

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About SEATCA

The Southeast Asia Tobacco Control Alliance (SEATCA) works closely with key partners in ASEAN member countries to generate local evidence through research programs, to enhance local capacity through advocacy fellowship program, and to be catalyst in policy development through regional forums and in-country networking. By adopting a regional policy advocacy mission, it has supported member countries to ratify and implement the WHO Framework Convention on Tobacco Control (FCTC)

Contact persons:

Ms. Bungon Ritthiphakdee: **SEATCA Director**
Email: bungon@seatca.org
Ms. Menchi G. Velasco: **SEATCA Research Program Manager**
Email: menchi@seatca.org; menchi55@yahoo.com
Southeast Asia Tobacco Control Alliance (SEATCA)
Address: Thakolsuk Apartment Room 2B, 115 Thoddamri Rd., Nakornchaisri Dusit, Bangkok 10300, THAILAND
Tel./Fax: +662 241 0082

Website: http://www.seatca.org

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