



SEATCA
SOUTHEAST ASIA TOBACCO CONTROL ALLIANCE

**The Collaborative Funding Program for
Southeast Asia Tobacco Control Research**

**ANALYSIS OF TOBACCO
AND POVERTY
IN SUPPORT OF
FCTC RATIFICATION
IN CAMBODIA**

Phauk Samrech, MSc.

**Financial support from
The Rockefeller Foundation
Research for International Tobacco Control
(RITC/IDRC) and
Thai Health Promotion Foundation (ThaiHealth)**

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ABBREVIATIONS

LIDEE Khmer	League of Khmer Students From Abroad
RITC	Research for International Tobacco Control
IDRC	Canada's International Development Research Center
TFI	Tobacco Free Initiative
WHO	World Health Organization
CSES	Cambodian Socio- Economic Survey
NIS	National Institute Statistics of Cambodia
KHR	Cambodian currency unit, the
ADB	Asian Development Bank
GDP	Gross Domestic Product
SEDP-II	Socio-Economic Development Plan II for 2001-2005

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EXECUTIVE SUMMARY

A. Research Rationale

The Royal Government of Cambodia (RGC) has named tobacco as one of the major obstacles to the realization of the Poverty Alleviation Program to reduce household poverty and to improve their welfare. Urgent measures have to be taken to eliminate the obstacles posed by tobacco and to ensure the program's success.

A previous research on tobacco and poverty had been undertaken by LIDEE Khmer using the 1999-CSES database collected by the National Institute of Statistics of the Ministry of Planning of Cambodia. It has provided strong evidence of the impacts of tobacco on household poverty as well as the threat to the success of the Poverty Alleviation Program of the RGC. Joint efforts of the National Centre for Health Promotion, the Ministry of Health, the Inter-Ministerial Committee, and the tobacco control community have been tremendously successful in combating tobacco epidemic with the ratification of the Framework Convention on Tobacco Control (FCTC) by the RGC in November 2005. Ironically, after the ratification of the FCTC, advertising, promotion of tobacco products and sponsorship by the tobacco industry have been intensified. The ratification of the FCTC is, thus, only the start of a new phase of the struggle to establish smoke-free policy in Cambodia. After the ratification of the FCTC a range of new problems arised: i) how to integrate the ratified international law into the legislation framework of Cambodia and to allow for its implementation locally, ii) how to concretely determine specific issues of the FCTC in the Cambodian context and to incorporate them into the national law, and iii) how to reinforce all the concretely stated Articles of the ratified FCTC and the future Cambodian law on tobacco control. Currently, a draft of National Law on tobacco control shaped after the FCTC has been prepared by the National Centre for Health Promotion and the Ministry of Health, and is pending ratification by the Cambodian Parliament. However, health reasons are, again, not enough to smoothly and successfully move the law through the Parliament. More research evidence is required to support the ratification of the Cambodian law, the implementation of both the new Cambodian law as well as the FCTC.

The current research update on tobacco and poverty will investigate the consumption behavior of Cambodian households on specific product groups taking into account the impact of tobacco spending.

The investigation will be conducted in the framework of the consumer demand theory using one of the most common functional forms of econometric analysis: the Almost Ideal Demand System. This method of investigation is different from the one used in the 1999-analysis of tobacco and poverty. The advantage of the current approach is the possibility of computation of expenditure (income) elasticity, own price and cross price elasticity using the result of the maximum likelihood estimation of demand model under the study.

B. Major Findings

B.1. Impacts of Tobacco on Households' Consumption

The current research has found that three items of household expenditure have total expenditure (income) elasticity smaller than one. Among these items is tobacco with total expenditure elasticity of 0.7834. Items with elasticity smaller than one are considered as items of necessity. This raises alarm to us as tobacco appears to be an item of necessity as well. Tobacco spending is moreover the least responsive to change in total expenditure (income) as compared to the food and clothing with total expenditure elasticity of 0.8263 and 0.9441, respectively. For households with regular smoker certain amount of spending on cigarette is always allocated regardless of change in the amount of total expenditure.

Besides being less responsive to change in total expenditure, tobacco is also less responsive to its own price change with own price elasticity of -0.7607. Tobacco consumption behavior of households with smokers is thus persistent and quite similar to consumption of food with nearly the same own price elasticity of -0.8510.

Negative cross-price elasticity of tobacco with respect to change in price of clothing, education and housing products points out that these products and tobacco are complementary products. On the other hand, the positive cross-price elasticity of tobacco with respect to food of 0.0447 and medical care of 0.0595 translates into potential substitution of products in these latter groups by tobacco products as their price rise. Spending on tobacco products as a substitute to products of basic needs present valuable opportunity costs for Cambodian households as well as the whole nation and is highlighted throughout the text of the current research study.

B.2. Impacts of Tobacco on Households' Poverty

Possessing less than one total expenditure elasticity, less than one own price elasticity and positive smaller than one cross-price elasticity with respect to food, tobacco products belong to products of basic needs that is not responsive to change in total expenditure, rise in its own price and a substitute away from products of the food group as food's price rises. As a result, tobacco prevalence based on the CSES-2004 is 58.7%, and half a million households in Cambodia consume tobacco products. In tobacco smoking households, tobacco spending decreases households' well-being, increases risk of diseases in respiratory tracts and mouth cavity and subsequently reduces labor productive capacity of the family. Poverty status of smoking households will transmit over to the non-smoking households and further to the community through social interaction and as a result the impact of poverty will be tremendously multiplied.

B.3 Impacts of Tobacco on Social Development

Tobacco spending as shown by the findings is a fairly persistent consumption expenditure for Cambodian households. Taking into account the current efforts of the Royal Government of Cambodia in reducing poverty, this is a very serious threat to the well-being of households and Cambodian society. Total nationwide spending on tobacco products amounted to US\$57.75 millions according to the database of the Cambodian Socio-Economic Survey (CSES) 2004. The opportunity cost of tobacco spending can translate into an enormous useful expenditure for households and the society as a whole.

INTRODUCTION

The current research update of tobacco and poverty will investigate the consumption behavior of Cambodian households on specific product groups taking into account the impact of tobacco spending.

The investigation will be conducted in the framework of the consumer demand theory using one of the most common functional forms of econometric analysis: the Almost Ideal Demand System (AIDS). This new method of investigation is more advanced than the one employed in the 1999 analysis of tobacco and poverty. It is the first attempt to estimate tobacco total expenditure (income), own and cross price elasticity and to provide their interpretation in the context of Cambodian households.

The study aims to investigate the socio-economic status of Cambodian households as a result of their patterns of expenditure in the context of tobacco consumption. The study is based on database built by the Cambodian Socio-Economic Survey (CSES) 2004. Using the result of this study, a number of suggestions were made in the policy implication section.

Section One presents study objectives. Section Two is a review of research literature. Section Three describes the data source and methodology. Section Four highlights some of the socio-demographic characteristics of Cambodian households. Section Five demonstrates a striking difference between non-tobacco consuming families and tobacco consuming ones. Section Six highlights the core subject of the study: the tobacco or health dilemma. It also shows the opportunity cost of tobacco consumption and its related health risks. Section Seven presents the results of the regression analysis. The conclusion and recommendation related to policy implication are in Section Eight, the conclusion of the paper.

STUDY OBJECTIVES

1.1. Research Problem

Tobacco epidemic is rampant in Cambodia, especially at the household level, with more than half of Cambodian households hosting at least one or more smokers. It is scientifically proven and firmly supported by facts that tobacco is one of the major factors associated with many kinds of diseases (cancer, respiratory and heart diseases). Smoking is responsible for the death of millions of people every year around the world. A 1997 study estimated that, based on the experience of other countries, nearly 6,000 Cambodian die each year from tobacco-related diseases (Sotharith, C., *et al*, C., Pheang, L.T., & Samnang, P. "Economic Cost of Tobacco in Cambodia: Some Preliminary Estimates for 1997-2007, WHO, October 1997). With the household smoking prevalence of 58%, there are more than 1.53 million smoking households nationwide. Hence, at least 1.53 million people smoke tobacco products (estimate of one smoker per smoking household by 2004-CSES data¹) and so that over time the risk of death as well as the burden of diseases from tobacco will be higher.

Although tobacco products kill thousands of people annually, they are freely traded in Cambodia. The consumption of tobacco products has a long history in Cambodia. Cambodian people in rural areas continue to follow the tradition of their ancestors by growing tobacco plant, processing the leaf and rolling their own cigarettes.

Despite the fact that Cambodian households would greatly benefit from the ceasing of consumption of tobacco products, any attempt to impose control on tobacco trade to reduce tobacco consumption presents a very challenging task for the Royal Government of Cambodia, the National Centre for Health Promotion, the Ministry of Health, the Tobacco and Health unit of ADRA Cambodia, and the local representative office of the World Health Organization (WHO).

1.2. Study Objectives and Research Hypothesis

This research has a broad social objective of presenting convincing evidence, based on descriptive and regression analysis of the existing data, to justify the move toward the development of the tobacco control policy and to gain support from a wide range of population as well as from the government and NGO agencies. The research is carried out through investigation into the consumption pattern of Cambodian households. From the result of the investigation we will be able to derive the policy implication needed to support the measures to counter tobacco trade as well as to ensure that the move would be an efficient one in the context of current Cambodian socio-cultural, economic and political settings.

¹ . Report on the Cambodia Socio-Economic Survey 1999, National Institute of Statistics, Ministry of Planning, Sponsored by United Nation Development Program, Swedish International Development Cooperation Agency and Executed by the World Bank

We are undertaking to investigate the hypothesis we forwarded in the initial project proposal.

- i. To investigate tobacco consumption pattern of Cambodian households and determine its change during the time of the economic recovery.
- ii. To identify the determinants of tobacco demand in Cambodia and assess their relative importance in the decision to smoke.
- iii. To attempt to estimate price elasticity of cigarette demand based on regional tobacco price differences.

REVIEW OF RESEARCH LITERATURE

The present research investigates the pattern of Cambodian households' consumptions expenditure in the context of tobacco use. It uses the aggregated cross-sectional data obtained during the Cambodian Socio-Economic Survey conducted in 2004 (2004-CSES) on 15,000 households in the 5 regions of Cambodia.

As an update to previous research, we employ the methodology provided by the consumer demand theory, which has been very popular among researchers investigating consumption expenditure of various products. The literature on theory and application of the theory of consumer demand system we have reviewed are as follow:

- i. Apec 8403: Lecture 2 "Functional Forms for Static Demand System" exposing brief theory of consumer demand. It describes Stone's Analysis, Linear Expenditure System, Rotterdam Model, and Search for Flexible Functional Form of Consumer Demand including Price-Independent Generalized Linear (PIGL) demand system and Price-Independent Generalized Logarithmic (PIGLOG) demand system, and Almost Ideal Demand System (AIDS).
- ii. Cardon Research Papers in Agricultural and Resource Economics "Estimation of Theoretically Plausible Demand Functions from US Consumer Expenditure Survey Data" exposes the result of an application of four functional forms of demand model on the same dataset for comparison.
- iii. Article of the *Chulalongkorn Journal of Economics* 7 (3), September 1995 "An estimation of Consumer Demand" by Isara Sarntisart. This article illustrates an application of demand function of the type of Linear Expenditure System (LES) form to the estimation of expenditure and price elasticity in Thailand.
- iv. Research Paper "Demand and Prospect for Food in Malaysia" by Nik Mustapha R. Abdullah, Abdul Aziz Abdul Rahman, Alias Radam, Ahmad Zubaidi Baharumsbah investigates the prospect of food demand in Malaysia. The AIDS model was used in the research study.
- v. A research paper of the Center for Energy and Environmental Policy Research entitled "A Residential Energy Demand System for Spain" by Xavier Labandeira, José M. Labeaga, and Miguel Rodriguez estimating for the first time in Spain an energy demand system with household micro-data. The functional form of the demand system is of the AIDS type with incorporation of demographic demand shifters.
- vi. Research Paper entitled "Household Demand in Turkey: An Application of Almost Ideal Demand System with Spatial Cost Index" by Ali Koc and Savas Alpay describing the result of the application of AIDS on regularly collected data on household expenditure. Household size, age group of household head as demand shifters were incorporated in the model. It claims to provide practical solution in term of reliable estimation of expenditure and price elasticity using available database.
- vii. Research Paper entitled "Estimation of Demand for Wheat by Classes for the United States and European Union" by Samarendu Mohanty, E. Wesley F. Peterson, and Darnell B. Smith to investigate price response for specific classes of imported and domestic wheat by firms and consumers in the US and the EU. The GP/AIDS, an extended form of the AIDS, was used to analyse the dynamics of the demand for wheat by different consumers.

- viii. Research Paper entitled “GAIDS: a Generalized Version of the Almost Ideal Demand System” by Carlo Andrea Bollino discussed a methodology to incorporate committed quantity into the AIDS. The author also showed improvement of the GAIDS together with augmented demand shifter in terms of scaled price dependant on demographic characteristics over the normal AIDS.
- ix. Economics Letters entitled “Incorporating Demand Shifters, by Juliana M. Alston, James A. Chalfan, Nicholas E. Piggou in the Almost Ideal Demand System.
- x. STATA 2001-Journal’s article by Brian P. Poi entitled “From the help desk: Demand system estimation” illustrating the use of STATA to estimate demand system. Data and program code for sample estimation is provided.

Based on these review, we will choose the AIDS functional form of the complete demand system as model for our investigation. The estimation will be carried using STATA program code, based on modified program code of Brian P. Poi and suggestion in the Economics Letters by Juliana M. Alston *et. al.*

DATA SOURCES AND METHODOLOGY

The present research investigates the pattern of Cambodian households' consumptions expenditure in the context of tobacco use in the framework of consumer demand theory. It uses the secondary data provided by the Cambodian Socio-Economic Survey conducted in 2004 (2004-CSES).

The investigation is divided into two parts. Part I is based on descriptive analysis of the dataset and the focus is made especially on the subset of the dataset, which comprises only those of smoking households. Part II is based on regression estimation of the whole dataset to find out how tobacco impact household expenditure such as food, clothing, education, medical care and housing based on socio-economic characteristics of those households.

We used SPSS, MS Excel and STATA software for data manipulation and analysis.

3.1. Data Source and Manipulation

The raw data of 2004-CSES were verified, cleaned and made available in the National Institute of Statistics (NIS) of Cambodia. During the survey of 2004-CSES, diary method was used to increase accuracy of the data collected. It is a major improvement over the 1999-CSES, which was based on recall method. It collected extensive information on 15,000 households in the 5 regions of Cambodia: i) Region of Phnom Penh ii) Plain Region, iii) Tonle Sap Region, iv) Coastal Region, and v) Plateau Mountain. The information includes household's assets, earning and schedule of expenditure on more than 100 items of non-durable and durable goods or services. From this large dataset we extracted a number of variables to constitute specific dataset for our study. The extracted dataset comprises household income, total consumption, and demographic characteristics.

In the beginning stage of the building of the research dataset we use SPSS and STATA statistical software to manipulate the raw data source, to group their line item of consumption into 6 classes of aggregated type of consumption: i) food, ii) clothing, iii) education, iv) health, v) housing, vi) tobacco and vii) miscellaneous. According to the research objectives, our update research on the impacts of tobacco on poverty using the 2004-CSES database moves one step further than those employed in the 1999 research with a first attempt to estimate expenditure (income) and price elasticity. We consequently need price of goods or services, classified in 6 product groups and consumed by households in each of the 5 geographic regions of Cambodia.

Although it is possible to compute the unit value of the goods or services consumed by dividing monetary amount by quantity, caution is required to consider the resulted unit value as proxy for price of the items purchased by households. The reason is the lack of common unit of measurement on the quantity reported and recorded during the data collection stage. This type of problem is common for researches related to estimation of consumption demand system and computation of expenditure (income) and price elasticity. The tasks we undertook to overcome the challenge posed by this problem were: a) to obtain prices of goods and services from the Bureau of CPI of the National Institute of Statistics, Ministry of Planning, b) to form price database for all 6 aggregate products to be investigated, and c) to merge the price database with the expenditure data. Upon possession of price information for the goods or services consumed by households we will be able to

proceed with the estimation of the demand model developed in the framework of demand theory to investigate the poverty impacts of tobacco consumption. A comparison of unit value with the relevant price of each product item from the listing of the CPI Bureau of the Ministry of Planning help in generating the price of the items to be aggregated.

The groups of aggregated products we will investigate are the following.

- 1- Food: The food group includes rice and cereal, meat and fish, fruit and vegetable.
- 2- Clothing: The clothing group includes apparel and footwear products.
- 3- Education: The goods and services groups under education item are books, stationary and tuition. .
- 4- Medical care: The goods and services groups under health item are medicament, consultation and hospitality.
- 5- Housing: Housing includes only rent and maintenance.
- 6- Tobacco: This group includes all types of consumption on tobacco products.

3.2. Aggregate Price Formation

The Cambodia Socio-Economic Survey 2004 was conducted in the following period: November/December 2003, the whole year 2004 and January 2005.

The record of expenditure follows the diary method in recording the household expenditure. Each household was visited during one month to capture the household's consumption expenditure on various items.

Each household is identified by a sample ID and the time frame ID when its expenditure is recorded.

It is therefore possible to generate aggregate goods from selected items consumed by households.

We can compare the unit value computed from household data and the table of price from the CPI Bureau of the Ministry of Planning

The CPI listing is compiled every quarter on about 300 various products on sale in different geographic zones of Cambodia.

It includes the base price (1998 price), weight characterizing percentage in total expenditure for typical households in various regions of Cambodia and the price index for the listed product items. The table of Current Price of selected items for aggregation is in a separate database.

A- Computation of CPI and unit value (diary price)

Step 1: to select product items:

Among many items of expenditure from the diary record only items that we can find a match from the listing of the CPI Bureau were selected. 37 items were selected for product aggregation: 20 items were aggregated into food aggregate; 2 items - cigarette aggregate; 8

items - clothing aggregate; 1 item - housing aggregate; 3 items - medical care aggregate and 3 items - education aggregate

Step 2: to compute the unit value:

From the recorded data in the household diary we compute the unit value per item selected.

Step 3: to build a price table from selected CPI listed product items:

A table comprising the base price and CPI index for all the 37 items selected for aggregation forms a database for computation of their current price before aggregation. The current CPI price equals the base price multiplied by the price index. After obtaining all current prices of the 37 selected items we proceeded with the formation of aggregate product.

Step 4: to compute the range of CPI price:

The lower bound, the lowest price, of the CPI price of item is equal to 0.87 multiplied by the CPI price. The upper bound, the highest price, of the CPI price of item is equal to 1.5 multiplied by the CPI price.

B- Comparison of prices to obtain item price for all households in the dataset

The approach for comparing unit value computed from household data with price from the CPI Bureau of Statistics of the Ministry of Planning is as follows:

- i- In case the diary price (the unit value) is smaller than the lower bound of the CPI price it is replaced by the value of the lower bound of the CPI price
- ii- In case the diary price (the unit value) is bigger than the upper bound of the CPI price it is replaced by the value of the upper bound of the CPI price
- iii- No replacement for all diary prices (the unit values) that lies between the lower and upper bounds of the CPI price.
- iv- Any missing diary price (the unit value) is simply replaced by the value of the price from the CPI price.

The time of the expenditure record and location, where the record was taken are used to generate the price database of selected items for aggregation.

After this comparison we will obtain all prices of selected items for aggregation for every household in the database.

C- Computation of price of aggregate product

Price of aggregate product is calculated using the formula according to Laspeyres' formula:

$$\ln(\text{price}_\alpha) = \frac{1}{\sum \text{weight}_i} \sum [\text{weight}_i * \ln(\text{price}_i)]$$

where $\alpha =$ denotes following aggregate expenditure products: food; clothing; education; medical care; housing and tobacco

$i =$ denotes each of the items forming the corresponding aggregate expenditure products: food; clothing; education; medical care; housing and tobacco

The reason to include the denominator is that a specific number of items from the CPI listing per aggregate product are selected for aggregation and the total weight per specific aggregate product is different from unity.

We should note that for all provinces and other urban areas weight per similar item on the CPI listing is similar.

D- Missing value of expenditure of aggregate item

Any missing value in the consumption expenditure of the food, clothing, education, medical care and housing aggregates is replaced by 30 KHR, which will not buy anything, as the smallest amount that can buy any product is 100 KHR.

Missing value of consumption expenditure on tobacco products is left as it is.

We can therefore distinguish the status of household in terms of tobacco product expenditure. Zero amount of consumption on tobacco product will qualify the household as a non-smoking household and bigger than zero amount of money spent by a household will qualify it as a smoking household.

E- Compilation of the complete database for demand estimation

Further tasks involving formation of a complete database comprising consumption of specific aggregate product and its corresponding price are as follows.

- i- to compute the total expenditure comprising of expenditure on the six aggregate products: food, clothing, education, medical care, housing and tobacco;
- ii- to compute the expenditure share of each aggregate product;
- iii- to compute the logarithm of price of the aggregate product;

3.3. Research Model Design and Software Tools

From the descriptive analysis parts we have some initial sense of the effects of tobacco consumption on households' expenditure patterns, however further analysis using regression method is needed.

In the regression analysis we undertake the iterative estimation of the AIDS functional form, a popular functional form of demand model in the theory of consumption to investigate the consumption behavior of Cambodian households in the context of tobacco consumption. The key parameters for the discussion of the tobacco impacts are the total expenditure (income), own price and cross price elasticity. The discussion will be made on the uncompensated value, embedding some effect of total expenditure (income), of the elasticity. A table of compensated values of price elasticity, which reflects the impact of

prices only, is also computed and presented. The values of elasticity are subject to point estimate, we therefore compute them at the sample mean and two sub-sample mean.

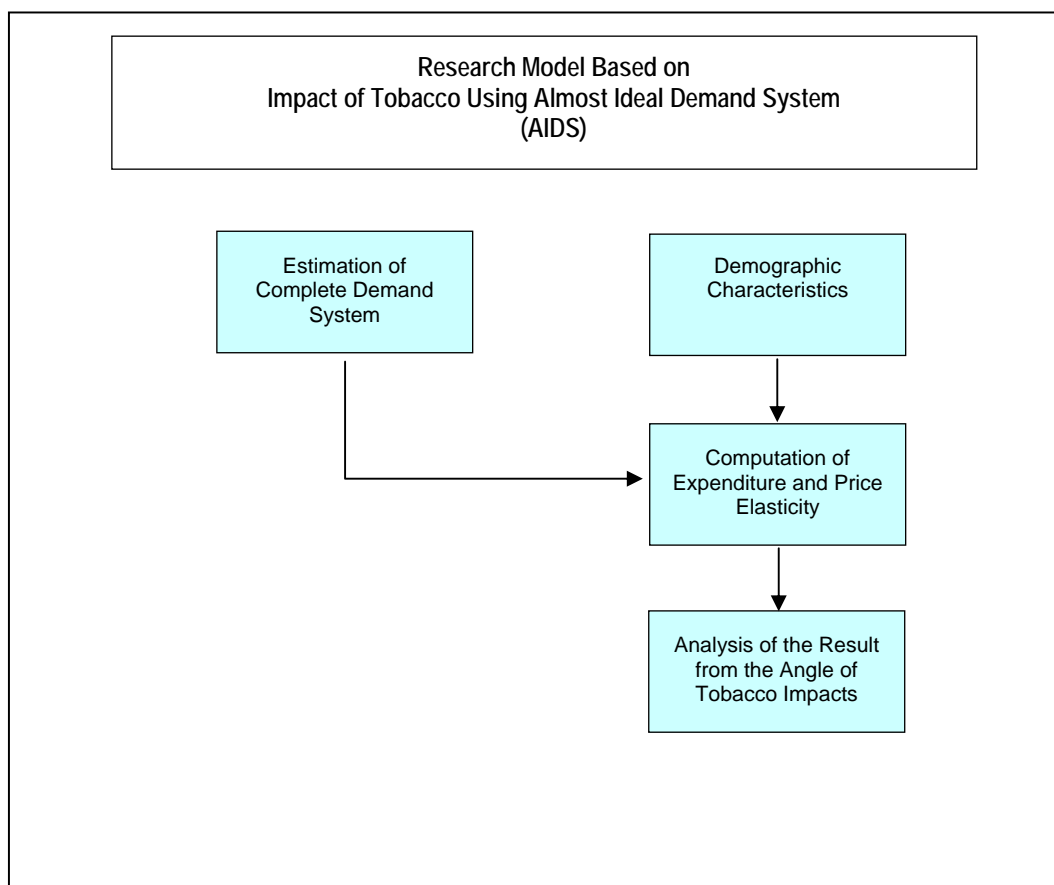
The demand system comprises following six equations:

- a) five equations related to household consumption of basic products such as food, clothing, education, medical care and housing;
- b) one core equation related to spending on tobacco products;

The program codes used to estimate the system are modified versions of the ones supplied by Dr. Brian P. Poi of the STATA Corp. Nearly all coded in the original programs were modified. A new complete program code is developed to handle the computation of the elasticity using the result of the maximum likelihood estimation. A set of program codes for estimation of our demand system were provided by Dr. Brian P. Poi of the STATA Corp. Based on the original codes the principal investigator writes new codes forming a complete program for estimation of the demand system in current research project. In fact five sets of program codes for various functional forms of the demand system were developed and tested: the Linear Expenditure System (LES), the Quadratic AIDS (QUAIDS), the Linear Approximated AIDS (LA/AIDS), the Generalized AIDS with demand shifters and committed expenditure (similar to LES) (GAIDS) and the AIDS used in the current project, but only the set of program codes used in this current project lead to successful completion of the estimation. The codes for parameter estimates are packed in different sub-routine, while the codes for elasticity computation were combined together in one program for easy execution and reference. The logs of the estimation and computation session are provided in the appendix. The actual codes for program execution are not included in the report, but are available upon request. The codes for the parameter estimate can be applied for any future research study without need of modification, while the codes for elasticity computation is suitable only for research case similar to the current one. Use in other research study needs modification.

The results of all these statistical and numerical processing are shown in the sections that follow and in the appendix part.

Figure 1. Research model



Box 1. Specification of Functional Form for Demand System

Expenditure share of all six items in the demand system:

$$w_i = \alpha_i + \sum_{j=1}^n (\gamma_{ij} * \ln(p_j)) + \sum_1^n (\beta_i * \ln(\frac{M}{P^{stone}}))$$

Translog price index to be used for estimation of the demand system:

$$\ln P^{stone} = \alpha_o + \sum_1^n (\alpha_i * \ln(p_i)) + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n (\gamma_{ij} * \ln(p_i) * \ln(p_j))$$

Total expenditure (income) elasticity:

$$\eta_i = 1 + \left(\frac{\beta_i}{w_i} \right) \quad i=1, \dots, n \text{ (number of equations)}$$

Uncompensated own (or cross) price elasticity:

$$e_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i} \left(\alpha_j + \sum_{k=1}^n (\gamma_{kj} * \ln(\bar{P}_k)) \right)$$

$$\delta_{ij} = 1 \quad \text{if } j = i \quad \text{and} \quad \delta_{ij} = 0 \quad \text{if } j \neq i$$

Compensated own (or cross) price elasticity:

$$e_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + \frac{-}{w_j} - \frac{\beta_i}{w_i} \left(\alpha_j + \sum_{k=1}^n (\gamma_{kj} * \ln(\bar{P}_k)) - \bar{w}_j \right)$$

$$\delta_{ij} = 1 \quad \text{if } j = i \quad \text{and} \quad \delta_{ij} = 0 \quad \text{if } j \neq i$$

where $\alpha_o, \alpha_i, \beta_i, \gamma_{ji}$ are parameters of the demand system;
with restrictions:

$$\Sigma \alpha_i = 1, \quad \Sigma \beta_i = 0, \quad \Sigma \gamma_{ji} = 0 \quad \text{adding-up conditions}$$

$$\Sigma \gamma_{ij} = 0 \quad \text{homogeneity condition}$$

$$\gamma_{ji} = \gamma_{ii} \quad \text{condition of symmetry}$$

$p_i, \ln(p_i)$ are price and logarithm of price respectively;

P^{stone} is stone price index;

η_i is total expenditure;

w_i is expenditure share.

$i = 1, \dots, n$ is index of the equations in the demand system,
here we have a total of $n_{equ} = 6$, i.e. equations for food,
clothing, education, medicare, housing and tobacco.

$i = 1$ for food expenditure share equation;

$i = 2$ for clothing expenditure share equation;

$i = 3$ for education expenditure share equation;

$i = 4$ for medicare expenditure share equation;

$i = 5$ for housing expenditure share equation;

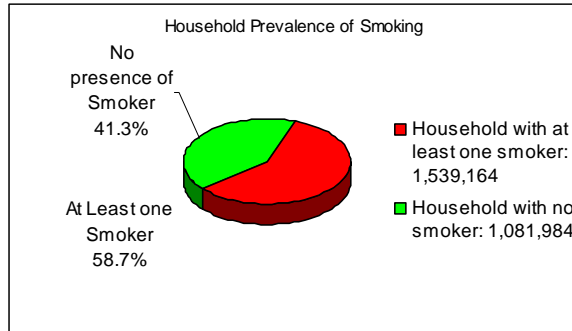
$i = 6$ for tobacco expenditure share equation;

SITUATION OF SMOKING IN CAMBODIA

In this section we look into the descriptive statistics of our dataset.

4.1. Households' Smoking Prevalence

Figure 2. Households' smoking prevalence



More than half of all Cambodian households in the investigated period have at least one smoker in their families. Therefore, the scope of tobacco products consumption is seen as very widespread in Cambodia.

The individual prevalence for Cambodia and other countries in the region is in Table 1 below. Male smoking prevalence is 41.2 and female-4.1. It shows evidence that smoking prevalence in Cambodia is still among the highest in the

region.

Figure 3. Individual smoking prevalence in Cambodia (aged 15 years or over)

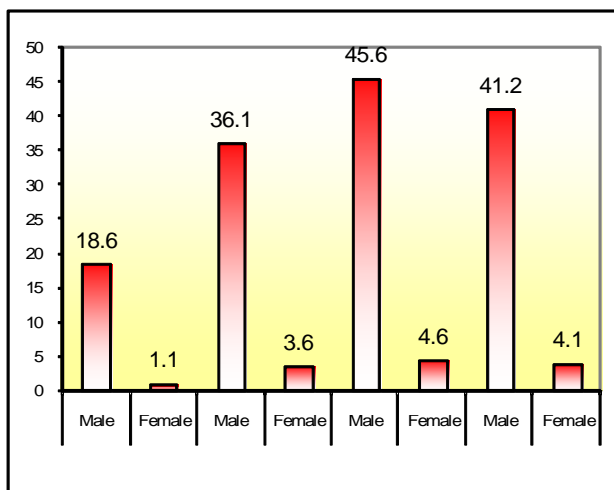


Table 1. Prevalence in selected Asian countries (aged 15 years or over)

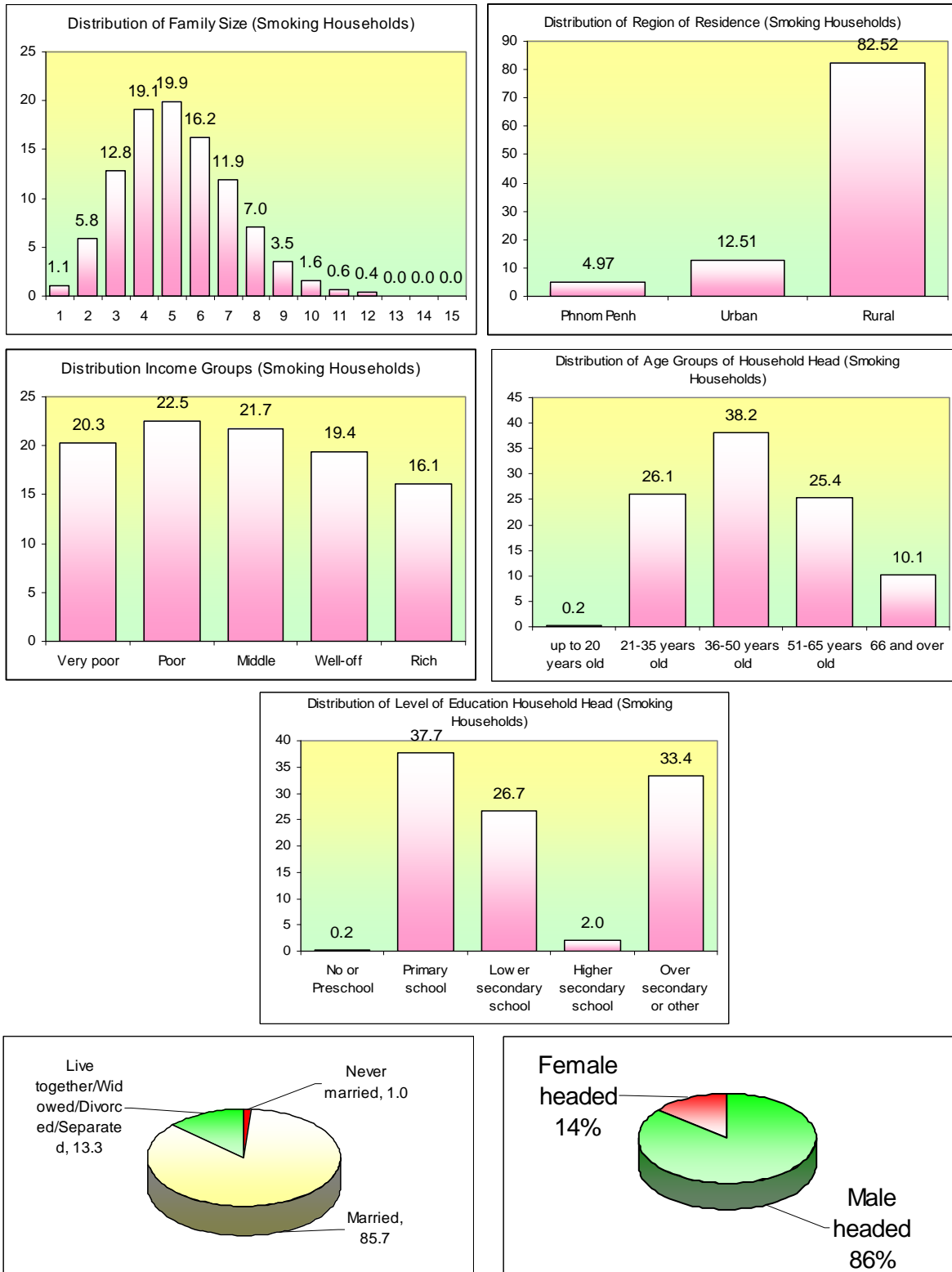
Country	Male	Female	Survey Date	Source
Cambodia	41.2	4.1	2004	NIS
Malaysia	49.2	3.5	1996	WHO
Thailand	43.0	2.4	2001	Ash-Thailand
Laos	41.0	15.0	1995	WHO
Philippines	50.6	8.0	2001	WHO
Viet Nam	50.7	3.5	1997-1998	WHO

4.2. Smoking Demography

The prevalence of smoking among female-run households is very small compared to those run by male head. There is a discernible upward trend of households' smoking prevalence from the region of Phnom Penh to Other Urban and Rural Areas. There is no clear effect of level of education of head of household on household smoking prevalence. It is worth noting, however, that higher household prevalence of smoking is observed for households with head having either primary or over-secondary education. By marital status, the highest prevalence of smoking is observed among households run by a currently married head. This is

understandable since most households are run by male head and male-run households have the highest prevalence of smoking.

Figure 4. Smoking demography



4.3. The Extent of the Problem

Table 2 describes the sample and the extent of the problem.

Table 2. Important statistics	
Description	Data
Number of All Households	2,621,147
Household Smoking Prevalence	58.72%
Number of Smoking Households	1,539,196
Monthly Household Tobacco Spending in 2004, KHR	13,071
Total Monthly Tobacco Spending Nationwide, KHR	19,975,088,647
Monthly Total Tobacco Spending Nationwide, US\$	4,813,274
Retail Price of ARA brand, KHR	1000
Packs of Cigarettes Consumed Monthly	19,975,087
Mean Smoking Household Size	5.4
People Living Under Environment Tobacco Smoke, persons	8,040,468
Estimated Total Number of Children Under 13-years-olds Living Under Environmental Tobacco Smoke, persons	2,734,670

The level of smoking expenditure reflects both smoking intensity and brand choice. Expenditures can be high because people smoke expensive cigarettes (high quality, high price) or because they smoke a lot (high quantity, but quality could be low), or both (smoke a lot of expensive cigarettes). We divided all smoking households into 3 groups to study their relative tobacco spending. According to our scale we called these households low spenders, medium spenders and high spenders on tobacco products. The spending of 15,000 Riels per month is the benchmark for high spenders and can be translated into at least 15 packs smoked in a family per month.

Between regions, comparison of the level of smoking expenditure in Figure 5 shows that smoking households in Phnom Penh are more likely to be the highest spenders on tobacco. The smoking households in the rural area have the lowest percentage of high spenders, but the highest percentage of low spenders.

Between income group comparisons of the level of smoking expenditure in Figure 7 shows that the percentage of high spenders increases as income group of the household rises and the percentage of low spenders is decreasing the higher the income group.

Putting together Figures 5 and 6 reveal that households in rural areas of low income are more likely to spend small amount of money on tobacco, albeit high smoking prevalence. On the other hand, households in Phnom Penh or other urban areas with high income will spend more on tobacco products. Unfortunately, this simple message has been well captured by the tobacco industry and exploited in its marketing strategy. Currently, expensive and imported brand of cigarette flood the market in Phnom Penh and urban areas, while various cheap brands of cigarette, especially local ones, flood the markets in rural areas.

Figure 5. Smoking Expenditure on Tobacco Products by Regions

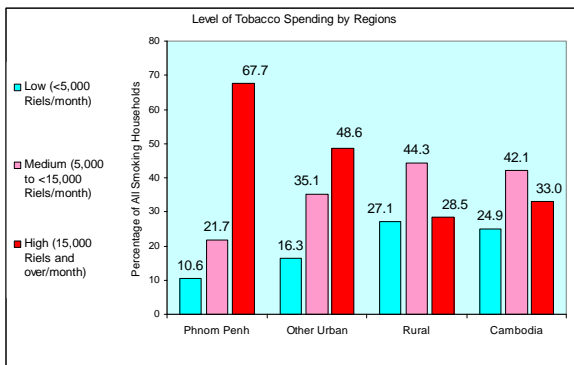
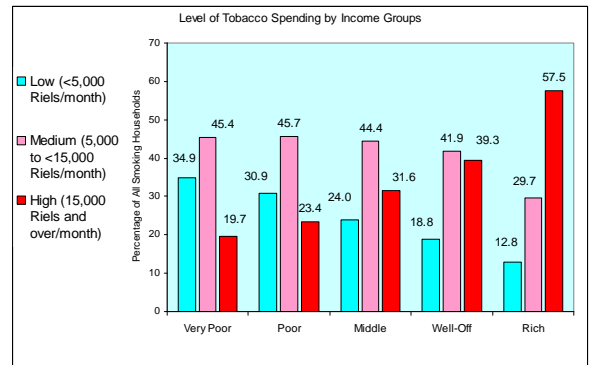


Figure 6. Smoking Expenditure on Tobacco Products by Income Groups



TOBACCO AND HOUSEHOLDS' EXPENDITURES

In this section, we try to see the difference between non-smoking and smoking households...

The monthly household spending on tobacco products nationwide was US\$5.83 million in 2004. The annual household expenditure on tobacco was over US\$57 million and exceeded most yearly-by-sector development assistance disbursement that Cambodia received from donor-communities each year between 1999-2001². This amount also exceeded most of the by-sector planned amount of socio-economic development program into the SEDP-II³ for 2001-2005 of the Royal Government of Cambodia.

5.1. Households' Expenditure and Tobacco Consumption

The share of specific expenditure in total expenditure for smoking and non-smoking households derived from the 2004-CSES is presented in Table 3 by income group and represented by graphs in Figure 7 by geographical location.

All statistics in Table 3 show that almost all non-smoking households have higher expenditure of clothing, education, housing and other miscellaneous products than that of smoking ones.

The bar graphs of expenditure share of non-smoking and smoking households in Figure 7 also present similar situations as the statistics in Table 3: non-smoking households have higher expenditure for clothing, education, housing and other miscellaneous products than that of smoking ones.

Almost all figures on medical care expenditure of smoking households in both the tables and the figure are higher than that of non-smoking ones. However, special research is required to provide appropriate interpretation that smoking is really a cause of higher spending on medical care in smoking households.

Consequently, we can say that most items of basic needs of Cambodian households are suffering due to spending on tobacco products.

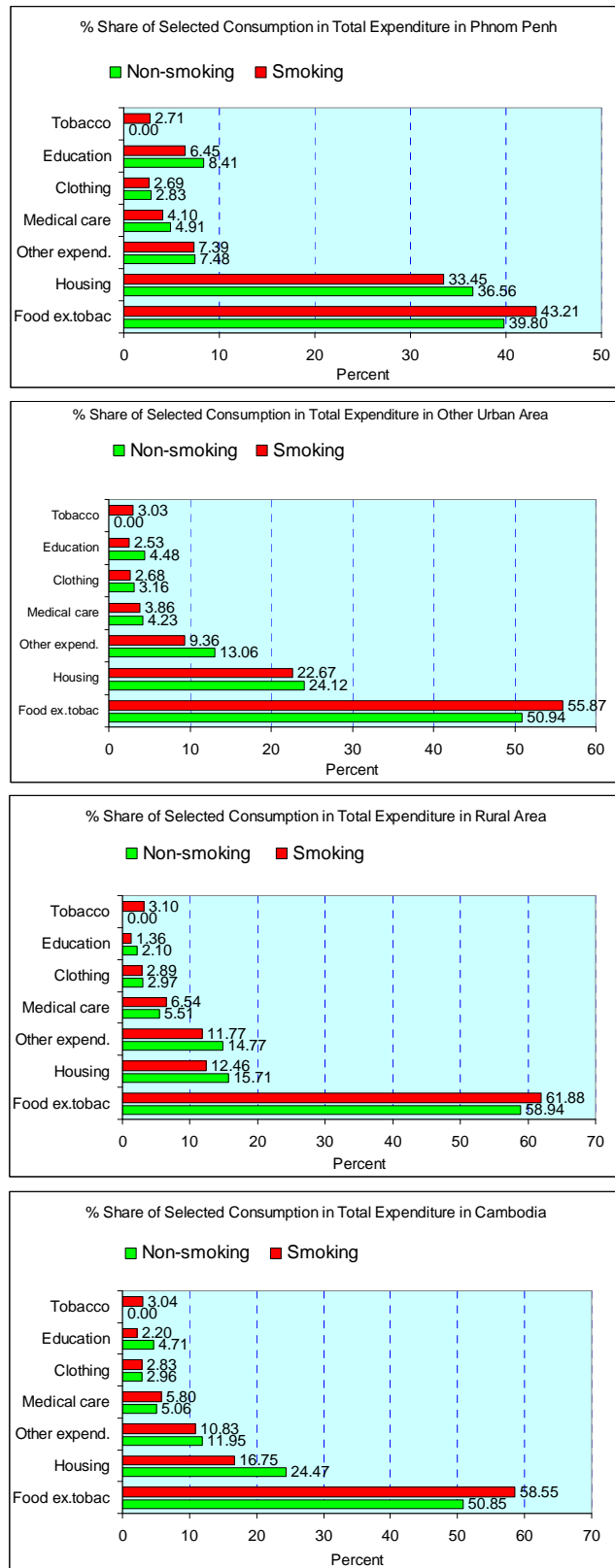
² Development Cooperation Report for the year 2001, Council for the Development of Cambodia, Cambodian Rehabilitation and Development Board, May 2002, page 18.

³ Socio-Economic Development Plan II (SEDP-II) for 2001-2005, the Royal Government of Cambodia.

Table 3. Average monthly households' expenditure in percentage of total expenditure

Smoking status	Income group	Food ex.tobac-alco	Clothing	Education	Medical care	Housing	Other expend.	Tobacco
Non-smoking	Very poor	67.29	2.80	1.28	7.54	14.85	6.24	0.00
	Poor	66.57	3.04	2.25	6.51	14.97	6.66	0.00
	Middle	65.46	2.97	2.73	5.51	15.59	7.74	0.00
	Well-off	57.84	3.01	3.67	6.12	20.86	8.50	0.00
	Rich	40.72	2.95	6.36	4.00	30.34	15.63	0.00
	All groups	50.85	2.96	4.71	5.06	24.47	11.95	0.00
Smoking	Very poor	68.76	2.70	1.34	6.97	12.69	3.92	3.62
	Poor	68.33	2.84	1.20	7.02	11.96	5.28	3.38
	Middle	65.04	2.92	1.53	6.49	15.26	5.56	3.21
	Well-off	63.51	3.15	2.05	6.48	14.33	7.26	3.21
	Rich	43.87	2.64	3.42	4.03	22.69	20.88	2.48
	All groups	58.55	2.83	2.20	5.80	16.75	10.83	3.04

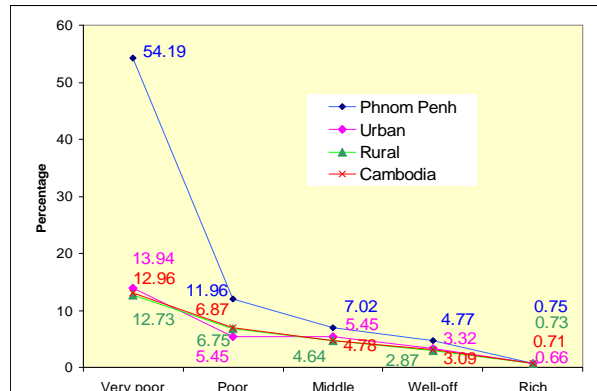
Figure 7. Average monthly households' expenditure on specific product in percentage of total expenditure



5.2. Average Share of Tobacco Consumption in Income

The graphical plotting of the amount in percentage of family's budget devoted to monthly purchase of tobacco products in various region as well as the whole of Cambodia reflects unique downwards pattern in a system of vertical axis of percentage with zero at the bottom and horizontal axis of increasing ranking of income groups from left to right with very poor on the far left and rich on the far right. This suggests that in each region, households in the poorer income groups allocate bigger share of income than the richer ones on tobacco spending.

Figure 8. Median share of tobacco consumption in income



By income groups, Phnom Penh households spend the biggest share of their income on tobacco, followed by Other Urban and Rural households, which nearly allocate the same share of income to tobacco spending. This pattern is the reverse of that of smoking prevalence in the respective region (Section 4.2 Smoking demography), but it is similar to the Figure 5 and 6 in section 4.3 on distribution of type of tobacco spenders. The most important message reveals by this figure is that poor households are allocating higher income share on tobacco products.

The 54% share from the very poor in Phnom Penh is obviously an outlier and the number requires a comment. I suggest looking at the number of respondents in this group and double-check their expenditures for accuracy. The following graph also indicates that there is a problem with this group.

5.3. Average Share of Tobacco Consumption in Total Expenditure

The graph below shows the percentage share of tobacco in total expenditure for Cambodian households in various regions by income group. Except for the region of Phnom Penh a noticeable downward trend of share in total expenditure is observed from the very poor to the rich income groups for the other regions. This means that the share of tobacco in total expenditure decreases as income rises. However, the corresponding share for the urban region is the highest as compared to Phnom Penh, rural areas and the whole Cambodia.

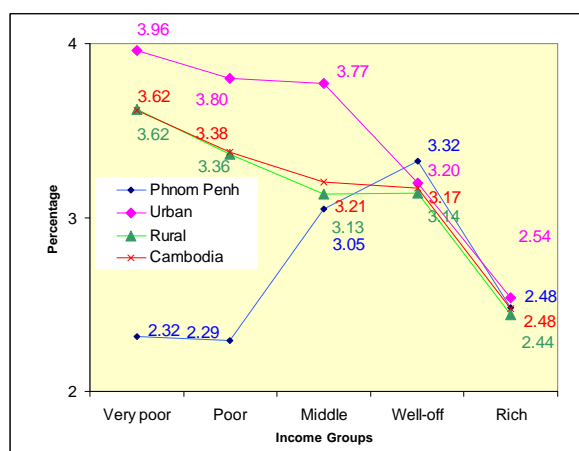


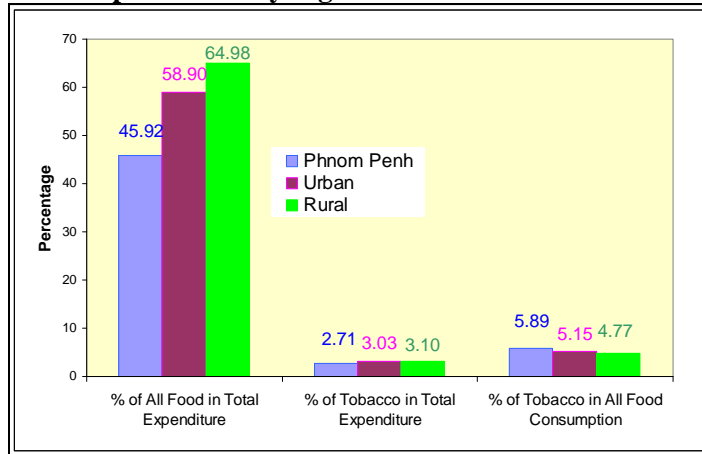
Figure 9. Mean share of tobacco consumption in total expenditure

For the region of Phnom Penh, tobacco spending of households in the Middle and Well-off income groups stands out as their share of tobacco spending to total expenditure is 3.05 and 3.32 percent, respectively, while the

corresponding figures for other income groups are less than 3 percent.

5.4. How Much Is Food Equivalence of Tobacco Consumption by Typical Smoking Household

Figure 4. Share of tobacco consumption in food expenditures by regions of Cambodia



In Figure 10 we analyze to what extent tobacco spending cut into spending on food by regions of Cambodia. Although for all income groups in each region there is an upward trend of food as well as tobacco share in total expenditure from Phnom Penh to other urban areas and to rural areas we observe a downward trend for food equivalence of tobacco in terms of spending. Hence, tobacco spending represents 5.89% of all food expenditure for households in Phnom Penh, 5.15% for those in other urban areas and 4.77% for those in the rural areas.

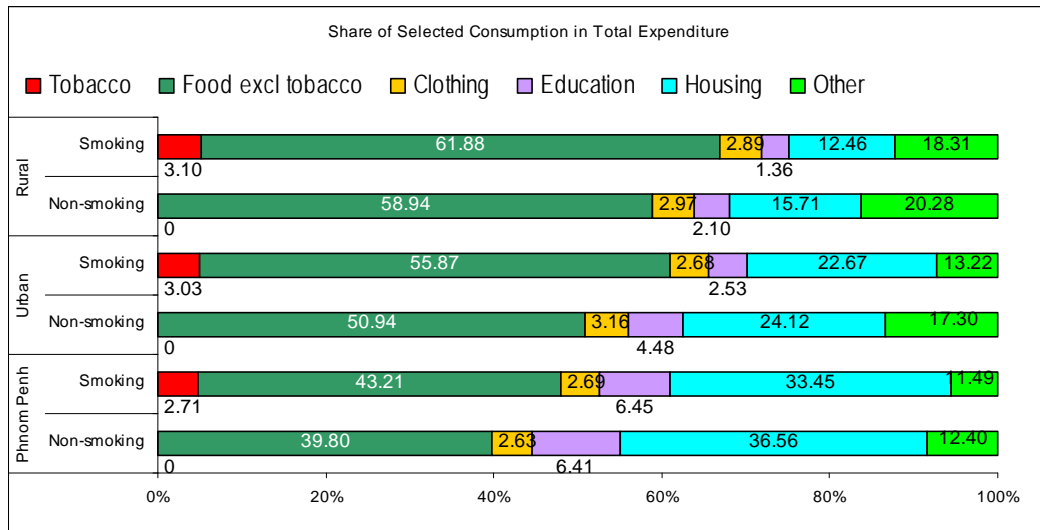
TOBACCO AND POVERTY

This Section tries to show how tobacco can affect households' welfare.

6.1. What Items of Basic Needs Suffer Most From Tobacco Spending

In Section 5 “Tobacco and Households’ Expenditure” we see how by every income group, smoking households lag behind non-smoking ones in terms of consumption on clothing, education, housing and miscellaneous expense. Here we look into the comparison of the analogous shares of expenditures of both smoking and non-smoking households by regions of Cambodia. We aggregate medical expenditure with miscellaneous expenditure. The graph reveals similar important facts on economic impacts of tobacco on households’ welfare in terms of satisfaction of the most basic needs in the family. Except food, all items of expenditures suffer the most from tobacco spending.

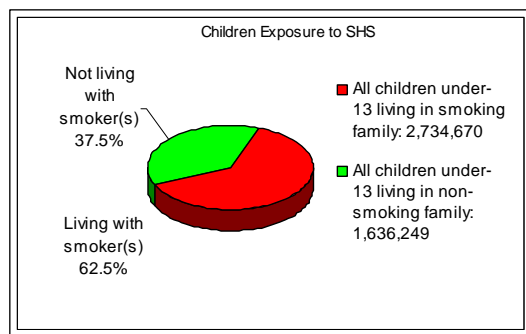
Figure 5. Share of specific consumption in total expenditure (Non-smoking and smoking households) (2004-CSES)



If households did not spend their income on tobacco, their education, clothing and especially housing expenditures can be significantly increased.

6.2. Possible Children Health Problem

Figure 6. Children exposure to SHS (2004-CSES)



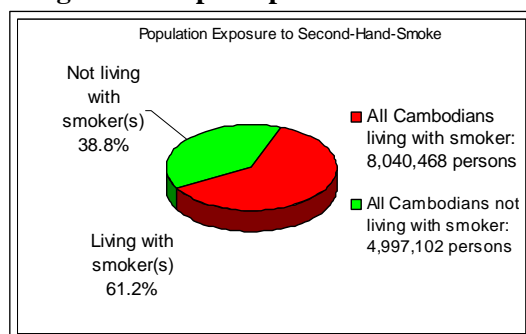
Children living long-term in smoking families will inevitably suffer from health problems due the exposure to second-hand-smoke (SHS)⁴.

According to the 2004-CSES data about 62.5% of Cambodian children under 13 years old live in households with at least one regular smoker in the family. This translates into more than 2.7 million children as victims of SHS.

In the future, these children having regularly been exposed to SHS would most probably suffer from diseases involving the respiratory tract such as lung diseases and breathing problems such as asthma (Health Canada). Risk of developing asthma among adult exposed to SHS during childhood will also increase (Health Canada).

6.3. Smoking and Potential Increase of Health Care Burden

Figure 7. People exposure to SHS

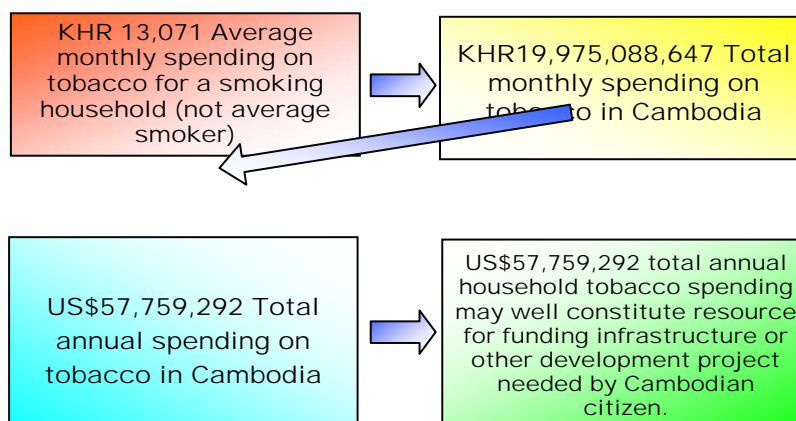


Not only children, but also all family members of smoking households will most probably seek health care due to the effect of SHS exposure the same manner as children would in the future. This will constitute one of the potential reasons for the increase need for health care in households as well as in the nation in the near future. The increase will pose a burden to the Cambodian economy in the future. However, the main burden is still the health impact of tobacco on smokers, and not on SHS

victims.

6.4. A Hidden Source of Financing

Figure 8. Hidden source of finance



Cambodians spend US\$57.75 million annually on tobacco products. This annual spending by Cambodian smoking households could easily fill the big deficit in the national budget and be a good source of financing for many of the useful projects for the reconstruction of the Cambodian society and economy.

⁴ . Curbing the Epidemic, World Bank, 1999.

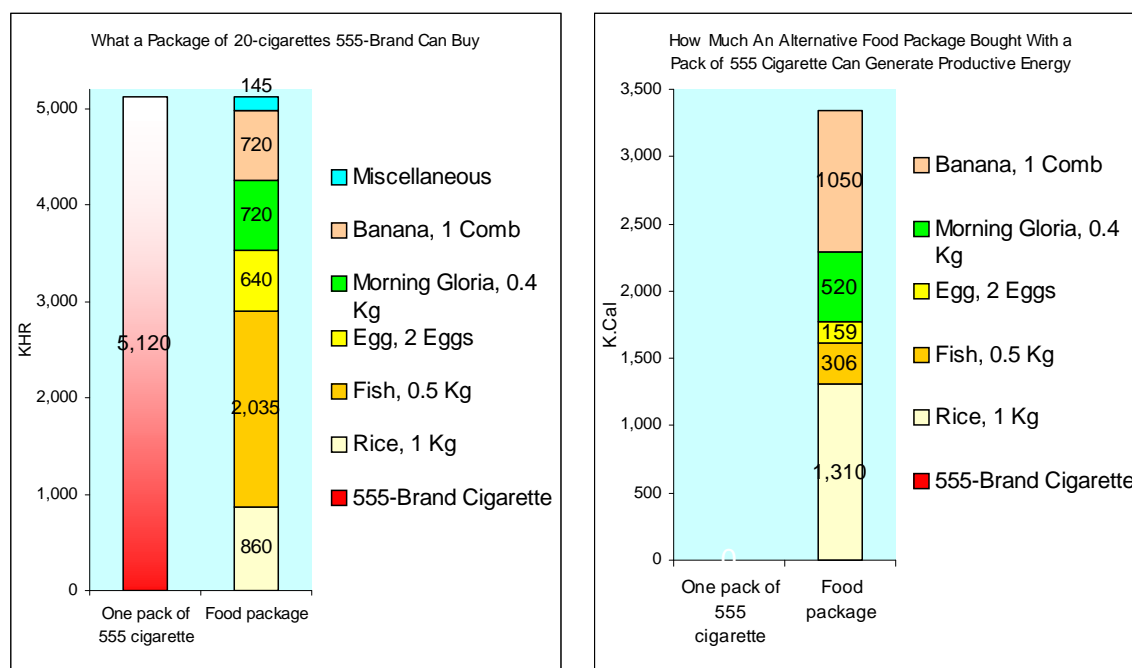
6.5. What a Pack of 555-Brand Cigarette Can Buy

The Table together with the graph below explain what a pack of 555-brand cigarette in Cambodia can buy.

Table 4. Food package equivalent to a pack of 555 cigarette (2004-CSES)

Tobacco and Food Items	Phnom Penh Region Price	Quantity	Amount, KHR	Food Package Content	Package Cost, KHR	Energy K.Cal
555-Brand Cigarette	5,120	0				
Rice, KHR/Kg		860	860	x	860	1,310
Beef, KHR/Kg		6,750	2,025			
Pork, KHR/Kg		13,560	4,068			
Chicken, KHR/Kg		7,470	2,241			
Fish, KHR/Kg		4,070	2,035	x	2,035	306
Egg, KHR/Egg		320	640	x	640	159
Morning Gloria, 1/4 KHR/Kg		180	720	x	720	520
Banana, KHR/Kg		720	720	x	720	1,050
Miscellaneous				x	145	
Total Package Cost, KHR					5,120	3,345

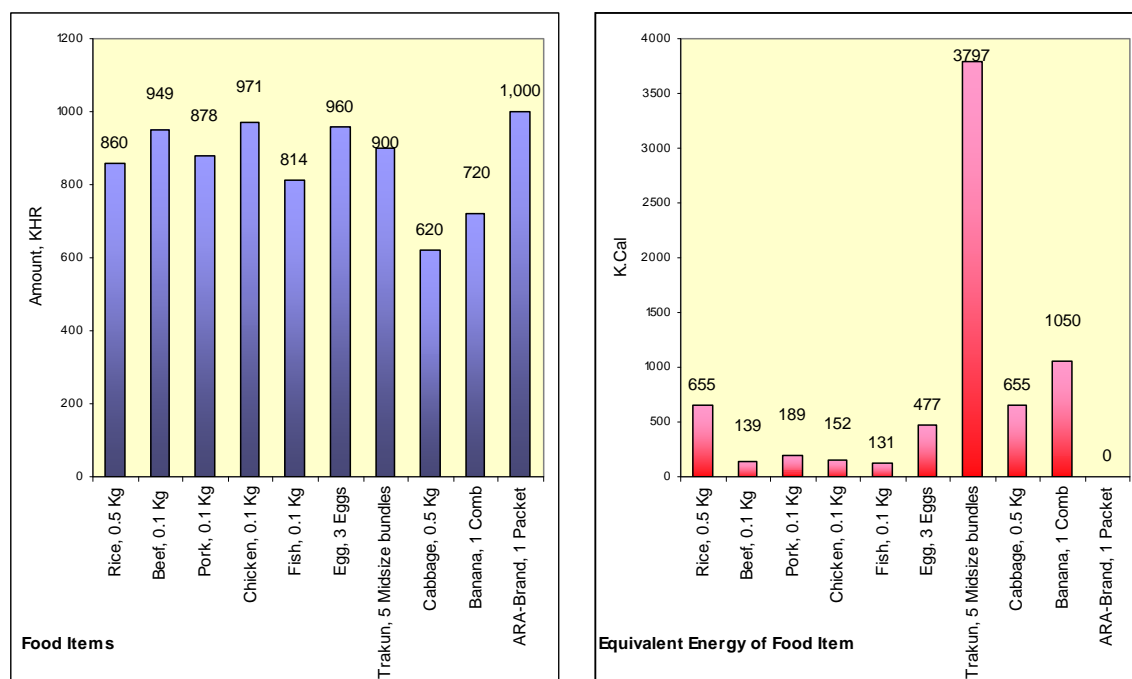
Figure 9. What a pack of 555 cigarette can buy and its energy equivalence (2004-CSES)



A pack of 555 can buy up to Kcal 3,345 of food energy which can support productive activity such as physical labor and education that helps improve standard of living and health status.

6.6. What a Pack of ARA-Brand Cigarette can Buy

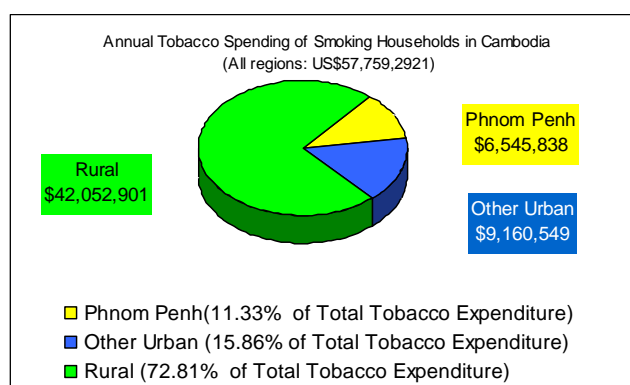
Figure 10. What a pack of ARA cigarette can buy (food equivalence in term of material and energy provided) (2004-CSES)



Even for more popular and cheap local cigarettes such as ARA the opportunity cost of smoking is striking. A variety of products can be purchased with the money spent on the cigarettes. Some of the selected useful nutritional substitute can provide up to 3,700 Kcal of energy to human body.

6.7. Areas Mostly Burdened by Tobacco Consumption

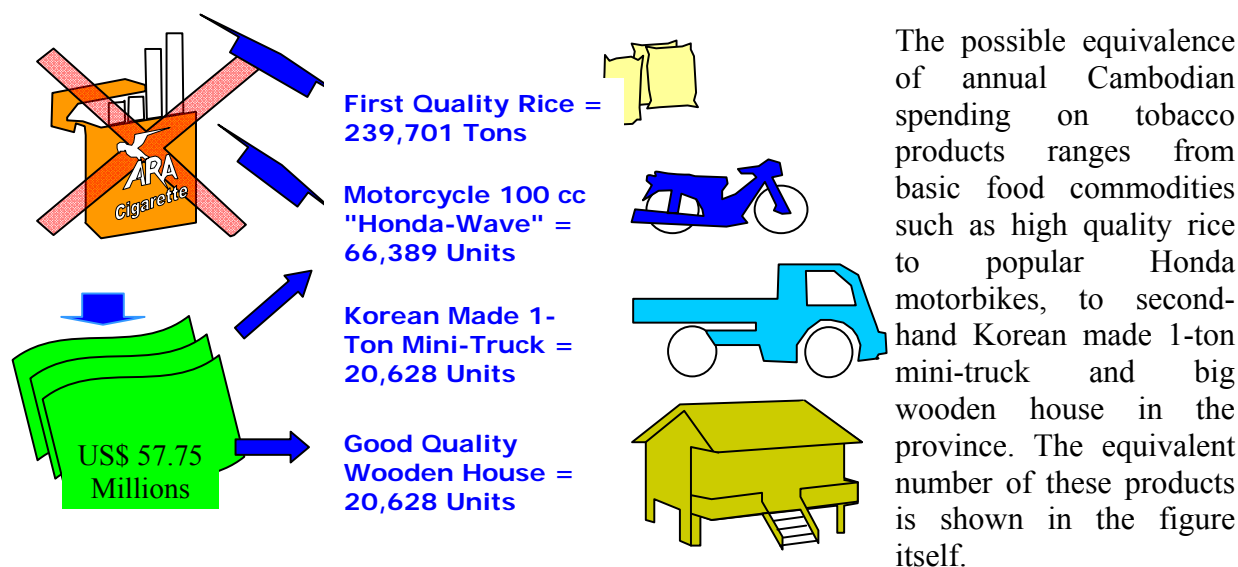
Figure 11. Areas mostly burdened by tobacco consumption (2004-CSES)



The total tobacco spending for the whole of Cambodia is evaluated to US\$57.75 million. While rural areas are the most populated region of Cambodia, they also bear the most burden of tobacco spending as the total tobacco spending in the Rural region is the highest in Cambodia. This further aggravates poverty in the rural areas, despite tremendous efforts of the Royal Government of Cambodia to alleviate poverty in Cambodia, especially in rural areas.

6.8. Equivalence of Annual Cambodian Tobacco Spending

Figure 12. Equivalence of annual Cambodian tobacco spending (2004-CSES)



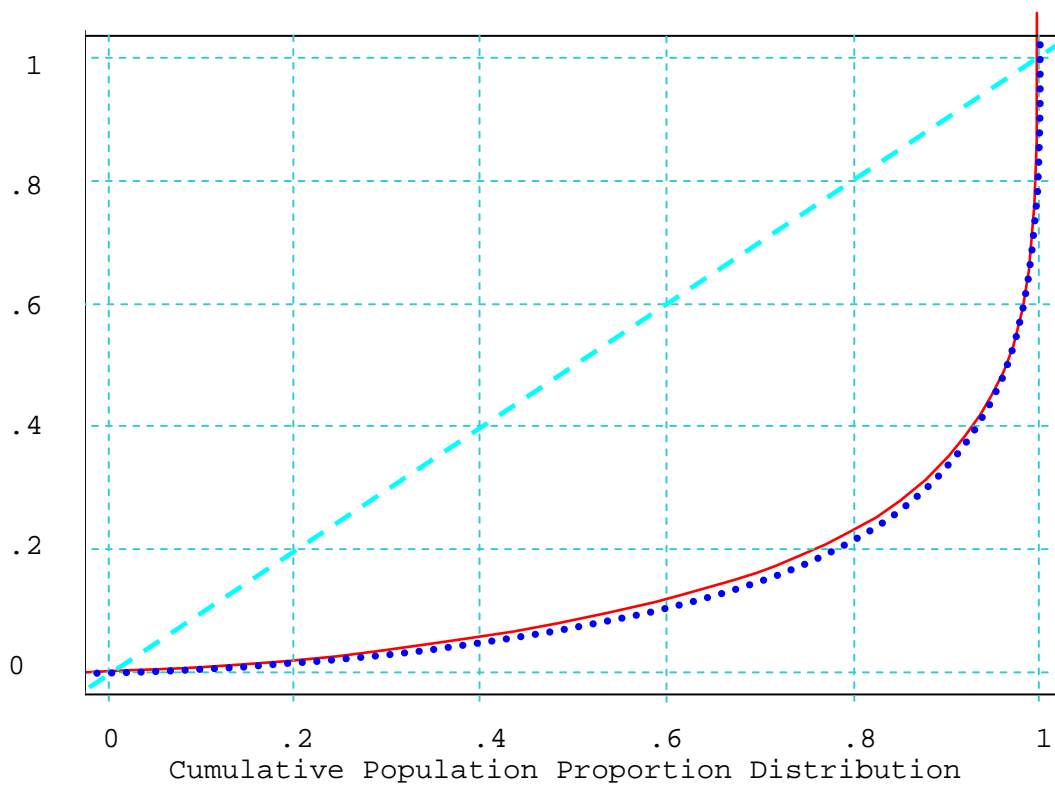
6.9. Inequality and Poverty Due to Tobacco

The prevailing poverty and inequality problem in Cambodian society can be attributed partly to the consumption of tobacco products. We will look into the result of superimposing two Lorenz curves to find out the increasing inequality in Cambodian society due to tobacco spending.

In a perfect society where income is fairly distributed among the population the graph plotting cumulative proportion of income against cumulative proportion of population will be a straight line running from zero to a total of one. The diagonal line in the rectangular box is the Lorenz curve representing perfect equality. However, in real social settings cumulative proportion of the population with their cumulative proportion of income does not follow the diagonal line, but lying below it. The more inequality in a society the further its Lorenz curve shifts away from the diagonal line.

Using STATA command we obtained 2 Lorenz curves. The dash curve shows the situation of current income distribution of households. Had tobacco been excluded from income, and the equivalent to a total disposable income is left behind by tobacco spending, the cumulative income against population proportion distribution would follow the other Lorenz curve represented by the continuous curve. It is worth noting that the latter curve is nearer to the diagonal than the previous one. This hypothetical scenario blazingly illustrated that inequality in the society would decrease if no spending on tobacco were made. In fact, any alternative to tobacco spending will just increase household welfare and standard of living which inevitably leads to subsequent reduction of inequality in the society.

Figure 19. Lorenz Curves with and without tobacco (2004-CSES)



MAXIMUM LIKELIHOOD ESTIMATION

In this section, we look into the statistical result of our regression estimate.

7.1. Result of the Maximum Likelihood Estimation

The number of households used in the estimation is 14,988 households. The iterative estimation was successfully completed at the 44th step and the result of the estimation is presented in the table below. The table also shows high fulfillment criteria of the constraints of additively, homogeneity and symmetry imposed on the estimated parameters. From the table in the Appendix a column showing P value indicates that nearly all parameters of the demand system are significant at 5% level of significance.

Table 5. Result of maximum likelihood estimation of the complete demand system

Equation No.	Aggregated Product group	Parameter of the estimated demand system							
		alpha	Gamma						beta
eq.1	food	0.3483	0.1079	0.0027	-0.0143	-0.0345	-0.0629	0.0010	-0.1289
	Std. Err.	0.0229	0.0081	0.0025	0.0034	0.0067	0.0036	0.0004	0.0017
eq.2	clothing	0.0488	0.0027	-0.0003	0.0045	-0.0029	-0.0037	-0.0003	-0.0020
	Std. Err.	0.0074		0.0019	0.0022	0.0028	0.0010	0.0001	0.0004
eq.3	education	0.0611	-0.0143	0.0045	0.0111	-0.0166	0.0171	-0.0018	0.0222
	Std. Err.	0.0122			0.0052	0.0044	0.0014	0.0001	0.0006
eq.4	medcare	0.0710	-0.0345	-0.0029	-0.0166	0.0382	0.0153	0.0005	0.0232
	Std. Err.	0.0164				0.0084	0.0028	0.0003	0.0012
eq.5	housing	0.4318	-0.0629	-0.0037	0.0171	0.0153	0.0393	-0.0051	0.0907
	Std. Err.	0.0201					0.0031	0.0003	0.0015
eq.6	tobacco	0.0391	0.0010	-0.0003	-0.0018	0.0005	-0.0051	0.0058	-0.0052
	Std. Err.	0.0018						0.0001	0.0003
Constraint verification		1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Additional steps were taken to integrate the computation of price and total expenditure elasticity into final stages of the maximum likelihood estimation. The complete result of the estimation of the demand system and the elasticity based on the resulted parameters is presented in the Appendix III. “Table of Result of Maximum Likelihood Estimation“. From that table a column showing P value indicates that all values of total expenditure elasticity, all values of own price elasticity, except tobacco, is significant at 5% level of significance. However, only a small number of the values of cross-price elasticity are significant at 5% level of significance.

A summary of the computation of the elasticity using the parameter estimate of the maximum likelihood is presented in two tables: a-) Uncompensated Own, Cross Price and Total Expenditure (Income) Elasticity; and b-) Compensated Own and Cross Price Elasticity. The computation is made at the whole sample mean value of expenditure share and logarithmic price. For a detailed comparison of computation at sub-sample mean value among non-smoking and smoking households is also shown in the same table. However, we will discuss only the results for Cambodia as a whole as shown in Table 8 and Figure 20.

a) Total Expenditure (Income) Elasticity:

All values of the total expenditure elasticity are of the expected sign, i.e. positive. Looking at Cambodia as a whole, the following observations can be made. Three expenditure items are greater than one: education, medical care and housing. These items are therefore considered as luxury products and are very elastic, with education the most elastic of all. Three other items of the expenditure have expenditure elasticity smaller than one, including tobacco with elasticity of 0.7834. These latter items are considered as necessity, which raise alarm for us as tobacco appear to be a necessary item, and it is the least responsive to change in total expenditure. Clothing and food items are fairly sensitive to total amount of available household budget for expenditure. These values fairly reflect the current pattern of consumption behavior of Cambodian households.

b) Own Price Elasticity

All 6 product items have negative own price elasticity, which are expected. We noticed that by absolute value of -1.0062 and -1.1436, respectively, clothing and housing are elastic items considered as luxury. With respect to its own price, tobacco is fairly inelastic with absolute elasticity of -0.7607. The most inelastic product item is medical care with absolute values of -0.2790.

c) Cross Price Elasticity

In terms of cross-price elasticity tobacco is a complementary product to clothing, education and housing, but a substitute for food and medical care. The cross-price elasticity of tobacco to food is 0.0447 which shows that it is highly inelastic. This further confirms that tobacco products continue to be consumed along with clothing and education, while being potential resource drainage for good nutrition provided by food, and necessary health care required in maintaining health fitness for income generation activity. In the current situation, when the price of food products is rising more rapid than that of cigarette the fight against tobacco can be more difficult.

Table 6. Total expenditure (income) and uncompensated own cross price elasticity computed at the sample mean and sub-sample mean

Uncompensated Own, Cross Price and Total Expenditure Elasticities								
		food	clothing	education	medcare	Housing	tobacco	tot-expend
not-Smoking:	food	-0.8498	0.0083	0.0076	-0.0163	0.0300		0.8239
	clothing	0.0729	-1.0059	0.1285	-0.0673	-0.0637		0.9464
	education	-0.4843	0.1303	-0.7454	-0.6795	0.0821		1.7360
	medcare	-0.7674	-0.0766	-0.4443	-0.2484	0.0004		1.5104
	housing	-0.4140	-0.0391	0.0200	-0.0039	-1.1317		1.5845
	tobacco							
Smoking:	food	-0.8519	0.0077	0.0052	-0.0153	0.0230	0.0034	0.8280
	clothing	0.0789	-1.0065	0.1375	-0.0723	-0.0707	-0.0094	0.9423
	education	-0.9147	0.2462	-0.5068	-1.2716	0.2039	-0.1292	2.3723
	medcare	-0.7210	-0.0704	-0.4087	-0.2994	0.0180	0.0047	1.4768
	housing	-0.5918	-0.0532	0.0394	-0.0083	-1.1555	-0.0561	1.8256
	tobacco	0.0265	-0.0055	-0.0265	0.0349	-0.0448	-0.8583	0.8737
Cambodia:	food	-0.8510	0.0079	0.0062	-0.0157	0.0259	0.0004	0.8263
	clothing	0.0763	-1.0062	0.1336	-0.0701	-0.0676	-0.0100	0.9441
	education	-0.6688	0.1799	-0.6432	-0.9333	0.1343	-0.0777	2.0088
	medcare	-0.7396	-0.0729	-0.4229	-0.2790	0.0110	0.0132	1.4903
	housing	-0.5025	-0.0461	0.0296	-0.0061	-1.1436	-0.0358	1.7044
	tobacco	0.0447	-0.0092	-0.0443	0.0595	-0.0734	-0.7607	0.7834

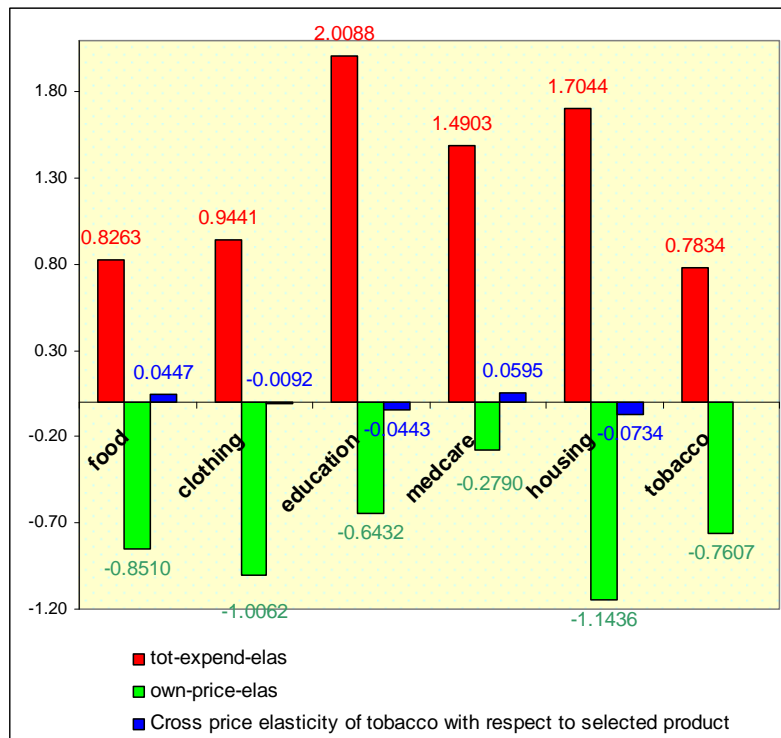
Table 7. Compensated own, cross price elasticity computed at the sample mean and sub-sample mean

Compensated Own, Cross Price Elasticities							
		food	clothing	education	medcare	housing	tobacco
not-smoking:	food	-0.2045	0.0298	0.0291	0.0256	0.1586	
	clothing	0.7182	-1.0048	0.1613	-0.0931	0.0876	
	education	0.6720	0.2295	-0.6909	-0.6688	0.3598	
	medcare	0.3729	-0.0573	-0.4412	-0.1532	0.1988	
	housing	0.6738	0.0433	0.0781	0.0632	-0.8896	
	tobacco						
smoking:	food	-0.2086	0.0340	0.0181	0.0301	0.1147	0.0118
	clothing	0.7283	-1.0085	0.1582	-0.1002	0.0376	0.1845
	education	0.8034	0.3384	-0.4877	-1.2898	0.4789	0.1568
	medcare	0.4705	-0.0722	-0.4324	-0.2050	0.1464	0.0928
	housing	0.7660	0.0107	0.0696	0.0698	-0.9608	0.0448
	tobacco	0.2674	0.1570	0.0532	0.0997	0.0849	-0.6621
Cambodia:	food	-0.2071	0.0323	0.0227	0.0282	0.1330	-0.0091
	clothing	0.7242	-1.0069	0.1593	-0.0971	0.0586	0.1619
	education	0.7310	0.2757	-0.6059	-0.9345	0.4038	0.1298
	medcare	0.4311	-0.0662	-0.4357	-0.1843	0.1681	0.0870
	housing	0.7211	0.0268	0.0727	0.0667	-0.9289	0.0415
	tobacco	-0.0697	0.2406	0.0833	0.1342	0.0848	-0.4733

Table 8. Selected uncompensated elasticity

Selected Elasticity						
	food	clothing	Education	medcare	housing	tobacco
tot-expend-elas	0.8263	0.9441	2.0088	1.4903	1.7044	0.7834
own-price-elas	-0.8510	-1.0062	-0.6432	-0.2790	-1.1436	-0.7607
Cross price elasticity of tobacco with respect to selected product	0.0447	-0.0092	-0.0443	0.0595	-0.0734	

Figure 13. Own, cross price and total expenditure elasticity for non-smoking households



7.2. Tobacco, Poverty and Socio-Economic Status

The result of the estimation of the demand system and the derived values of elasticity show that tobacco is still a threat to Cambodian households' well-being as it is considered as a product of necessity, and is fairly inelastic with respect to its own price. It is a substitute product to food and medical care, while being a complementary product to other items of basic needs, including clothing and education, which can pose a serious threat to investment in human resource development and knowledge enhancement. This can further trigger the aggravation of household poverty.

CONCLUSION AND RECOMMENDATIONS

A. Conclusion: Hidden Resource and Potential Risks behind Households Consumption of Tobacco

The values of cross-price elasticity have shown that tobacco is a substitute item to product of the food group and a complement for other products of basic needs. This fact supports our research findings about opportunity cost of tobacco product and the difficulty in the fight against tobacco consumption as cross-price elasticity of tobacco to food is 0.0447 witnesses that it is highly inelastic with consequent of persistent consumption of tobacco products aggravated by the intensive marketing and promotion strategy currently implemented by the tobacco industry in Cambodia. The monthly household spending on tobacco products nationwide was US\$5.83 million in 1999. The annual household expenditure on tobacco was over US\$69 million and exceeded most yearly-by-sector development assistance disbursement that Cambodia received from donor-communities in each of the year between 1999-2001⁵. This figure drops slightly to US\$57.75 million per year according to the 2004 survey database using a different, diary methodology of data collection compared to the random sampling method used for the 1999 survey. However, this amount still exceeds most of the by-sector planned amount of socio-economic development program in the SEDP-II⁶ for 2001-2005 of the Royal Government of Cambodia.

In terms of health conditions, 61.2% of the Cambodian population or 8.065 million Cambodians would need health care in the future as a result of secondhand smoke.

B. Recommendations

As a consequence, the following important recommendations are proposed:

- Mobilized efforts are needed to tackle tobacco consumption.
- Intensive anti-tobacco awareness campaign should be implemented in Cambodia, especially in the rural areas, where the level of education of the population is low and facts about tobacco-related diseases are not known, neither recognized.
- An efficient starting point of the tobacco control policy will be naturally the increase of tobacco tax to reduce demand of tobacco products.
- The measures should be accompanied by the adoption of strict marketing regulation for tobacco products to reduce the public's exposure to tobacco products and instead promote more educational programs to raise the awareness of the risk of tobacco products.
- Tobacco control must be incorporated into the poverty alleviation strategy of the Royal Government of Cambodia.
- To be effective as a component of the poverty alleviation strategy the tobacco control policy must comprise a complete package of measures that would tackle the issues in all its social and economic dimensions.

⁵ Development Cooperation Report for the year 2001, Council for the Development of Cambodia, Cambodian Rehabilitation and Development Board, May 2002, page 18.

⁶ Socio-Economic Development Plan II (SEDP-II) for 2001-2005, the Royal Government of Cambodia.

C. Policy Implications

The implications derived from the research discussion and conclusion can be expressed in terms of strategic measures suggested so to ensure an efficient tobacco control policy while ensuring the highest success of the poverty alleviation program of the Royal Government of Cambodia. :

- To mobilize efforts from a wide range of supporters to tackle tobacco control.
- To conduct more educational programs to raise the awareness of the eminent risk of tobacco products.
- To explicitly provide more evidence that link tobacco control to that of increasing success of the Royal Government of Cambodia in implementing the poverty alleviation program.
- To use the evidence found through researches to persuade the Royal Government of Cambodia to incorporate tobacco control measures as a component of the poverty alleviation strategy.
- To help elaborate an effective and complete package of measures that would make tobacco component the most important contribution to the poverty alleviation program of the Royal Government of Cambodia.

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APPENDICES

Appendix I. Survey Questionnaire for 2004-CSES: Diary Record

WEEK 3

09. NUTRITION

A. RICE CONSUMPTION

Respondents: All household members

Please provide information on nutrition for the household members

How much rice did ..[NAME].. eat yesterday?						
ID NUMBER	Show the plate and enter number of plates. If a person didn't eat rice, enter "0" for that meal. Enter "99" if data is not available for a person. Note: If the quantity of rice is less than one plate, please record a half (0.5) or a quarter (0.25) of plate					
	For breakfast	For lunch	For dinner	Other	TOTAL	
	(1)	(2)	(3)	(4)	(5)	(6)
	01					
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						

B. OTHER FOOD

Respondent: head of household, spouse of the head of household, or of another adult household member

Note: a palm is approximately 50 grams

FOOD NUMBER	TYPE OF FOOD	2. How many times in the past 7 days did your household consume ..[FOOD ITEM].. at home? <small>If never, write '0' and ==> Next Item</small>	3. How much in total did the household consume of this food in the last 7 days?	UNIT
(1)		(2)	(3)	
1	Eggs (any)			NUMBER
2	Fish/fish paste, squid, shrimp and prawns, etc.			KILOGRAM
3	Other meat (beef, pork, chicken, duck, etc.)			KILOGRAM
4	Green leafy vegetables			KILOGRAM
5	Orange vegetables (pumpkin, carrot, orange sweet potato, etc.)			KILOGRAM
6	Orange fruits (Ripe mango, ripe papaya, jackfruit, etc.)			KILOGRAM

C. VULNERABILITY

1 Did your family use iodized salt, yesterday?

1=Yes
2=No
8=Don't know

2 In the last 12 months, has this household had enough food all days or were there days and weeks with very little or no food so that the household had to starve?

1= Enough food all the last 12 months
(=>>NEXT SECTION)
2= Not enough food

3 How many of the last 52 weeks did the household have so little food that it was starving?

N° WEEKS:

Write 0 if less than 1 week

07. DURABLE GOODS AND OTHER EXPENSES

Respondent: head of household, spouse of the head of household, or of another adult household member

WEEK 3

A DURABLE GOODS

ITEM NUMBER	How many of the following items does the household own? (Write '0' if none and => Next item)		Did you buy it, receive it as a gift, as pay for work or in other way?				How many of this(these) this .[ITEM]. were acquired or received...		For items bought or received within the last 12 months: What was the purchase value (or the imputed value) of all these .[ITEM]s.?	For items bought or received before the last 12 months: According to current prices, what do you think you could get if you sold .[ITEM]s.?
	ITEM	PRODUCT CODE	NUM-BER	1-Purchased	2-Payment for services	3-Received as a gift	4-Other (specify)	a. Within the last 12 months?		
(1)	(2)	(3)	(4a)	(4b)	(4c)	(4d)	(5a)	(5b)	(6)	(7)
Communication equipment										
01	Radio	801								
02	Television	802								
03	Telephone	817								
04	Cell phone	818								
05	Video tape/Recorder/ player	807								
06	Stereo	808								
07	Camera	809								
08	Satellite dish	824								
Personal transport										
09	Bicycle	803								
10	Motorcycle	804								
11	Car	829								
12	Jeep/Van	830								
Household equipment										
13	Sewing machine	806								
14	Refrigerator	810								
15	Kitchen/Stove	813								
16	Washing machine	819								
17	Dishwasher	820								
18	Freezer	821								
19	Vacuum cleaner	822								
20	Electric iron	823								
21	Electric fan	811								
22	Air conditioner	812								
23	Suitcases									
24	Generator	816								

WEEK 3

A DURABLE GOODS

ITEM NUMBER	How many of the following items does the household own? (Write '0' if none and => Next item)		Did you buy it, receive it as a gift, as pay for work or in other way?				How many of this(these) this .[ITEM]. were acquired or received...		For items bought or received within the last 12 months: What was the purchase value (or the imputed value) of all these .[ITEM]s.?	For items bought or received before the last 12 months: According to current prices, what do you think you could get if you sold .[ITEM]s.?
	ITEM	PRODUCT CODE	NUM-BER	1-Purchased	2-Payment for services	3-Received as a gift	4-Other (specify)	a. Within the last 12 months?		
(1)	(2)	(3)	(4a)	(4b)	(4c)	(4d)	(5a)	(5b)	(6)	(7)
25	Batteries									
Furniture										
26	Sofa set	814								
27	Dining set (dinning table + chairs)	815								
28	Bed sets									
29	Wardrobe, cabinets									
Computers										
30	PC	825								
31	Printer	826								
Recreation										
32	Musical instruments	827								
33	Sport instruments	828								
Water transport										
34	Rowing boat	831								
35	Motor Boat	832								
Agriculture										
36	Cart (pulled by animal)	805								
37	Tractor	833								
38	Bulldozer	834								
39	Plough	835								
40	Threshing machine	837								
41	Harrow/trake/hoes/spade/axe...	838								
42	Semi-tractor (Kou Yon)	839								
43	Rice mill	840								
44	Water pump	836								
Other items										
45	Other (specify)	841								
46	Other (specify)									

WEEK 3

B OTHER EXPENDITURES

No.	ITEM	Time period	Value (in Riels)		
			In-cash expenditure	In-kind exp. or gifts given away	Total expenditure (Col 3 + Col 4)
(1)	(2)	(3)	(4)	(5)	
1	Clothing and footwear (tailored clothes, ready-made clothes, rain clothes, underwear, baby clothes, diapers, hats, shoes, boots, etc.)	Last 6 months			
2	Furnishings and household equipment and operation (curtain, household appliances, cooking utensils, servant's salary etc.)	Last 6 months			
3	Recreation (entertainment services, recreational goods and supplies, tourist travel)	Last 12 months			
4	Personal effects (costume/gold jewellery, handbags, wallets, wristwatch, clocks, umbrellas)	Last 12 months			
5	Special occasions, as funerals, weddings, parties, rituals, cash gifts, charity, etc.	Last 12 months			
6	Total 1 - 5				

14. HEALTH

Respondent: the head of household or the spouse of the head of household

WEEK 4

The following questions should be asked of the head of household, spouse of the head of household, or of another adult household member, if both head and spouse are absent.

A ILLNESSES DURING THE PAST 4 WEEKS Please provide information on all members usually residing in this household

ID NUMBER	How would you evaluate [NAME]'s health? 1=Very good 2=Good 3=Average 4=Bad 5=Very bad 6=Don't know	Compared with others of the same age would you say that [NAME]'s health is..... 1 - Much better 2 - Some what better 3 - About the same 4 - Some what worse 5 - Much worse 6 - Don't know	Does [NAME] have any disability? 01-Seeing difficulties 02-Hearing difficulties 03-Speaking difficulties 04-Moving difficulties 05-Feeling difficulties 06-Psychological difficulties 07-Learning difficulties 08-People who have fits 09-Other (specify) Enter 00 if none, =>> 6	What was the cause of the disability? 01-MeetUXO 02-Traffic Accident 03-Work Accident 04-Disease(s) 05-Old age 06-Congenital 07-Fever 08-Difficultly Delivery 09-Chemical Accident 10-Rape 11-Violent Attack 12-Domestic Violent 13-Suicide Attempt 14-Mental Trauma due to war and other traumatic events 15-War injuries 16-Malnutrition 17-Burns 18-Torture 19-Bad Luck 20-Other (specify) 21-Don't know			Did [NAME] have any illness, injury or other health problem in the past 4 weeks? 1=Yes 2=No (=>> 13)	What kind of illness, injury or other health related symptom? 01-STOMACH ACHE 02-BACK PAIN 03-HEADACHE 04-EAR PAIN 05-EYE PAIN 06-FEVER 07-DIARRHOEA 08-COLD & COUGH WITHOUT RAPID OR DIFFICULT BREATHING 09-COLD & COUGH WITH RAPID OR DIFFICULT BREATHING 10-BROWNHIT 11-PLEURISY 12-TUBERCULOSIS 13-DIABETES 14-DISEASE OF URINARY SYSTEM 15-DISEASE OF THE HEART 16-ARISLES 17-HYPERTENSION 18-TYPHOID FEVER 19-CHOLERA FEVER 20-CHICKENPOX 21-MENINGITIS 22-ENCEPHALITIS 23-CANCER 24-GENECLODY 25-AUTISMOSS AND OTHER NUTRITIONAL DEFICIENCIES 26-ANEMIA 27-JAUNDICE 28-SKIN DISORDER 29-EPHROSY 30-MALARIA 31-FOOD BORNE DISEASE 32-WATER BORNE DISEASE 33-MENTAL DISORDERS 34-GROPSY (SWALLEN BELLY) 35-ARDS 36-MINE INJURY 37-ROAD ACCIDENT 38-OTHER INJURY 39-ANTENATAL CARE 40-POSTNATAL CARE 41-OTHER CARE NEED (
				1	2	3			1	2	3
				(1)	(2)	(3)			(4a)	(4b)	(4c)
01											
02											
03											
04											
05											
06											
07											
08											
09											
10											
11											
12											

A ILLNESSES DURING THE PAST 4 WEEKS (CONTINUED)

WEEK 4

The following questions should be asked of the head of household, spouse of the head of household, or of another adult household member, if both head and spouse are absent.

ID NUMBER	Did [NAME] seek care for any health problem in the past 4 weeks? 1=Yes 2=No (=>>10)	Which provider is usually consulted for care? 01 = Health Center 02 = Referral (or District) Hospital 03 = Provincial Hospital 04 = National Hospital 05 = Private Hospital 06 = Private Clinic 07 = Doctor's or Nurse's Home 08 = Dedicated drug store 09 = Other stop selling drugs 10 = Patient's home/ Dw	Was [NAME] hospitalised for the treatment/care during past 4 weeks? 1=Yes 2=No (=>> 12)	How many days was [NAME] hospitalised during past 4 weeks? N° OF DAYS	How much in total was spent on medical care in the past 4 weeks? RIELS	Does [NAME] use (hammock) mosquito net while sleeping? 1=Yes 2=No (=>> Next Person)	Were [NAME] nets impregnated with safe pyrethroid insecticide to prevent malaria transmission during the past 12 months, that is since [MONTH], last year? 1=Yes 2=No 3=Don't know
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							

14. HEALTH (CONTINUED)

For all household members aged 15 and over

WEEK 4

B SMOKING INFORMATION

Please provide smoking information on all members of household aged from 15 years old and over

ID NUMBER	Are you a daily smoker? 1=Yes (=>> 5) 2=No	Does it sometimes happen that you are smoking? 1=Yes 2=No	Have you, at any time during your life, been a daily smoker? 1=Yes (=>>6) 2=No (=>>7)	How many cigarettes are you usually smoking per day? No OF CIGARETTES	For how many years in total have you been smoking daily? YEARS	Do you think smoking cigarettes can be harmful to one's health? 1=Yes 2=No 3=Don't know
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						

08. CONSTRUCTION ACTIVITIES IN THE PAST 12 MONTHS

Respondent: head of household, spouse of the head of household, or of another adult household member

WEEK 3

1 Does the household own buildings used for residential, agricultural, commercial or industrial purposes? 1 = Yes 2 = No (=> NEXT SECTION)

Please fill up the following table below

BUILDING NUMBER	What is the building used for?			What is the total area for living or other use of the building?	How much would you have to pay to buy a building like this in the village?	How much would you have to pay per month to rent a building like this in this village?	Is any part of this building rented-out?	How much does your household receive in monthly rent for this building?	Was this building constructed, extended or repaired in the last 12 months, that is, since ..[MONTH].. last year?	What kind of work was it?	In what year and month did the construction start?		In what year and month did people start to use this building?	
	1=Residential 2=Agricultural 3=Commercial (purchase/sale of goods and services) 4=Industrial (manufacturing)	SQUARE METERS			RIELS	RIELS	1=Yes 2=No (=> 9)	RIELS	1=Yes 2=No (=> NEXT BUILDING)	1=Constructed 2=Extension (=> 14) 3=Repair (=> 14)	MONTH	YEAR	MONTH	YEAR
(2)	(3a)	(3b)	(3c)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11a)	(11b)	(12a)	(12b)
1														
2														
3														
4														

BUILDING NUMBER	Who built this building?	How much did you pay those who helped, hired or contracted?	How much did you spend for materials?	If not possible to separate labour and materials: How much were the total costs?	If anyone in the household has put in own labour try to estimate the value of it as if you had engaged someone to do it?	If anyone else not belongin to the household has put in own labour try to estimate the value of it as if you had engaged someone to do it?	For buildings not yet completed: What will be the estimated remaining cost of the building completed?
	1=Household members only 2=Household members and other relatives 3=Household members and hired help 4=Contracted builder 5=Other (specify)	Write '0' if nothing For building still under work the cost up till now	Write '0' if nothing For building still under work the cost up till now	RIELS	RIELS	RIELS	RIELS
(1)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1							
2							
3							
4							

Appendix II. Table of Data Description

Table 9. Data description and descriptive statistics

Descriptive Statistics						
Variable	Label	N	Minimum	Maximum	Mean	Std. Deviation
Q00_PROV	Province	15000	1	24	9.746	6.42631858
urbanity	Urbanity	14984	1	3	2.67371863	0.6372186
fsize	Household size	14984	1	15	4.98658569	2.00273963
hhsex	Sex of head	14984	1	2	1.22217032	0.4157189
hhage	Age completed of head	14983	18	95	45.1444971	13.7430464
hheduc	Highest level completed of head	15000	0	4	2.32753333	1.25987873
hhmarit	Marital status of head	15000	1	3	2.18026667	0.42526382
income	Household monthly income	14970	700	337146000	882548.673	4662866.76
expend	Household monthly expenditure	15000	8170	20424470	481015.135	711891.637
food	Food consumption excluding tobacco	15000	6520	4499490	263868.197	201771.548
clothing	Clothing spending	15000	80	666670	13923.1807	22740.376
educ	Education spending	15000	30	2544960	16356.1953	67038.0062
health	Medical spending	15000	540	7061010	26231.002	138359.907
housing	Housing spending	15000	8.0659E-304	20000000	98349.4613	438582.128
tobacco	Total tobacco spending	15000	0	456250	7612.6116	13610.0847
tobastat	Smoking status of household	15000	0	1	0.5824	0.49317994
groupinc	Group of income	14970	1	5	3.02130929	1.42180331

Report
Mean

tobastat	urbanity	groupinctob	Income	Total expenditure	All Food	Food excl. tobacco	Clothing	Education	Health care	Housing	Tobacco
Withouttobacco	Phnom Penh	Very poor	53556	896211	377845	377845	28801	70080	158669	253938	0
		Poor	150037	688007	314609	314609	17610	61491	50675	228167	0
		Middle	263346	749217	334682	334682	15624	53397	55384	211686	0
		Well-off	511853	783966	367755	367755	19003	47218	47575	254285	0
		Rich	3389618	1495065	565969	565969	44295	134233	63752	569915	0
		Total	2281229	1226684	488273	488273	34753	103119	60250	448485	0
	Urban	Very poor	71281	327510	235824	235824	9430	4515	9241	40521	0
		Poor	151498	372340	232660	232660	12358	11034	19615	85577	0
		Middle	257654	435429	264659	264659	13339	13125	14994	95470	0
		Well-off	495260	507939	307217	307217	17459	21162	21824	106205	0
		Rich	4407597	1006351	442454	442454	31074	51749	43433	264414	0
		Total	1990701	673192	342931	342931	21283	30178	28504	162349	0
	Rural	Very poor	69345	227357	155272	155272	6292	2037	16826	32523	0
		Poor	144918	265896	183892	183892	8060	4053	17677	31702	0
		Middle	246148	292858	208339	208339	9181	5023	16581	32800	0
		Well-off	458970	400140	253826	253826	12742	7992	27828	54781	0
		Rich	3110271	800702	343450	343450	22771	24658	26919	167559	0
		Total	690618	373456	220120	220120	11087	7827	20580	58665	0
	Total	Very poor	69249	242325	163070	163070	6782	3100	18281	35977	0
		Poor	145790	290098	193113	193113	8814	6527	18872	43440	0
		Middle	248915	343218	224668	224668	10196	9368	18921	53501	0
		Well-off	476563	495460	286570	286570	14912	18181	30329	103368	0
		Rich	3518280	1093039	445048	445048	32294	69509	43766	331623	0
		Total	1144378	552793	281092	281092	16365	26063	27950	135241	0
Withouttobacco	Phnom Penh	Very poor	44500	1040852	502830	478714	56717	75428	78289	308200	24116
		Poor	155900	813413	432953	414302	17864	50511	15791	293308	18651.08
		Middle	252776	582695	316704	298952	8186	40396	72258	116912	17751.56
		Well-off	488244	613670	378071	354771	16450	32097	24256	143164	23300.43
		Rich	4756058	1426713	598263	562820	38479	95053	51877	518083	35442.94
		Total	2953050	1104035	506947	477080	29696	71232	45221	369351	29866.83
	Urban	Very poor	70244	247479	191496	181701	6810	8431	11129	23398	9795.248
		Poor	150697	313237	224808	212898	7295	4178	13058	45139	11909.43
		Middle	249049	359575	270545	256983	9297	4483	15502	49118	13562.58
		Well-off	494624	513012	333691	317281	15687	11823	23880	108807	16410.1
		Rich	3617636	934919	445421	421704	24147	28676	30393	266428	23716.84
		Total	1261386	546320	321804	305235	14654	13797	21079	123860	16569.3

	Rural	Very poor	71321	250519	181884	172808	6590	2565	17913	31333	9076.249
		Poor	145742	292578	210876	201041	8474	3174	21564	32942	9835.298
		Middle	244438	361794	245069	233734	10935	5008	23861	55425	11334.92
		Well-off	459792	421187	285760	272544	13612	6565	30691	47911	13215.45
		Rich	2449690	729906	352883	335079	19259	11987	34000	85052	17803.66
		Total	473457	372411	241984	230450	10778	5081	24344	46393	11533.59
	Total	Very poor	71092	254758	184395	175181	6889	3403	17760	32317	9213.466
		Poor	146181	297584	213395	203345	8448	3563	20887	35585	10049.44
		Middle	245142	365488	249418	237700	10689	5579	23724	55769	11717.87
		Well-off	467363	449597	300003	285555	14145	9236	29148	64421	14447.6
		Rich	3133625	902816	418413	396067	23853	30831	36414	204817	22345.78
Total		695193	430499	265130	252056	12202	9455	24971	72122	13074.08	
Total	Phnom Penh	Very poor	50073	951842	425916	416641	39538	72137	127753	274808	9275
		Poor	151809	725920	350388	344749	17687	58171	40129	247860	5639
		Middle	259890	694777	328805	323001	13193	49147	60900	180702	5803
		Well-off	503918	726731	371222	363391	18145	42136	39738	216939	7831
		Rich	3795081	1474783	575551	565034	42569	122607	60228	554535	10517
		Total	2490208	1188532	494082	484791	33180	93200	55575	423870	9290
	Urban	Very poor	70612	275890	207233	200915	7741	7041	10459	29477	6318
		Poor	151040	338534	228169	221356	9462	7112	15864	62447	6812
		Middle	252463	389676	268209	260029	10901	7912	15300	67512	8181
		Well-off	494939	510499	320578	312296	16564	16448	22862	107518	8282
		Rich	4061787	975081	443753	433370	28041	41649	37725	265296	10382
		Total	1610929	607127	331930	323302	17831	21648	24638	142307	8628
	Rural	Very poor	70525	241181	171155	165738	6470	2352	17475	31812	5417
		Poor	145474	283900	202100	195464	8339	3460	20300	32539	6637
		Middle	245018	338407	232608	225119	10340	5013	21391	47749	7489
		Well-off	459488	413415	273968	265633	13290	7092	29634	50448	8336
		Rich	2753514	762468	348544	338929	20874	17815	30743	123000	9615
		Total	554408	372800	233834	226599	10893	6105	22941	50967	7234
	Total	Very poor	70351	249763	175828	170316	6846	3281	17969	33788	5512
		Poor	146048	295043	206509	199872	8572	4569	20203	38252	6638
		Middle	246494	357507	240548	233029	10512	6937	22003	54956	7518
		Well-off	471301	469226	294254	285989	14473	13064	29654	81090	8264
		Rich	3345419	1007555	433078	423036	28501	52128	40462	274637	10042
		Total	882549	481508	271787	264167	13938	16383	26213	98449	7621

Appendix III. Table of Results of Maximum Likelihood Estimation

(using modified code originally contributed by Dr. Brian P. Poi, Expert at STATA Corp.)
 “lnl_laidsig_1cam.log” recorded session of the estimation.

	Coef.	Std. Err.	z	P>z	[95% Conf. Interv]	
Alpha						
1	0.3483	0.0229	15.20	0	0.3034	0.3932
2	0.0488	0.0074	6.58	0	0.0343	0.0633
3	0.0611	0.0122	5.02	0	0.0372	0.0849
4	0.0710	0.0164	4.33	0	0.0389	0.1031
5	0.4318	0.0201	21.52	0	0.3925	0.4711
6	0.0391	0.0018	21.52	0	0.0355	0.0426
beta						
1	-0.1289	0.0017	-74.93	0	-0.1322	-0.1255
2	-0.0020	0.0004	-4.60	0	-0.0029	-0.0012
3	0.0222	0.0006	39.53	0	0.0211	0.0233
4	0.0232	0.0012	19.11	0	0.0208	0.0255
5	0.0907	0.0015	61.51	0	0.0878	0.0936
6	-0.0052	0.0003	-16.83	0	-0.0058	-0.0046
gamma						
11	0.1079	0.0081	13.25	0	0.0920	0.1239
21	0.0027	0.0025	1.08	0.279	-0.0022	0.0076
31	-0.0143	0.0034	-4.16	0	-0.0210	-0.0075
41	-0.0345	0.0067	-5.13	0	-0.0476	-0.0213
51	-0.0629	0.0036	-17.65	0	-0.0698	-0.0559
61	0.0010	0.0004	2.37	0.018	0.0002	0.0018
22	-0.0003	0.0019	-0.15	0.883	-0.0039	0.0034
32	0.0045	0.0022	2.01	0.044	0.0001	0.0089
42	-0.0029	0.0028	-1.03	0.303	-0.0083	0.0026
52	-0.0037	0.0010	-3.68	0	-0.0057	-0.0017
62	-0.0003	0.0001	-3.88	0	-0.0005	-0.0002
33	0.0111	0.0052	2.15	0.031	0.0010	0.0212
43	-0.0166	0.0044	-3.76	0	-0.0252	-0.0079
53	0.0171	0.0014	12.20	0	0.0143	0.0198
63	-0.0018	0.0001	-14.82	0	-0.0021	-0.0016
44	0.0382	0.0084	4.53	0	0.0216	0.0547
54	0.0153	0.0028	5.37	0	0.0097	0.0208
64	0.0005	0.0003	2.00	0.046	0.0000	0.0010
55	0.0393	0.0031	12.82	0	0.0333	0.0453
65	-0.0051	0.0003	-15.78	0	-0.0057	-0.0044
66	0.0058	0.0001	88.33	0	0.0056	0.0059
price-elasticity						
11	-0.8510	0.0146	-58.40	0	-0.8796	-0.8225
21	0.0763	0.1632	0.47	0.64	-0.2435	0.3961
31	-0.6688	0.3051	-2.19	0.028	-1.2667	-0.0709
41	-0.7396	0.1994	-3.71	0	-1.1304	-0.3488
51	-0.5025	0.0863	-5.82	0	-0.6716	-0.3333
61	0.0447	0.2090	0.21	0.831	-0.3649	0.4543
12	0.0079	0.0080	0.99	0.324	-0.0078	0.0237
22	-1.0062	0.0518	-19.44	0	-1.1077	-0.9048
32	0.1799	0.1041	1.73	0.084	-0.0241	0.3840
42	-0.0729	0.0620	-1.18	0.24	-0.1944	0.0487
52	-0.0461	0.0271	-1.70	0.089	-0.0993	0.0070
62	-0.0092	0.0892	-0.10	0.918	-0.1840	0.1655
13	0.0062	0.0083	0.74	0.458	-0.0101	0.0225

23	0.1336	0.0623	2.14	0.032	0.0115	0.2558
33	-0.6432	0.2369	-2.72	0.007	-1.1074	-0.1789
43	-0.4229	0.0945	-4.47	0	-0.6082	-0.2377
53	0.0296	0.0258	1.15	0.251	-0.0210	0.0802
63	-0.0443	0.2259	-0.20	0.845	-0.4871	0.3986
14	-0.0157	0.0115	-1.37	0.172	-0.0383	0.0068
24	-0.0701	0.0786	-0.89	0.372	-0.2241	0.0838
34	-0.9333	0.2037	-4.58	0	-1.3326	-0.5340
44	-0.2790	0.1805	-1.55	0.122	-0.6328	0.0747
54	-0.0061	0.0320	-0.19	0.85	-0.0689	0.0567
64	0.0595	0.3339	0.18	0.859	-0.5949	0.7139
15	0.0259	0.0089	2.91	0.004	0.0084	0.0433
25	-0.0676	0.0931	-0.73	0.467	-0.2500	0.1148
35	0.1343	0.1696	0.79	0.428	-0.1980	0.4667
45	0.0110	0.0943	0.12	0.907	-0.1738	0.1957
55	-1.1436	0.0451	-25.35	0	-1.2320	-1.0552
65	-0.0734	0.1007	-0.73	0.466	-0.2709	0.1240
16	0.0004	0.0389	0.01	0.991	-0.0759	0.0767
26	-0.0100	0.1397	-0.07	0.943	-0.2839	0.2639
36	-0.0777	0.3022	-0.26	0.797	-0.6701	0.5146
46	0.0132	0.1797	0.07	0.941	-0.3391	0.3655
56	-0.0358	0.0349	-1.03	0.305	-0.1043	0.0326
66	-0.7607	0.4580	-1.66	0.097	-1.6584	0.1370
total-expen-elasticity						
1	0.8263	0.0023	356.56	0	0.8218	0.8309
2	0.9441	0.0122	77.61	0	0.9202	0.9679
3	2.0088	0.0255	78.71	0	1.9587	2.0588
4	1.4903	0.0256	58.10	0	1.4400	1.5405
5	1.7044	0.0115	148.83	0	1.6820	1.7269
6	0.7834	0.0332	23.60	0	0.7183	0.8485

Appendix IV. Calculation and Tables for Graphs Construction

Log of the STATA session on estimation of the demand system together with the elasticity is recorded in text file: Inl_laid_s_elast_sig_1cam.log

Table for graph in figure 2

Prevalence of Smoking		
Smoking Status	Households	Smoking Prevalence
Household with at least one smoker: 1,539,164	1,539,164	58.7
Household with no smoker: 1,081,984	1,081,984	41.3
Total	2,621,148	100.0

Table for graph in figure 3

Region	Sex	Individual Smoking Prevalence (15 years old or over)
Phnom Penh	Male	18.6
	Female	1.1
Other Urban	Male	36.1
	Female	3.6
Rural	Male	45.6
	Female	4.6
Cambodia	Male	41.2
	Female	4.1

Table for graphs in figure 4

Family Size, persons Percentage	Region With tobacco consumer(s)	
1 1.1	Phnom Penh	4.97
2 5.8	Urban	12.51
3 12.8	Rural	82.52
4 19.1		
5 19.9		
6 16.2		
7 11.9		
8 7.0		
9 3.5		
10 1.6		

11
0.6
12
0.4
13
0.0
14
0.0
15
0.0

Income Groups Percentage		Age Groups Percentage	
Very poor	20.3	up to 20 years old	0.2
Poor	22.5	21-35 years old	26.1
Middle	21.7	36-50 years old	38.2
Well-off	19.4	51-65 years old	25.4
Rich	16.1	66 and over	10.1
Education Level of Head Percentage		Marital Status of Head Percentage	
No or Preschool	0.2	Never married	1.0
Primary school	37.7	Married	85.7
Lower secondary school	26.7	Live together/Widowed/Divorced/Separated	13.3
Higher secondary school	2.0		
Over secondary or other	33.4		
Sex of Head Percentage			
Male	85.7		
Female	14.3		

Table for graph in figure 5

Smoking Expenditure on Tobacco Products by Regions				
	Phnom Penh	Other Urban	Rural	Cambodia
Low (<5,000 Riels/month)	10.6	16.3	27.1	24.9
Medium (5,000 to <15,000 Riels/month)	21.7	35.1	44.3	42.1
High (15,000 Riels and over/month)	67.7	48.6	28.5	33.0
	100.0	100.0	100.0	100.0

Table for graph in figure 6

Smoking Expenditure on Tobacco Products by Income Groups					
	Very Poor	Poor	Middle	Well-Off	Rich
Low (<5,000 Riels/month)	34.9	30.9	24.0	18.8	12.8
Medium (5,000 to <15,000 Riels/month)	45.4	45.7	44.4	41.9	29.7
High (15,000 Riels and over/month)	19.7	23.4	31.6	39.3	57.5
	100	100	100.0	100	100

Table for graphs in figure 7

urbanity	Smoking status	Food ex.tobac	Housing	Other expends.	Medical care	Clothing	Education	Tobacco
Phnom Penh	Non-smoking	39.80	36.56	7.48	4.91	2.83	8.41	0.00
	Smoking	43.21	33.45	7.39	4.10	2.69	6.45	2.71
Urban	Non-smoking	50.94	24.12	13.06	4.23	3.16	4.48	0.00
	Smoking	55.87	22.67	9.36	3.86	2.68	2.53	3.03
Rural	Non-smoking	58.94	15.71	14.77	5.51	2.97	2.10	0.00
	Smoking	61.88	12.46	11.77	6.54	2.89	1.36	3.10
Cambodia	Non-smoking	50.85	24.47	11.95	5.06	2.96	4.71	0.00
	Smoking	58.55	16.75	10.83	5.80	2.83	2.20	3.04

Table for graphs in figure 8

Income Groups	Phnom Penh	Urban	Rural	Cambodia
Very poor	54.19	13.94	12.73	12.96
Poor	11.96	5.45	6.75	6.87
Middle	7.02	5.45	4.64	4.78
Well-off	4.77	3.32	2.87	3.09
Rich	0.75	0.66	0.73	0.71

Table for graphs in figure 9

Income Groups	Phnom Penh	Urban	Rural	Cambodia
Very poor	2.32	3.96	3.62	3.62
Poor	2.29	3.80	3.36	3.38
Middle	3.05	3.77	3.13	3.21
Well-off	3.32	3.20	3.14	3.17
Rich	2.48	2.54	2.44	2.48

Table for graphs in figure 10

Selected Percentage	Phnom Penh	Urban	Rural
% of All Food in Total Expenditure	45.92	58.90	64.98
% of Tobacco in Total Expenditure	2.71	3.03	3.10
% of Tobacco in All Food Consumption	5.89	5.15	4.77

Table for graphs in figure 11

Region	Tobacco-Status	Tobacco	Food Ex Tobac	Clothing	Education	Medi-care	Housing	Other	Total Expenditure
Phnom Penh	Non-smoking	0	39.8	2.83	8.41	4.91	36.56	7.49	100
	Smoking	2.71	43.21	2.69	6.45	4.1	33.45	7.39	100
Urban	Non-smoking	0	50.94	3.16	4.48	4.23	24.12	13.07	100
	Smoking	3.03	55.87	2.68	2.53	3.86	22.67	9.36	100
Rural	Non-smoking	0	58.94	2.97	2.1	5.51	15.71	14.77	100
	Smoking	3.1	61.88	2.89	1.36	6.54	12.46	11.77	100

Table for graphs in figure 12

Children Exposure to SHS (Among all Cambodian children 4,370,919)	
Status	Percentage
All children under-13 living in smoking family: 2,734,670	62.5
All children under-13 living in non-smoking family: 1,636,249	37.5
All children: 4,370,919	100.0

Table for graphs in figure 13

Exposure to Second-Hand-Smoke (Among all Cambodian people: 13,037,571)	
Living Status	Percentage
All Cambodians living with smoker: 8,040,468 persons	61.7
All Cambodians not living with smoker: 4,997,102 persons	38.3
Total population: 13,037,571	100.0

Table for graphs in figure 15

Food Package Bought With One Pack of 555 Cigarette		
	One pack of 555 cigarette	Food package
555-Brand Cigarette	5120	0
Rice, 1 Kg	0	860
Fish, 0.5 Kg	0	2035
Egg, 2 Eggs	0	640
Morning Gloria, 0.4 Kg	0	720
Banana, 1 Comb	0	720
Miscellaneous	0	145
	5120	5120

Energy Generated From Food Package Bought With One Pack of 555 Cigarette		
	One pack of 555 cigarette	Food package
555-Brand Cigarette	0	0
Rice, 1 Kg	0	1310
Fish, 0.5 Kg	0	306
Egg, 2 Eggs	0	159
Morning Gloria, 0.4 Kg	0	520
Banana, 1 Comb	0	1050
Miscellaneous	0	0
		3345

Table for graphs in figure 16

Food Bought With One Pack of ARA and Energy Generated From Food		
Food Items	Amount	Energy Generated
	KHR	Kcal
Rice, 0.5 Kg	860	655
Beef, 0.1 Kg	949.2	139
Pork, 0.1 Kg	877.5	189
Chicken, 0.1 Kg	971.1	152
Fish, 0.1 Kg	814	131
Egg, 3 Eggs	960	477
Trakun, 5 Midsized bundles	900	3797
Cabbage, 0.5 Kg	620	655
Banana, 1 Comb	720	1050
ARA-Brand, 1 Packet	1000	0

Table for graph in figure 17

Annual Total Spending on Tobacco, \$US	
Region	Amount, \$US
Phnom Penh (11.33% of Total Tobacco Expenditure)	\$6,545,838
Other Urban (15.86% of Total Tobacco Expenditure)	\$9,160,549
Rural (72.81% of Total Tobacco Expenditure)	\$42,052,901
Cambodia	\$57,759,292



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)

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