ANALYSIS OF TOBACCO AND POVERTY IN SUPPORT OF FCTC RATIFICATION IN CAMBODIA (BASED ON 2004 TOBACCO DATABASE)

Support from IDRC/RITC (Canada)

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Executive Summary

A. Research Rationale

The Royal Government of Cambodia (RGC), through its Poverty Alleviation Program, has undertaken efforts to reduce households’ poverty and improve their welfare. Tobacco use is one of the major obstacles to realization of the goals of the Poverty Alleviation Program. Urgent measures must be taken to eliminate the obstacles posed by tobacco use to the program’s success.

Previous research on tobacco and poverty was undertaken by LIDEE Khmer using the 1999-CSES database collected by the National Institute of Statistics of the Ministry of Planning of Cambodia. That research provided strong evidence of the negative impacts of tobacco use on household poverty as well as the threat posed by tobacco use 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 taken a tremendous step forward in combating the tobacco epidemic, with the ratification of the Framework Convention on Tobacco Control (FCTC) by the RGC in November 2005. Ironically, however, after the ratification of the FCTC the advertising and promotion of tobacco products and sponsorship by the tobacco industry has intensified. The ratification of the FCTC is, thus, only the start of a new phase in the struggle to establish smoke free policy in Cambodia. After the ratification of the FCTC a range of new problems arise, including: i) how to integrate the ratified international law into the legislative framework for Cambodia and to allow for its implementation locally, ii) how to concretely determine specific issues of the FCTC that are relevant to the Cambodian context and to incorporate them into the national law, and iii) how to concretely reinforce all the stated articles of the ratified FCTC and strengthen the Cambodian law on tobacco control. Currently a draft 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 approval by the Cambodian Parliament. However, health reasons are, again, not enough to smoothly and successfully move the law through Parliament. More research evidence is required to support the promulgation of the Cambodian law, and the implementation of both the new Cambodian law and the FCTC.

The purpose of this updated research on tobacco use and poverty was to investigate the consumption behavior of Cambodian households for specific product groups (food, clothing, education, medical care, housing and tobacco) taking into account the impact of tobacco spending.

The investigation was 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 use and poverty. The advantage of the current approach is the possibility to compute expenditure (income) elasticity, own price and cross price elasticity using the results 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 three items of household expenditure having total expenditure (income) elasticity smaller than one. Among these items is tobacco with a total expenditure elasticity of 0.6957. 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 food and clothing with total expenditure elasticity of 0.8273 and 0.9466 respectively. With respect to own price, tobacco is fairly inelastic with absolute own price elasticity of 0.4733, which is in the middle range of inelasticity as compared to the least inelastic (education (0.6506)) and the most inelastic (medical care), whereas clothing and housing are very elastic with own price elasticity of –1.0409 and –1.1493 respectively.

All values of cross price elasticity show that tobacco and other products are items of substitution in terms of cross price, except food and housing which are complements. The value of cross price elasticity of tobacco with respect to food is -0.5859 and the reverse relationship is -0.029. This means that food and tobacco spending are complementary items, or literally speaking, tobacco is a product to be consumed along with food and this is fairly well reflected in various sections of the discussion of total expenditure (income), own and cross price elasticity.

B.2. Impact of Tobacco on Households’ Poverty

Tobacco spending becomes a problematic issue in terms of socio-economic status of Cambodian households. Of all two and a half million households in Cambodia, 58.7 percent consume tobacco products. This tobacco spending decreases household well-being, increases the risk of diseases in respiratory tracts and in the mouth cavity, and subsequently reduces labor productive capacity of the family, which further aggravates the situation of poverty.

B.3. Impact of Tobacco on Social Development

Tobacco spending as shown by these findings is a fairly persistent consumption expenditure for Cambodian households. Taking into account the current efforts of the RGC 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 million 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 investigated the consumption behavior of Cambodian households for specific product groups (food, clothing, education, medical care, housing and tobacco) taking into account the impact of tobacco spending.

The investigation was 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, in order to provide their interpretation in the context of Cambodian households.

This paper investigates 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 the database built by Cambodian Socio-Economic Survey (CSES) 2004. Using the results of this study, a number of suggestions are made in the policy implication section.

Section One presents the study objectives. Section Two is a review of the research literature. Section Three describes the data sources 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 risk. Section Seven presents the results of the regression analysis. Finally, a conclusion and recommendations related to policy implications are detailed in Section Eight, which concludes the paper.
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## Abbreviations

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<td>LIDEE Khmer</td>
<td>League of Khmer Students From Abroad</td>
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<td>RITC</td>
<td>Research for International Tobacco Control</td>
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<td>CSES</td>
<td>Cambodian Socio-Economic Survey</td>
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<td>NIS</td>
<td>National Institute Statistics of Cambodia</td>
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<td>KHR</td>
<td>Cambodian currency unit, the Riels</td>
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<td>UNPF</td>
<td>United Nations Population Fund</td>
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<td>ADB</td>
<td>Asian Development Bank</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>SEDP-II</td>
<td>Socio-Economic Development Plan II for 2001-2005</td>
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Section One: Study Objectives

1.1. Research Problem

The tobacco epidemic is rampant in Cambodia, especially at the household level, with more than half of all Cambodian households having at least one or more smokers. It is scientifically proven and firmly supported by facts that tobacco use is a major risk factor associated with many kinds of diseases (cancer, respiratory and heart diseases). Smoking is responsible for the deaths of millions of people every year around the world. In Cambodia 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 a household smoking prevalence of 58 percent, nationwide there are more then 1.53 million smoking households. Hence, at least 1.53 million people smoke tobacco products (estimate of one smoker per smoking household by 2004-CESE data1), 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 traces its roots into the far remote times of Cambodian history. Cambodian people in rural areas continue to follow the tradition of their ancestors by growing the tobacco plant, processing the leaf, and rolling their own cigarettes.

Despite the fact that Cambodian households would greatly benefit from ceasing to consume tobacco products, any attempt to impose control on the 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.

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 tobacco control policy and to gain support from a wide range of populations as well as from the government and NGO agencies. The research was carried out through investigation into the consumption patterns of Cambodian households. From the results of the investigation we were able to derive policy implications needed to support measures to counter the tobacco trade as well as to ensure that the move toward tobacco control would be an efficient one in the context of current Cambodian socio-cultural, economic and political environmental settings.

We investigated the hypotheses we presented in the initial project proposal:

i. To investigate the tobacco consumption pattern of Cambodian households and determine its change during the time of the economic recovery.

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ii. To identify 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.
Section Two: Review of Research Literature

The present research investigates the pattern of Cambodian households’ consumption 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 fifteen thousand households in the five regions of Cambodia.

As an update to the 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. We have reviewed the following literature on theory and application of the theory of consumer demand system:


ii. Cardon Research Papers in Agricultural and Resource Economics “Estimation of Theoretically Plausible Demand Functions from U.S. 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 Cholalomkorn 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 Baharumshah 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 a result of the application of AIDS on regularly collected data on household expenditure. Household size, age group of household dead as demand shifters were incorporated in the model. It claims to provide practical solutions in terms of reliable estimation of expenditure and price elasticity using the 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 U.S. and the E.U. The GP/AIDS, an extended form of the AIDS, was used to analysis dynamic of the demand of 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 term 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 reviews, we chose the AIDS functional form of the complete
demand system as the model for our investigation. The estimation was carried out using
STATA program code, based on modified program code of Brian P. Poi and suggestions
contained in the Economics Letters by Juliana M. Alston el. al.
Section Three: Data Sources and Methodology

The present research investigates the pattern of Cambodian households’ consumption expenditure in the context of tobacco use in the framework of consumer demand theory. It uses 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 focuses on a subset of the dataset, which comprises only smoking households. Part II is based on a regression estimation of the whole dataset to find out how tobacco use impacts household expenditure on items such as food, clothing, education, medical care and housing, based on the 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 the 2004-CSES were verified, cleaned and made available in the National Institute of Statistics (NIS) of Cambodia. During the survey of 2004-CSES, the diary method was used to increase accuracy of the data collected. It is a major improvement over the 1999-CSES, which was based on the recall method. It collected extensive information on fifteen thousand households in the five 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 one hundred items of non-durable and durable goods or services. From this large dataset we extracted a number of variables to constitute the specific dataset for our study. The extracted dataset comprises household income, total consumption, and demographic characteristics.

In the beginning stage of building the research dataset, we used SPSS and STATA statistical software to manipulate the raw data source and to group the line items of consumption into six classes of aggregated types of consumption: i) food, ii) clothing, iii) education, iv) health, v) housing, vi) tobacco and vii) miscellaneous. According to the research objectives, our updated research on the impacts of tobacco use 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 six product groups and consumed by households in each of the five 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 resulting unit value as a 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 research related to estimation of the 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 six 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 were 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 helped in generating the price of the item to be aggregated.

The groups of aggregated products that were investigated were the following.

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

3.2. Aggregate Price Formation

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

The record of expenditure follows the diary method in recording 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 household.

We compared 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 three hundred 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 could find a match from the listing of the CPI Bureau were selected. Thirty-seven (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 household diary, we computed 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 formed 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 formation of aggregate product.

Step 4: to compute the range of CPI price:
The lower bound, the lowest price, of the CPI price of the item is equal to 0.87 multiplied by the CPI price. The upper bound, the highest price, of the CPI price of the 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 in comparison of unit value computed from household data to price from the CPI Bureau of Statistics of the Ministry of Planning is the following:
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 lie 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, and where the record was taken, were used to generate the price database of selected items for aggregation.

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

C- Computation of price of aggregate product

Price of aggregate product was calculated using the formula according to Laspeyres’ formula:

$$\ln(\text{price}_\alpha) = \frac{1}{\sum_\text{weight}_i} \sum_\text{weight}_i \times \ln(\text{price}_i)$$

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 is 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 aggregate is replaced by 30 KHR, which did 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 is.

We can therefore distinguish the status of households in terms of tobacco product expenditure. Zero amount of consumption on tobacco products will qualify the household as a non-smoking household and larger 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 involved in formation of a complete database comprising consumption of specific aggregate product and its corresponding price were the following:

i- to compute the total expenditure, comprising 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, we had some initial sense of the effects of tobacco consumption on households’ expenditure patterns, however, further analysis using the regression method was needed.

In the regression analysis we undertook 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, are 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 the 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 codes in the original programs were modified. A new complete program code was developed to handle the computation of the elasticity using the results 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 wrote new codes forming a complete program for estimation of the demand system in the 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-routines, 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 this 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 are suitable only for research cases similar to the current one. Use in other research studies requires modification.

The results of all these statistical and numerical processing are shown in the sections that follow and in the appendix.
Research Model Based on Impact of Tobacco Using Almost Ideal Demand System (AIDS)

- Estimation of Complete Demand System
- Demographic Characteristics
- Computation of Expenditure and Price Elasticity
- Analysis of the Result from the Angle of Tobacco Impacts
Box 1. Specification of Functional Form for Demand System

Expenditure share of all six items in the demand system:

\[ w_i = \alpha_i + \sum_{j=1}^{n} (\gamma_{ij} * \ln(p_j)) + \frac{\sum_{i=1}^{n} (\beta_i * \ln(M_{stone}))}{P_{stone}} \]

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

\[ \ln P_{stone} = \alpha_i + \sum_{j=1}^{n} (\alpha_i * \ln(p_j)) + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} ( \gamma_{ij} * \ln(p_j) * \ln(p_j) ) \]

Total expenditure (income) elasticity:

\[ \eta_i = 1 + \left( \frac{\beta_i}{w_j} \right) \]

Uncompensated own (or cross) price elasticity:

\[ e_{ij} = - \delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_j} \left( \alpha_j + \sum_{k=1}^{n} (\gamma_{kj} * \ln(P_k)) \right) \]

\[ \delta_{ij} = 1 \text{ if } j = i \text{ and } \delta_{ij} = 0 \text{ if } j \neq i \]

Compensated own (or cross) price elasticity:

\[ e_{ij} = - \delta_{ij} + \frac{\gamma_{ij}}{w_i} + \frac{1}{w_j} - \frac{\beta_i}{w_i} \left( \alpha_j + \sum_{k=1}^{n} (\gamma_{kj} * \ln(P_k)) - \frac{1}{w_j} \right) \]

\[ \delta_{ij} = 1 \text{ if } j = i \text{ and } \delta_{ij} = 0 \text{ if } j \neq i \]

where \( \alpha_i, \beta_i, \gamma_{ij} \) are parameters of the demand system; with restrictions:

\[ \Sigma \alpha_i = 1, \Sigma \beta_i = 0, \Sigma \gamma_{ij} = 0 \] adding-up conditions
\[ \Sigma \gamma_{ij} = 0 \] homogeneity condition
\[ \gamma_{ij} = \gamma_{ji} \] condition of symmetry

\( p_i, \ln(p_i) \) are price and logarithm of price respectively;
\( P_{stone} \) is stone price index;
\( \eta_i \) is total expenditure;
\( w_i \) is expenditure share.
\( i = 1, \ldots, n \) is index of the equations in the demand system,
here we have a total of nequ = 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;
Section Four: Situation of Smoking in Cambodia

In this part, we look at the descriptive statistics of our dataset.

4.1. 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.

<table>
<thead>
<tr>
<th>Country</th>
<th>Male</th>
<th>Female</th>
<th>Survey Date</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cambodia</td>
<td>41.2</td>
<td>4.1</td>
<td>2004</td>
<td>NIS</td>
</tr>
<tr>
<td>Malaysia</td>
<td>49.2</td>
<td>3.5</td>
<td>1996</td>
<td>WHO</td>
</tr>
<tr>
<td>Thailand</td>
<td>43.0</td>
<td>2.4</td>
<td>2001</td>
<td>ASH-Thailand</td>
</tr>
<tr>
<td>Laos</td>
<td>41.0</td>
<td>15.0</td>
<td>1995</td>
<td>WHO</td>
</tr>
<tr>
<td>Philippines</td>
<td>50.6</td>
<td>8.0</td>
<td>2001</td>
<td>WHO</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>50.7</td>
<td>3.5</td>
<td>1997-98</td>
<td>WHO</td>
</tr>
</tbody>
</table>

4.2. Smoking Demography

The prevalence of smoking among female-run households is very small compared to those run by males. There is a discernible upward trend of households' smoking prevalence from the region of Phnom Penh to Other Urban and Rural Areas. Household smoking prevalence is found to be higher among households having between 3 to 7 family members. 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 males and male-run households have the highest prevalence of smoking.
Figure 4. Smoking Demography

Distribution of Family Size (Smoking Households)

Distribution of Region of Residence (Smoking Households)

Distribution Income Groups (Smoking Households)

Distribution of Age Groups of Household Head (Smoking Households)

Distribution of Level of Education Household Head (Smoking Households)

Live together/Widowed/Divorced/Separate, 13.3

Never married, 1.0

Married, 85.7

Female headed

Male headed

14% 86%
4.3. The Extent of the Problem

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of All Households</td>
<td>2,621,147</td>
</tr>
<tr>
<td>Household Smoking Prevalence</td>
<td>58.72%</td>
</tr>
<tr>
<td>Number of Smoking Households</td>
<td>1,539,196</td>
</tr>
<tr>
<td>Monthly Household Tobacco Spending in 2004, KHR</td>
<td>13,071</td>
</tr>
<tr>
<td>Total Monthly Tobacco Spending Nationwide, KHR</td>
<td>19,975,088,647</td>
</tr>
<tr>
<td>Monthly Total Tobacco Spending Nationwide, US$</td>
<td>4,813,274</td>
</tr>
<tr>
<td>Retail Price of ARA brand, KHR</td>
<td>1000</td>
</tr>
<tr>
<td>Packs of Cigarettes Consumed Monthly</td>
<td>19,975,087</td>
</tr>
<tr>
<td>Mean Smoking Household Size</td>
<td>5.4</td>
</tr>
<tr>
<td>People Living with exposure to Environmental Tobacco Smoke, persons</td>
<td>8,040,468</td>
</tr>
<tr>
<td>Estimated Total Number of Children Under 13-years-old exposed to Environmental Tobacco Smoke, persons</td>
<td>2,734,670</td>
</tr>
</tbody>
</table>

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 three 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 can be translated into at least fifteen packs smoked per month.

Regional 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 Rural Areas have the lowest percentage of high spenders, but the highest percentage of low spenders.

Comparison between income groups of the level of smoking expenditure in Figure 6 shows that the percentage of high spenders increases as the 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 reveals that households in rural areas of low income are more likely to spend small amounts 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 brands of cigarettes 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

[Graphs showing data on smoking expenditure by regions and income groups]
Section Five: Tobacco and Households’ Expenditures

In this part, we investigate the differences 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 disbursements that Cambodia received from donor communities in each of the years 1999-2001\(^2\). This amount also exceeded most of the by-sector planned amounts of the socio-economic development program into the SEDP-II\(^3\) 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.

Almost all statistics in Table 3 shows that non-smoking households have higher expenditures on clothing, education, housing and other miscellaneous products than smoking households.

The bar graphs showing expenditure share of non-smoking and smoking households in Figure 4 also present similar situations as the statistics in Table 3: non-smoking households have higher expenditure on clothing, education, housing and other miscellaneous products than smoking households.

Almost all figures on medical care expenditure of smoking households in both the table 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 from the spending on tobacco products.

---


\(^3\) 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

<table>
<thead>
<tr>
<th>Smoking status</th>
<th>Income group</th>
<th>Food ex.tobacco</th>
<th>Clothing</th>
<th>Education</th>
<th>Medical care</th>
<th>Housing</th>
<th>Other expend.</th>
<th>Tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very poor</td>
<td>67.29</td>
<td>2.80</td>
<td>1.28</td>
<td>7.54</td>
<td>14.85</td>
<td>6.24</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>66.57</td>
<td>3.04</td>
<td>2.25</td>
<td>6.51</td>
<td>14.97</td>
<td>6.66</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>65.46</td>
<td>2.97</td>
<td>2.73</td>
<td>5.51</td>
<td>15.59</td>
<td>7.74</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Well-off</td>
<td>57.84</td>
<td>3.01</td>
<td>3.67</td>
<td>6.12</td>
<td>20.86</td>
<td>8.50</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Rich</td>
<td>40.72</td>
<td>2.95</td>
<td>6.36</td>
<td>4.00</td>
<td>30.34</td>
<td>15.63</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>All groups</td>
<td>50.65</td>
<td>2.96</td>
<td>4.71</td>
<td>5.06</td>
<td>24.47</td>
<td>11.95</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very poor</td>
<td>68.76</td>
<td>2.70</td>
<td>1.34</td>
<td>6.97</td>
<td>12.69</td>
<td>3.92</td>
<td>3.62</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>68.33</td>
<td>2.84</td>
<td>1.20</td>
<td>7.02</td>
<td>11.96</td>
<td>5.28</td>
<td>3.38</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>65.04</td>
<td>2.92</td>
<td>1.53</td>
<td>6.49</td>
<td>15.26</td>
<td>5.56</td>
<td>3.21</td>
<td></td>
</tr>
<tr>
<td>Well-off</td>
<td>63.51</td>
<td>3.15</td>
<td>2.05</td>
<td>6.48</td>
<td>14.33</td>
<td>7.26</td>
<td>3.21</td>
<td></td>
</tr>
<tr>
<td>Rich</td>
<td>43.87</td>
<td>2.64</td>
<td>3.42</td>
<td>4.03</td>
<td>22.69</td>
<td>20.88</td>
<td>2.48</td>
<td></td>
</tr>
<tr>
<td>All groups</td>
<td>58.55</td>
<td>2.83</td>
<td>2.20</td>
<td>5.80</td>
<td>16.75</td>
<td>10.83</td>
<td>3.04</td>
<td></td>
</tr>
</tbody>
</table>
Figure 7. Average Monthly Households’ Expenditure on Specific Products in Percentage of Total Expenditure

% Share of Selected Consumption in Total Expenditure in Phnom Penh

- Tobacco: 2.71%
- Education: 8.41%
- Clothing: 3.88%
- Medical care: 2.47%
- Other expend.: 2.83%
- Housing: 7.31%
- Food ex./tobac.: 43.21%

% Share of Selected Consumption in Total Expenditure in Other Urban Area

- Tobacco: 3.03%
- Education: 2.53%
- Clothing: 3.46%
- Medical care: 2.36%
- Other expend.: 7.39%
- Housing: 22.67%
- Food ex./tobac.: 55.87%

% Share of Selected Consumption in Total Expenditure in Rural Area

- Tobacco: 3.10%
- Education: 1.70%
- Clothing: 2.08%
- Medical care: 5.44%
- Other expend.: 11.77%
- Housing: 15.71%
- Food ex./tobac.: 61.88%

% Share of Selected Consumption in Total Expenditure in Cambodia

- Tobacco: 3.04%
- Education: 2.71%
- Clothing: 3.93%
- Medical care: 2.04%
- Other expend.: 11.05%
- Housing: 16.75%
- Food ex./tobac.: 58.55%
5.2. Average Share of Tobacco Consumption in Income

The graphical plotting of the amount (in percentage) of a family’s budget devoted to monthly purchases of tobacco products in various regions as well as the whole of Cambodia reflects a unique downward pattern (the vertical axis shows percentage with zero at the bottom; the horizontal axis shows increasing ranking of income groups from left to right, with very poor on the left and richest on the right). This suggests that in each region households in the poorer income groups allocate a larger share of income on tobacco spending than the richer ones.

By income groups, Phnom Penh households spend the largest 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 smoking prevalence in the respective regions (Section 3.2 Smoking demography), but it is similar to Figures 5 and 6 in Section 4.3 on distribution of types of tobacco spenders. The most important message revealed by this figure is that poor households are allocating a higher income share to tobacco products.

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 groups of income. 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. 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 of Cambodia.

For the region of Phnom Penh the tobacco spending of households in the well-off group of income stands out, as its share of tobacco spending in total expenditure is 3.8 percent, 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

In figure 8 we analyzed to what extent tobacco spending cuts into spending on food by regions of Cambodia. For all income groups in each region, there is an upward trend on food expenditures from Phnom Penh, to Other Urban areas, to Rural Areas. The same trend is seen for tobacco’s share in total expenditures. However, we observe a downward trend for food equivalence of tobacco in terms of spending. Hence, tobacco spending represents 5.89 percent of all food expenditure for households in Phnom Penh, 5.15 for those in other urban areas and 4.77 percent for those in rural areas.
Section Six: Tobacco and Poverty

This Section shows how tobacco can affect households’ welfare.

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

In Section Four, “Tobacco and Households’ Expenditure”, we see how by every group of income, smoking households lag behind non-smoking ones in terms of consumption on clothing, education, housing and miscellaneous expenses. 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 about the economic impacts of tobacco on households’ welfare in term of satisfaction of the most basic needs in the family. Except food, all items of expenditures suffer the most from tobacco spending.

Figure 11. Share of Specific Consumption in Total Expenditure (Non-Smoking and Smoking Households) (2004-CSES)

If households did not spend their income on tobacco, their household expenditures on education, clothing and especially housing could be significantly increased. In Rural Areas, food expenditure would also benefit from savings on tobacco consumption.
6.2. Possible Children’s Health Problem

Figure 12. Children’s Exposure to SHS (2004-CSES)

The long-term living of children in smoking families increases their risk of health problems due to their exposure to secondhand smoke (SHS) \(^4\).

According to the 2004-CSES data, about 62.5 percent of Cambodian children under 13 years old live in households with at least one regular smoker in the family. This equates to more than 2.7 million children who are involuntary victims of SHS.

In the future, these children who have regularly been exposed to SHS are more likely to suffer from diseases involving the respiratory tract such as lung diseases and breathing problems such as asthma (Health Canada). The risk of developing asthma among adults exposed to SHS during childhood will also increase (Health Canada).

6.3. Second Hand Smoke Exposure To Cambodian Populations

Figure 13. People Exposure to SHS

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

6.4. A Hidden Source of Financing

Figure 14. Hidden Source of Finance

The annual spending by Cambodian smoking households would easily fill a 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. That huge annual spending on tobacco products is US$57.75 million.

6.5. What a Pack of 555-Brand Cigarette can buy

The table below on the left together with the graph on right explains what a pack of 555-brand cigarette in Cambodia can buy.

<table>
<thead>
<tr>
<th>Tobacco and Food Items</th>
<th>Phnom Penh Region Price</th>
<th>Quantity</th>
<th>Amount, KHR</th>
<th>Food Package Content</th>
<th>Package Cost, KHR</th>
<th>Energy K.Cal</th>
</tr>
</thead>
<tbody>
<tr>
<td>555-Brand Cigarette</td>
<td>5,120</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice, KHR/Kg</td>
<td>860</td>
<td>860</td>
<td>x</td>
<td></td>
<td>860</td>
<td>1,310</td>
</tr>
<tr>
<td>Beef, KHR/Kg</td>
<td>6,750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pork, KHR/Kg</td>
<td>13,560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken, KHR/Kg</td>
<td>7,470</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish, KHR/Kg</td>
<td>4,070</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg, KHR/Egg</td>
<td>320</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning Gloria, 1/4 KHR/Kg</td>
<td>180</td>
<td></td>
<td>x</td>
<td></td>
<td>720</td>
<td>520</td>
</tr>
<tr>
<td>Banana, KHR/Kg</td>
<td>720</td>
<td></td>
<td></td>
<td></td>
<td>720</td>
<td>1,050</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>145</td>
<td></td>
</tr>
<tr>
<td><strong>Total Package Cost, KHR</strong></td>
<td><strong>5,120</strong></td>
<td><strong>3,345</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 15** 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, education that helps improve the standard of living, and health status.
6.6. What a Pack of ARA-Brand Cigarette can Buy

**Figure 16.** 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 cigarettes. Some of the selected useful nutritional substitutes can provide up to 3,700 Kcal of energy to the human body.

6.7. Areas Mostly Burdened by Tobacco Consumption

**Figure 17.** Areas Mostly Burdened by Tobacco Consumption (2004-CSES)

Total tobacco spending for the whole of Cambodia is evaluated as 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 aggravates the poverty situation in the rural areas, despite the 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 18. Equivalence of Annual Cambodian Tobacco Spending (2004-CSES)

The possible equivalence of annual Cambodian spending on tobacco products ranges from basic food commodities such as high quality rice to popular Honda motorbikes, to second-hand Korean made 1-ton mini-truck and big wooden house in the province. The number of these products is shown in the figure itself.

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 results 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 the cumulative proportion of income against the cumulative proportion of the population will be a straight line running from zero to a total of one. In a rectangular box the line is its diagonal: this is the Lorenz curve of a special case of perfect equality. However, in real social settings the cumulative proportion of the population with their cumulative proportion of income does not follow the diagonal line, but lies below it. The more inequality in a society the further its Lorenz curve shifts away from the diagonal line.

Using the STATA command we obtained two Lorenz curves. The dash curve shows the situation of current income distribution of households. Had tobacco been excluded from the income, which would be the equivalent of total disposable income without considering 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 illustrates that inequality in the society would decrease if no spending on tobacco were made. In fact, any alternative to tobacco spending will increase household welfare and standard of living, which inevitably leads to a subsequent reduction of inequality in the society.
Figure 19. Lorenz Curves With and Without Tobacco (2004-CSES)
Section Seven: Maximum Likelihood Estimation

In this part, we look into the statistical results of our regression estimate.

7.1. Result of the Maximum Likelihood Estimation

The number of households used in the estimation was 14,9882 households. The iterative estimation was successfully completed at seventeen step and the result of the estimation is presented in Table 5 below. The table also shows high fulfillment criteria of the constraints of additivity, homogeneity and symmetry imposed on the estimated parameters.

<table>
<thead>
<tr>
<th>Result of the Maximum Likelihood Estimation</th>
<th>Constr.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>alpha</strong></td>
<td></td>
</tr>
<tr>
<td>Coef.</td>
<td>0.34558</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.02115</td>
</tr>
<tr>
<td><strong>beta</strong></td>
<td></td>
</tr>
<tr>
<td>Coef.</td>
<td>-0.12815</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00173</td>
</tr>
<tr>
<td><strong>gamma</strong></td>
<td></td>
</tr>
<tr>
<td>Food Coef.</td>
<td>0.12613</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00912</td>
</tr>
<tr>
<td>Clothing Coef.</td>
<td></td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00281</td>
</tr>
<tr>
<td>Education Coef.</td>
<td></td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00393</td>
</tr>
<tr>
<td>Medcare Coef.</td>
<td></td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00789</td>
</tr>
<tr>
<td>Housing Coef.</td>
<td></td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00369</td>
</tr>
<tr>
<td>Tobacco Coef.</td>
<td></td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.00433</td>
</tr>
<tr>
<td>constr.</td>
<td>0</td>
</tr>
</tbody>
</table>

The computation of 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 detail, comparison 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 the whole of Cambodia as shown in the Table 8 and Figure 18.

a) Total Expenditure (Income) Elasticity:

All values of the total expenditure elasticity are of the expected sign, i.e. positive. Looking to the whole of Cambodia, the following points 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 expenditure have expenditure elasticity smaller than one, including tobacco with an elasticity of 0.6957. These latter items are considered as necessities, which
raises alarm for us as tobacco appears to be a necessary item, and it is the least responsive
to change in total expenditure. Clothing and food items are fairly sensitive to the total
amount of the available household expenditure budget. These values fairly reflect the
current pattern of consumption behavior of Cambodian households.

b) Own Price Elasticity

All six product items have negative own price elasticity, which is expected. We notice
that by absolute value of 1.0409, clothing is the only elastic item considered as luxury.
With respect to its own price tobacco is fairly inelastic with absolute elasticity of 0.4899.
The most inelastic product item is medical care with absolute values of 0.2547.

c) Cross Price Elasticity

The values of cross price elasticity show that tobacco is a substitute item of expenditure
with respect to price of all products, except food. With respect to price of food, tobacco
spending is a complementary item, which means that tobacco is a product to be consumed
along with food as a complement product item and it hurts other expenditures by being
their substitute and this is fairly well reflected in our previous discussion of the total
expenditure and own price elasticity.

Table 6. Total Expenditure (Income) and Uncompensated Own, Cross Price Elasticity Computed at the Sample Mean and Sub-Sample Mean

<table>
<thead>
<tr>
<th></th>
<th>food</th>
<th>clothing</th>
<th>education</th>
<th>medcare</th>
<th>housing</th>
<th>tobacco</th>
<th>tot-expend</th>
</tr>
</thead>
<tbody>
<tr>
<td>not-smoking:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>food</td>
<td>-0.8082</td>
<td>-0.0010</td>
<td>0.0042</td>
<td>-0.0119</td>
<td>0.0305</td>
<td>0.8249</td>
<td></td>
</tr>
<tr>
<td>clothing</td>
<td>0.0239</td>
<td>-1.0403</td>
<td>0.1327</td>
<td>-0.1362</td>
<td>-0.0597</td>
<td>0.9488</td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>-0.6094</td>
<td>0.1639</td>
<td>-0.7436</td>
<td>-0.7483</td>
<td>0.0880</td>
<td>1.7510</td>
<td></td>
</tr>
<tr>
<td>medcare</td>
<td>-0.7319</td>
<td>-0.1138</td>
<td>-0.4867</td>
<td>-0.2217</td>
<td>-0.0355</td>
<td>1.5098</td>
<td></td>
</tr>
<tr>
<td>housing</td>
<td>-0.4899</td>
<td>-0.0162</td>
<td>0.0302</td>
<td>-0.0090</td>
<td>-1.1364</td>
<td>1.5901</td>
<td></td>
</tr>
<tr>
<td>smoking:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>food</td>
<td>-0.8299</td>
<td>0.0052</td>
<td>0.0047</td>
<td>-0.0102</td>
<td>0.0236</td>
<td>-0.0223</td>
<td>0.8290</td>
</tr>
<tr>
<td>clothing</td>
<td>0.0202</td>
<td>-1.0414</td>
<td>0.1430</td>
<td>-0.1461</td>
<td>-0.0662</td>
<td>0.1456</td>
<td>0.9449</td>
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<tr>
<td>education</td>
<td>-0.9954</td>
<td>0.2549</td>
<td>-0.5265</td>
<td>-1.4064</td>
<td>0.2151</td>
<td>0.0561</td>
<td>2.4003</td>
</tr>
<tr>
<td>medcare</td>
<td>-0.6359</td>
<td>-0.1236</td>
<td>-0.4563</td>
<td>-0.2767</td>
<td>-0.0158</td>
<td>0.0320</td>
<td>1.4763</td>
</tr>
<tr>
<td>housing</td>
<td>-0.6081</td>
<td>-0.0531</td>
<td>0.0400</td>
<td>-0.0193</td>
<td>-1.1623</td>
<td>-0.0306</td>
<td>1.8335</td>
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<tr>
<td>tobacco</td>
<td>-0.3491</td>
<td>0.1284</td>
<td>0.0399</td>
<td>0.0597</td>
<td>-0.0055</td>
<td>-0.6960</td>
<td>0.8226</td>
</tr>
</tbody>
</table>

| Cambodia:            |        |          |           |         |         |         |            |
| food                 | -0.8210| 0.0026   | 0.0045    | -0.0109 | 0.0264  | -0.0290 | 0.8273     |
| clothing             | 0.0218 | -1.0409  | 0.1385    | -0.1418 | -0.0634 | 0.1392  | 0.9466     |
| education            | -0.7749| 0.2029   | -0.6506   | -1.0304 | 0.1425  | 0.0812  | 2.0293     |
| medcare              | -0.6744| -0.1197  | -0.4685   | -0.2547 | -0.0237 | 0.0512  | 1.4897     |
| housing              | -0.5487| -0.0346  | 0.0350    | -0.0141 | -1.1493 | 0.0005  | 1.7112     |
| tobacco              | -0.5859| 0.2156   | 0.0680    | 0.1014  | -0.0048 | -0.4899 | 0.6957     |
Table 7. Compensated Own, Cross Price Elasticity Computed at the Sample Mean and Sub-Sample Mean

<table>
<thead>
<tr>
<th>Compensated Own, Cross Price Elasticities</th>
<th>food</th>
<th>clothing</th>
<th>education</th>
<th>medcare</th>
<th>housing</th>
<th>tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>not-smoking:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>food</td>
<td>-0.2045</td>
<td>0.0298</td>
<td>0.0291</td>
<td>0.0256</td>
<td>0.1586</td>
<td></td>
</tr>
<tr>
<td>clothing</td>
<td>0.7182</td>
<td>-1.0048</td>
<td>-0.1613</td>
<td>-0.0931</td>
<td>0.0876</td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>0.672</td>
<td>0.2295</td>
<td>-0.6909</td>
<td>-0.6688</td>
<td>0.3598</td>
<td></td>
</tr>
<tr>
<td>medcare</td>
<td>0.3729</td>
<td>-0.0573</td>
<td>-0.4412</td>
<td>-0.1532</td>
<td>0.1988</td>
<td></td>
</tr>
<tr>
<td>housing</td>
<td>0.6738</td>
<td>0.0433</td>
<td>0.0781</td>
<td>0.0632</td>
<td>-0.8896</td>
<td></td>
</tr>
<tr>
<td>tobacco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>smoking:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>food</td>
<td>-0.2086</td>
<td>0.034</td>
<td>0.0181</td>
<td>0.0301</td>
<td>0.1147</td>
<td>0.0118</td>
</tr>
<tr>
<td>clothing</td>
<td>0.7283</td>
<td>-1.0085</td>
<td>0.1582</td>
<td>-0.1002</td>
<td>0.0376</td>
<td>0.1845</td>
</tr>
<tr>
<td>education</td>
<td>0.8034</td>
<td>0.3384</td>
<td>-0.4877</td>
<td>-1.2898</td>
<td>0.4789</td>
<td>0.1568</td>
</tr>
<tr>
<td>medcare</td>
<td>0.4705</td>
<td>-0.0722</td>
<td>-0.4324</td>
<td>-0.205</td>
<td>0.1464</td>
<td>0.0928</td>
</tr>
<tr>
<td>housing</td>
<td>0.766</td>
<td>0.0107</td>
<td>0.0696</td>
<td>0.0698</td>
<td>-0.9608</td>
<td>0.0448</td>
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<tr>
<td>tobacco</td>
<td>0.2674</td>
<td>0.157</td>
<td>0.0532</td>
<td>0.0997</td>
<td>0.0849</td>
<td>-0.6621</td>
</tr>
<tr>
<td>Cambodia:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>food</td>
<td>-0.2071</td>
<td>0.0323</td>
<td>0.0227</td>
<td>0.0282</td>
<td>0.133</td>
<td>-0.0091</td>
</tr>
<tr>
<td>clothing</td>
<td>0.7242</td>
<td>-1.0069</td>
<td>0.1593</td>
<td>-0.0971</td>
<td>0.0586</td>
<td>0.1619</td>
</tr>
<tr>
<td>education</td>
<td>0.731</td>
<td>0.2757</td>
<td>-0.6059</td>
<td>-0.9345</td>
<td>0.4038</td>
<td>0.1298</td>
</tr>
<tr>
<td>medcare</td>
<td>0.4311</td>
<td>-0.0662</td>
<td>-0.4357</td>
<td>-0.1843</td>
<td>0.1681</td>
<td>0.087</td>
</tr>
<tr>
<td>housing</td>
<td>0.7211</td>
<td>0.0268</td>
<td>0.0727</td>
<td>0.0667</td>
<td>-0.9289</td>
<td>0.0415</td>
</tr>
<tr>
<td>tobacco</td>
<td>-0.0697</td>
<td>0.2406</td>
<td>0.0833</td>
<td>0.1342</td>
<td>0.0848</td>
<td>-0.4733</td>
</tr>
</tbody>
</table>

Table 8. Selected Elasticity

<table>
<thead>
<tr>
<th>Selected Elasticity</th>
<th>food</th>
<th>Clothing</th>
<th>education</th>
<th>medcare</th>
<th>housing</th>
<th>tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total expenditure elasticity</td>
<td>0.8273</td>
<td>0.9466</td>
<td>2.0293</td>
<td>1.4897</td>
<td>1.7112</td>
<td>0.6957</td>
</tr>
<tr>
<td>Own price elasticity</td>
<td>-0.8210</td>
<td>-1.0409</td>
<td>-0.6506</td>
<td>-0.2547</td>
<td>-1.1493</td>
<td>-0.4899</td>
</tr>
<tr>
<td>Cross price elasticity of tobacco with respect to selected product</td>
<td>-0.5859</td>
<td>0.2156</td>
<td>0.0680</td>
<td>0.1014</td>
<td>-0.0048</td>
<td></td>
</tr>
</tbody>
</table>

Figure 20. Own, Cross Price and Total Expenditure Elasticity for Non-Smoking Households
7.2. Tobacco, Poverty and Socio-Economic Status

The results of the estimation of the demand system and the derived values of elasticity show that tobacco is a threat to the well-being of Cambodian households as it is considered among the products of necessity, and is fairly inelastic with respect to its own price. It is a complementary product to food and a substitute to other items of basic need, including education expenditure, which can pose a serious threat to investment in human resource development and knowledge enhancement. This can further trigger the aggravation of household poverty.
Section Eight: Conclusion and Recommendation

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

The values of cross price elasticity have shown that tobacco is a complement to food and a potential substitute for other products of basic need. This highlights the behavior of persistent consumption of tobacco products, which is aggravated by the intensive marketing and promotion strategies and activities 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 disbursements that Cambodia received from donor communities in each of the years 1999-2001\(^5\). This figure drops slightly to US$57.75 million according to the 2004 survey database. However, this amount still exceeds most of the by-sector planned amount of socio-economic development program into the SEDP-II\(^6\) for 2001-2005 of the Royal Government of Cambodia.

In terms of health conditions, 61.2% of the Cambodian population translated into 8.065 million Cambodians who would need health care in the future as a result of their exposure to secondhand smoke.

B. Recommendation

As a consequence, important recommendations are to be made as follows:

- Mobilized efforts are needed to tackle tobacco consumption
- Intensive anti-tobacco awareness campaigns 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, nor recognized.
- An efficient starting point for tobacco control policy will be naturally to increase the tobacco tax to reduce demand for tobacco products.
- The measures should be accompanied by adoption of strict marketing regulations for tobacco products to reduce the public’s exposure to tobacco products and to promote instead more educational programs to raise the awareness of the risks 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 their social and economic dimensions.

C. Policy Implication

The implication deriving from the research discussion and conclusion can be expressed in terms of strategic measures suggested to ensure an efficient tobacco control policy while

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\(^6\) Socio-Economic Development Plan II (SEDP-II) for 2001-2005, the Royal Government of Cambodia.
ensuring the highest success of the poverty alleviation program of 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 imminent risk of tobacco products.
- To more explicitly provide evidence of the link of tobacco control to the increased success of the efforts of the Royal Government of Cambodia to implement the poverty alleviation program.
- To use the evidence found through research 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 the tobacco control component the most important contribution to the poverty alleviation program of the Royal Government of Cambodia.
Appendix I. Survey Questionnaire for 2004-CSES: Diary Record
09. NUTRITION

A. RICE CONSUMPTION

**Respondents: All household members**

Please provide information on nutrition for the household members.

<table>
<thead>
<tr>
<th>ID NUMBER</th>
<th>For breakfast</th>
<th>For lunch</th>
<th>For dinner</th>
<th>Other</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td></td>
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<tr>
<td>07</td>
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</tr>
<tr>
<td>08</td>
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<td></td>
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</tr>
<tr>
<td>09</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much rice did ..NAME.. eat yesterday?

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.

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

<table>
<thead>
<tr>
<th>FOOD NUMBER</th>
<th>TYPE OF FOOD</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eggs (any)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fish/fish paste, squid, shrimp and prawns, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Other meat (beef, pork, chicken, duck, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Green leafy vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Orange vegetables (pumpkin, carrot, orange sweet potato, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Orange fruits (Ripe mango, ripe papaya, jackfruit, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How many times in the past 7 days did your household consume ..FOOD ITEM.. at home?

If never, write ‘0’ and =>> Next Item

3. How much in total did the household consume of this food in the last 7 days?

**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
   - 2= Not enough food

3. How many of the last 52 weeks did the household have so little food that it was starving?
   - Nbro WEEKS:
02. EDUCATION AND LITERACY

Please provide information on all members aged 5 years and older who usually reside in this household.

<table>
<thead>
<tr>
<th>ID NUMBER</th>
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02. EDUCATION AND LITERACY (CONTINUED)

Please provide information on all members aged 5 years and older who usually reside in this household.

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Respondent: all household members aged 5 years and older
### A Durable Goods

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

#### WEEK 3

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PRODUCT CODE</th>
<th>NUM-BER</th>
<th>a. Within the last 12 months?</th>
<th>b. Before the last 12 months?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Within the last 12 months?</td>
<td>b. Before the last 12 months?</td>
<td>RIELS</td>
<td>RIELS</td>
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**Commodity equipment**

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<tr>
<th>Item</th>
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<td>a. Within the last 12 months?</td>
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**Furniture**

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**Computers**

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**Recreation**

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**Water transport**

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**Agriculture**

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**Other items**

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#### OTHER EXPENDITURES

**Week 3**

- **What was your household's expenditure on the following items during the indicated time periods?**
  - **Write '0' if nothing**
  - **In-cash expenditure**
  - **In-kind expenditure or gifts given away**
  - **Value (in Riel)**
  - **Total expenditure (Col 3 + Col 4)**

### A Durable Goods

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

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#### OTHER EXPENDITURES

**Week 3**

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### A Durable Goods

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

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</table>
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.

### Health

Please provide information on all members usually residing in this household.

#### Illnesses During the Past 4 Weeks

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

<table>
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<th>Week 4</th>
<th>Total</th>
<th>More than one, who is the most important</th>
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#### Smoking Information

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

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</table>

For all household members aged 15 and over:

#### Health (Continued)

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

<table>
<thead>
<tr>
<th>ID NUMBER</th>
<th>WEEK 1</th>
<th>WEEK 2</th>
<th>WEEK 3</th>
<th>WEEK 4</th>
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## 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

   Please fill up the following table below:

| BUILDING NUMBER | What is the building used for?  
|------------------|-------------------------------|
|                  | 1=Residential 2=Agricultural 3=Commercial (purchases) sale of goods and services) 4=industrial (manufacturing)  
|                  |  
|                  | How much would you have to pay to buy a building like this in the village?  
|                  |  
|                  | Is any part of this building rented-out?  
|                  | 1=Yes 2=No
|                  |  
|                  | 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?  
|                  | 1=Yes 2=No
|                  |  
|                  | What kind of work was it?  
|                  | 1=Constructed 2=Extension 3=Repair
|                  |  
|                  | In what year and month did the construction start?  
|                  |  
|                  | In what year and month did people start to use this building?  
|                  |  

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### WEEK 3

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

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<td>123860</td>
<td>24344</td>
<td>123860</td>
<td>24344</td>
<td>123860</td>
</tr>
<tr>
<td>Rich</td>
<td>266428</td>
<td>17097</td>
<td>266428</td>
<td>17097</td>
<td>266428</td>
<td>17097</td>
</tr>
<tr>
<td>Total</td>
<td>23716.84</td>
<td>16569.3</td>
<td>23716.84</td>
<td>16569.3</td>
<td>23716.84</td>
<td>16569.3</td>
</tr>
</tbody>
</table>

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### Appendix III. Table of Result of Maximum Likelihood Estimation

(using modified code originally contributed by Dr. Brian P. Poi, Expert at STATA Corp.)

| alpha          | Coef.       | Std. Err. | z    | P>|z|   | [95% Conf. Interval] |
|---------------|-------------|-----------|------|-------|----------------------|
| 1             | 0.3455849   | 0.0241494 | 14.31| 0     | 0.298253 - 0.392917  |
| 2             | 0.0550763   | 0.0082082 | 6.71 | 0     | 0.03899 - 0.071164   |
| 3             | 0.0671178   | 0.012795  | 5.25 | 0     | 0.04204 - 0.092196   |
| 4             | 0.0798141   | 0.0178623 | 4.47 | 0     | 0.044805 - 0.114824  |
| 5             | 0.4500893   | 0.0205816 | 21.87| 0     | 0.40975 - 0.490429   |
| 6             | 0.0023176   | 0.0129443 | 0.18 | 0.858 | -0.02305 - 0.027688  |

| beta          | Coef.       | Std. Err. | z    | P>|z|   | [95% Conf. Interval] |
|---------------|-------------|-----------|------|-------|----------------------|
| 1             | -0.128151   | 0.0017339 | -73.91| 0     | -0.13155 - 0.12475  |
| 2             | -0.0019173  | 0.0004362 | -4.4 | 0     | -0.00277 - 0.00106  |
| 3             | 0.0226334   | 0.000564  | 40.13| 0     | 0.021528 - 0.023739 |
| 4             | 0.0231389   | 0.0012112 | 19.1 | 0     | 0.020765 - 0.025513 |
| 5             | 0.0915963   | 0.0015055 | 60.84| 0     | 0.088646 - 0.094547 |
| 6             | -0.0073003  | 0.000385  | -18.96| 0     | -0.00805 - 0.00655  |

| gamma         | Coef.       | Std. Err. | z    | P>|z|   | [95% Conf. Interval] |
|---------------|-------------|-----------|------|-------|----------------------|
| 11            | 0.1261253   | 0.0091248 | 13.82| 0     | 0.108241 - 0.14401  |
| 21            | 0.0006819   | 0.0028103 | 0.24 | 0.808 | -0.00483 - 0.00619  |
| 31            | -0.0158519  | 0.0039335 | -4.03| 0     | -0.02356 - 0.00814  |
| 41            | -0.0306511  | 0.007589  | -4.04| 0     | -0.04553 - 0.01578  |
| 51            | -0.065865   | 0.003687  | -17.86| 0     | -0.07309 - 0.05864  |
| 61            | -0.0144391  | 0.0043345 | -3.33| 0.001 | -0.02293 - 0.00594  |
| 22            | -0.0014871  | 0.0020115 | -0.74| 0.46  | -0.00543 - 0.002455 |
| 32            | 0.0046846   | 0.0023638 | 1.98 | 0.047 | 5.17E-05 - 0.009318 |
| 42            | -0.0054274  | 0.0030793 | -1.76| 0.078 | -0.01146 - 0.00608  |
| 52            | -0.0035531  | 0.001006  | -3.53| 0     | -0.00552 - 0.00158  |
| 62            | 0.0051011   | 0.0029175 | 1.75 | 0.08  | -0.00062 - 0.010819 |
| 33            | 0.0110725   | 0.0053026 | 2.09 | 0.037 | 0.00068 - 0.021466  |
| 43            | -0.0186715  | 0.0048756 | -3.83| 0     | -0.02823 - 0.00912  |
| 53            | 0.0182283   | 0.0014253 | 12.79| 0     | 0.015435 - 0.021022 |
| 63            | 0.000538    | 0.0041446 | 0.13 | 0.897 | -0.00759 - 0.008661 |
| 44            | 0.039292    | 0.0092645 | 4.24 | 0     | 0.021134 - 0.05745  |
| 54            | 0.0143119   | 0.0028098 | 5.09 | 0     | 0.008805 - 0.019819 |
| 64            | 0.0011462   | 0.0088543 | 0.13 | 0.897 | -0.01621 - 0.0185   |
| 55            | 0.0418623   | 0.0031631 | 13.23| 0     | 0.035663 - 0.048062 |
| 65            | -0.0049845  | 0.0031631 | -1.58| 0.115 | -0.01118 - 0.001215 |
| 66            | 0.0126382   | 0.0104196 | 1.21 | 0.225 | -0.00778 - 0.03306  |
Appendix IV. Calculation and Tables for Graphs Construction

Log of the STATA session on estimation of the demand system is recorded in text file: lnl_lais_1original.log
Log of the STATA session on computation of elasticity is recorded in text file: laids_elast_camb.log

Table for graph in figure 2

<table>
<thead>
<tr>
<th>Smoking Status</th>
<th>Households</th>
<th>Smoking Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household with at least one smoker: 1,539,164</td>
<td>1,539,164</td>
<td>58.7</td>
</tr>
<tr>
<td>Household with no smoker: 1,081,984</td>
<td>1,081,984</td>
<td>41.3</td>
</tr>
<tr>
<td>Total</td>
<td>2,621,148</td>
<td>100.0</td>
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</table>

Table for graph in figure 3

<table>
<thead>
<tr>
<th>Region</th>
<th>Sex</th>
<th>Individual Smoking Prevalence (15 years old or over)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phnom Penh</td>
<td>Male</td>
<td>18.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.1</td>
</tr>
<tr>
<td>Other Urban</td>
<td>Male</td>
<td>36.1</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.6</td>
</tr>
<tr>
<td>Rural</td>
<td>Male</td>
<td>45.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4.6</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Male</td>
<td>41.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4.1</td>
</tr>
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</table>

Table for graphs in figure 4

<table>
<thead>
<tr>
<th>Family Size, persons</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>2</td>
<td>5.8</td>
</tr>
<tr>
<td>3</td>
<td>12.8</td>
</tr>
<tr>
<td>4</td>
<td>19.1</td>
</tr>
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<td>5</td>
<td>19.9</td>
</tr>
<tr>
<td>6</td>
<td>16.2</td>
</tr>
<tr>
<td>7</td>
<td>11.9</td>
</tr>
<tr>
<td>8</td>
<td>7.0</td>
</tr>
<tr>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>10</td>
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<tr>
<td>11</td>
<td>0.6</td>
</tr>
<tr>
<td>12</td>
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<tr>
<td>14</td>
<td>0.0</td>
</tr>
<tr>
<td>15</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>With tobacco consumer(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phnom Penh</td>
<td>4.97</td>
</tr>
<tr>
<td>Urban</td>
<td>12.51</td>
</tr>
<tr>
<td>Rural</td>
<td>82.52</td>
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</tbody>
</table>
### Table for graph in figure 5

<table>
<thead>
<tr>
<th>Smoking Expenditure on Tobacco Products by Regions</th>
<th>Phnom Penh</th>
<th>Other Urban</th>
<th>Rural</th>
<th>Cambodia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;5,000 Riels/month)</td>
<td>10.6</td>
<td>16.3</td>
<td>27.1</td>
<td>24.9</td>
</tr>
<tr>
<td>Medium (5,000 to &lt;15,000 Riels/month)</td>
<td>21.7</td>
<td>35.1</td>
<td>44.3</td>
<td>42.1</td>
</tr>
<tr>
<td>High (15,000 Riels and over/month)</td>
<td>67.7</td>
<td>48.6</td>
<td>28.5</td>
<td>33.0</td>
</tr>
<tr>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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### Table for graph in figure 6

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

### Table for graphs in figure 7

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<th>Urbanity</th>
<th>Smoking status</th>
<th>Food ex.tobac</th>
<th>Housing</th>
<th>Other expend.</th>
<th>Medical care</th>
<th>Clothing</th>
<th>Education</th>
<th>Tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phnom Penh</td>
<td>Non-smoking</td>
<td>39.80</td>
<td>36.58</td>
<td>7.48</td>
<td>4.91</td>
<td>2.83</td>
<td>8.41</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Smoking</td>
<td>43.21</td>
<td>33.45</td>
<td>7.39</td>
<td>4.10</td>
<td>2.69</td>
<td>6.45</td>
<td>2.71</td>
</tr>
<tr>
<td>Urban</td>
<td>Non-smoking</td>
<td>50.94</td>
<td>24.12</td>
<td>13.06</td>
<td>4.23</td>
<td>3.16</td>
<td>4.48</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Smoking</td>
<td>55.87</td>
<td>22.67</td>
<td>9.36</td>
<td>3.86</td>
<td>2.68</td>
<td>2.53</td>
<td>3.03</td>
</tr>
<tr>
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<td>Non-smoking</td>
<td>58.94</td>
<td>15.71</td>
<td>14.77</td>
<td>5.51</td>
<td>2.97</td>
<td>2.10</td>
<td>0.00</td>
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<tr>
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<td>61.88</td>
<td>12.46</td>
<td>11.77</td>
<td>6.54</td>
<td>2.89</td>
<td>1.36</td>
<td>3.10</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Non-smoking</td>
<td>50.85</td>
<td>24.47</td>
<td>11.95</td>
<td>5.06</td>
<td>2.96</td>
<td>4.71</td>
<td>0.00</td>
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<td>58.55</td>
<td>16.73</td>
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<td>5.80</td>
<td>2.83</td>
<td>2.20</td>
<td>3.04</td>
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### Table for graphs in figure 8

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<th>Income Groups</th>
<th>Phnom Penh</th>
<th>Urban</th>
<th>Rural</th>
<th>Cambodia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>54.19</td>
<td>13.94</td>
<td>12.73</td>
<td>12.96</td>
</tr>
<tr>
<td>Poor</td>
<td>11.96</td>
<td>5.45</td>
<td>6.75</td>
<td>6.87</td>
</tr>
<tr>
<td>Middle</td>
<td>7.02</td>
<td>5.45</td>
<td>4.64</td>
<td>4.78</td>
</tr>
<tr>
<td>Well-off</td>
<td>4.77</td>
<td>3.32</td>
<td>2.87</td>
<td>3.09</td>
</tr>
<tr>
<td>Rich</td>
<td>0.75</td>
<td>0.66</td>
<td>0.73</td>
<td>0.71</td>
</tr>
</tbody>
</table>

### Table for graphs in figure 9

<table>
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<tr>
<th>Income Groups</th>
<th>Phnom Penh</th>
<th>Urban</th>
<th>Rural</th>
<th>Cambodia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>2.32</td>
<td>3.96</td>
<td>3.62</td>
<td>3.62</td>
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<td>3.80</td>
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<td>Well-off</td>
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<td>3.14</td>
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<td>Rich</td>
<td>2.48</td>
<td>2.54</td>
<td>2.44</td>
<td>2.48</td>
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</table>

### Table for graphs in figure 10

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<th>Selected Percentage</th>
<th>Phnom Penh</th>
<th>Urban</th>
<th>Rural</th>
</tr>
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<tbody>
<tr>
<td>% of All Food in Total Expenditure</td>
<td>45.92</td>
<td>58.90</td>
<td>64.98</td>
</tr>
<tr>
<td>% of Tobacco in Total Expenditure</td>
<td>2.71</td>
<td>3.03</td>
<td>3.10</td>
</tr>
<tr>
<td>% of Tobacco in All Food Consumption</td>
<td>5.89</td>
<td>5.15</td>
<td>4.77</td>
</tr>
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</table>

### Table for graphs in figure 11

<table>
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<tr>
<th>Region</th>
<th>Tobacco</th>
<th>Food Ex Toab</th>
<th>Clothing</th>
<th>Education</th>
<th>Medicare</th>
<th>Housing</th>
<th>Other</th>
<th>Total Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phnom Penh</td>
<td>Non-smoking</td>
<td>0</td>
<td>39.8</td>
<td>2.83</td>
<td>8.41</td>
<td>4.91</td>
<td>36.56</td>
<td>7.49</td>
</tr>
<tr>
<td></td>
<td>Smoking</td>
<td>2.71</td>
<td>43.21</td>
<td>2.69</td>
<td>6.45</td>
<td>4.1</td>
<td>33.45</td>
<td>7.39</td>
</tr>
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<td>Non-smoking</td>
<td>0</td>
<td>50.94</td>
<td>3.16</td>
<td>4.48</td>
<td>4.23</td>
<td>24.12</td>
<td>13.07</td>
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<td>55.87</td>
<td>2.68</td>
<td>2.53</td>
<td>3.86</td>
<td>22.67</td>
<td>9.36</td>
</tr>
<tr>
<td>Rural</td>
<td>Non-smoking</td>
<td>0</td>
<td>58.94</td>
<td>2.97</td>
<td>2.1</td>
<td>5.51</td>
<td>15.71</td>
<td>14.77</td>
</tr>
<tr>
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<td>61.88</td>
<td>2.89</td>
<td>1.36</td>
<td>6.54</td>
<td>12.46</td>
<td>11.77</td>
</tr>
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</table>

### Table for graphs in figure 12

<table>
<thead>
<tr>
<th>Status</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All children under-13 living in smoking family</td>
<td>62.5</td>
</tr>
<tr>
<td>All children under-13 living in non-smoking family</td>
<td>37.5</td>
</tr>
<tr>
<td>All children: 4,370,919</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Table for graphs in figure 13

<table>
<thead>
<tr>
<th>Status</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Cambodians living with smoker: 8,040,468 persons</td>
<td>61.7</td>
</tr>
<tr>
<td>All Cambodians not living with smoker: 4,997,102 persons</td>
<td>38.3</td>
</tr>
<tr>
<td>Total population: 13,037,571</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table for graphs in figure 15

<table>
<thead>
<tr>
<th>Food Package Bought With One Pack of 555 Cigarette</th>
<th>One pack of 555 cigarette</th>
<th>Food package</th>
</tr>
</thead>
<tbody>
<tr>
<td>555-Brand Cigarette</td>
<td>5120</td>
<td>0</td>
</tr>
<tr>
<td>Rice, 1 Kg</td>
<td>0</td>
<td>860</td>
</tr>
<tr>
<td>Fish, 0.5 Kg</td>
<td>0</td>
<td>2035</td>
</tr>
<tr>
<td>Egg, 2 Eggs</td>
<td>0</td>
<td>640</td>
</tr>
<tr>
<td>Morning Gloria, 0.4 Kg</td>
<td>0</td>
<td>720</td>
</tr>
<tr>
<td>Banana, 1 Comb</td>
<td>0</td>
<td>720</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0</td>
<td>145</td>
</tr>
<tr>
<td>Total</td>
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<td>5120</td>
</tr>
</tbody>
</table>

Energy Generated From Food Package Bought With One Pack of 555 Cigarette

<table>
<thead>
<tr>
<th>One pack of 555 cigarette</th>
<th>Food package</th>
</tr>
</thead>
<tbody>
<tr>
<td>555-Brand Cigarette</td>
<td>0</td>
</tr>
<tr>
<td>Rice, 1 Kg</td>
<td>0</td>
</tr>
<tr>
<td>Fish, 0.5 Kg</td>
<td>0</td>
</tr>
<tr>
<td>Egg, 2 Eggs</td>
<td>0</td>
</tr>
<tr>
<td>Morning Gloria, 0.4 Kg</td>
<td>0</td>
</tr>
<tr>
<td>Banana, 1 Comb</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

Table for graphs in figure 16

<table>
<thead>
<tr>
<th>Food Bought With One Pack of ARA and Energy Generated From Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Items</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Rice, 0.5 Kg</td>
</tr>
<tr>
<td>Beef, 0.1 Kg</td>
</tr>
<tr>
<td>Pork, 0.1 Kg</td>
</tr>
<tr>
<td>Chicken, 0.1 Kg</td>
</tr>
<tr>
<td>Fish, 0.1 Kg</td>
</tr>
<tr>
<td>Egg, 3 Eggs</td>
</tr>
<tr>
<td>Trakun, 5 Midsize bundles</td>
</tr>
<tr>
<td>Cabbage, 0.5 Kg</td>
</tr>
<tr>
<td>Banana, 1 Comb</td>
</tr>
<tr>
<td>ARA-Brand, 1 Packet</td>
</tr>
</tbody>
</table>

Table for graph in figure 17

<table>
<thead>
<tr>
<th>Annual Total Spending on Tobacco, $US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Phnom Penh (11.33% of Total Tobacco Expenditure)</td>
</tr>
<tr>
<td>Other Urban (15.86% of Total Tobacco Expenditure)</td>
</tr>
<tr>
<td>Rural (72.81% of Total Tobacco Expenditure)</td>
</tr>
<tr>
<td>Cambodia</td>
</tr>
</tbody>
</table>
Reference

2. ADRA, Cambodian Tobacco or Health Program, Phnom Penh, 1996
4. A study of the tobacco sector in selected province, Cambodia, WB, 2003
7. Ministry of Planning and Ministry of Health, 2000, Demographic and Health Survey, Cambodia 2000,
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