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Economics of Tobacco Control Paper No. 7

# Analysis of the Economics of Tobacco in Morocco

Omar Aloui

March 2003

Tobacco Free Initiative
World Health Organization

HNP
HEALTH, NUTRITION, AND POPULATION
THE WORLD BANK

# ANALYSIS OF THE ECONOMICS OF TOBACCO IN MOROCCO

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## Health, Nutrition and Population (HNP) Discussion Paper

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# ECONOMICS OF TOBACCO CONTROL PAPER NO. 7

# ANALYSIS OF THE ECONOMICS OF TOBACCO IN MOROCCO

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Paper prepared for the World Health Organization Tobacco Free Initiative, Eastern Mediterranean Region, for a meeting on the Economics and Health issues related to Tobacco Use and Tobacco Control, held in Malta in September 2001.

**Abstract**: This study of the tobacco industry and taxation policy in Morocco summarizes tobacco expenditure data from surveys, and looks at trends in these expenditures. The taxation and price policy implemented by the Moroccan government through the Régie des Tabacs is described, and the overall contribution of the industry to tax revenues is estimated. The report briefly describes how the industry is organized, including farming activities, processing, marketing and the distribution network. Effective rates of taxation by categories of brands are estimated. The study then analyses the impact of price and taxation policy on tobacco demand and tax revenues. Data and estimation model specifications are described, and the results presented of different simulations of tax/price increases on tobacco consumption and tax revenues. The analysis shows that modest increases in tobacco tax rates in Morocco would generate additional revenues, and reduce consumption of tobacco products. Since few jobs are generated by the tobacco industry in Morocco, and 70% of all raw tobacco is imported, a fall in cigarette consumption would not be likely to cause any significant loss of employment. Moreover, as consumers switch their expenditures to other goods and services instead of cigarettes, the additional demand in other sectors of the economy will generate new jobs and incomes. The report concludes with recommendations for further research.

**Keywords**: tobacco; tobacco tax; cigarette tax; economics of tobacco; economics of tobacco control; smoking; tobacco policy; price elasticity; demand for cigarettes; Morocco; Régie des Tabacs.



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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| CPI | consumer price index |
| DH | Moroccan dirham |
| GDP | gross domestic product |
| IMF | International Monetary Fund |
| kg | kilogram |
| OLS | ordinary least squares |
| 2-SLS | two-stage least squares |
| Ton | metric tonne |
| USDA | United States Department of Agriculture |
| VAT | value added tax |

**Exchange rate**

US$ 1 = DH 10.61

# TABLE OF CONTENTS

## List Of Tables



## List Of Figures

# FOREWORD

In 1999, the World Bank published "Curbing the Epidemic: governments and the economics of tobacco control", which summarizes the trends in global tobacco use and the resulting immense and growing burden of disease and premature death. By 1999, there were already 4 million deaths from tobacco each year, and this huge number is projected to grow to 10 million per year by 2030, given present trends in tobacco consumption. Already about half of these deaths are in high-income countries, but recent and continued increases in tobacco use in the developing world is causing the tobacco-related burden to shift increasingly to low- and middle-income countries. By 2030, seven of every ten tobacco-attributable deaths will be in developing countries. "Curbing the Epidemic" also summarizes the evidence on the set of policies and interventions that have proved to be effective and cost-effective in reducing tobacco use, in countries around the world.

Tax increases that raise the price of tobacco products are the most powerful policy tool to reduce tobacco use, and the single most cost-effective intervention. They are also the most effective intervention to persuade young people to quit or not to start smoking. This is because young people, like others with low incomes, tend to be highly sensitive to price increases.

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

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

Much of the evidence presented and summarized in "Curbing the Epidemic" was from high income countries. But the main battleground against tobacco use is now in low- and middle-incomes countries. If needless disease and millions of premature deaths are to be prevented, then it is crucial that developing counties raise tobacco taxes, introduce comprehensive bans on all advertising and promotion of tobacco products, ban smoking in public places, inform their citizens well about the harm that tobacco causes and the benefits of quitting, and provide advice and support to help people who smoke and chew tobacco, to quit.

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

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

*Joy de Beyer*

Tobacco Control Coordinator
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The consultant remains exclusively responsible for the content of this report.

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# SUMMARY


**Economics of the tobacco industry in Morocco.**

Tobacco sales in Morocco represented a market of DH 8.3 billion (US$ 782 million[1]) in 2000, excluding smuggling (estimated at 8% of total consumption). In terms of value added, the tobacco industry generated DH 7.5 billion in 2000, 2.1% of Moroccan GDP. This creation of value is mainly due to processing and distribution activities (99%), and marginally due to farming. The state company (Régie des Tabacs) is, by law, the only buyer and seller of tobacco products. The farming subsector involves around 7,000 producers, and a total land area of 4,500 hectares on average.

In terms of expenditures, tobacco represents an increasing share, around 2.5% of total per capita expenditures in 1999 (corresponding to US$ 19) against only 1.2% in the 1960s. In real terms, tobacco expenditures have been systematically increasing during the past 40 years. Between the early 1960s and 1999, tobacco expenditure increased 4.4 fold in rural areas and 2.7 fold in urban areas. Income levels do not seem to affect expenditures shares, which remain uniform at around 2.7%, except for the richest group, which has a lower share. Since the early 1990s, in relative terms, the poorest population group, the rural one, has tended to spend slightly more than the richer urban group.

Taxes and levies represent 73% of the average retail price of cigarettes in Morocco. Local and imported inputs account for 8.4% of this price. Capital remuneration and depreciation represent 7.8% of this price. The rest (around 5%) is shared between wages and marketing costs. As far as fiscal receipts are concerned, taxes on tobacco represent some 6% of government expenditure.

**Impact analysis of tobacco price/tax increases.**

The demand analysis for cigarettes over the period 1965–2000 allowed us to estimate the price and income elasticity and the form of the function of demand for cigarettes.
The short-run price elasticity ranged between –0.51 and –0.73.
The long-run price elasticity ranged between –1.36 and –1.54.
The short-run income elasticity ranged between +0.32 and +0.56.
The long-run income elasticity ranged between +0.87 and +1.04.

The analysis results show that there is no risk of a fall in tax revenues due to increased tobacco taxes. The risk of decreasing marginal tax revenue begins only with high levels of tax increases (above 60% and depending on elasticity). Within moderate ranges of increase, tobacco tax increase have a positive impact on government revenues. The analysis in this study shows that a tax rise of 10% would increase revenues from taxes by about 6%. Increasing tobacco taxes is an effective way to reduce tobacco consumption. A tax rise of 10% in Morocco would decrease demand for cigarettes (per adult) by 3.3%.

The employment effect of a consumption reduction would be moderate. The tobacco farming industry is quite small in terms of land use (4500 hectares out of 9 million hectares of farm land) and in terms of market share of the total supply of raw tobacco (around 70% of raw


[1] This paper uses an exchange rate of US$ 1 = DH 10.61. The rate as of mid March 2002 was US$ 1 = DH 11.60.

tobacco is imported). This means that if tobacco consumption were to fall, it would have a negligible effect on rural labour markets. The processing industry is capital-intensive, with only 1,000 employees, spread around different units. This means that a reduction in processing activity will not have any major effect on specific urban labour markets.

The impact on the poor of tax increases remains a complex question in the absence of specific surveys of tobacco consumption among different income groups. The income elasticities have been estimated based on relatively poor data (particularly for income proxies). Tobacco appears from this analysis to be a normal good for which income elasticity is positive and less than 1. This estimate is confirmed by the results of a 1999 expenditures survey published by Direction de la Statistique.

**Further research.**

To fill the main gaps remaining in the study of tobacco economics in Morocco, three priorities emerge: better knowledge of consumption by region, income level and brand; the impact of privatisation on relative prices and effective taxation rates; and the economic cost of tobacco-induced diseases.

# INTRODUCTION

This report presents a study on the economics of the tobacco industry in Morocco. It has two parts. The first part contains a general description of the tobacco market in Morocco. It is structured in three sections. The first section summarizes tobacco expenditure data coming from surveys and analyses different indicators related to tobacco expenditures. The second section addresses the taxation and price policy implemented by the Moroccan government through the Régie des Tabacs. The overall contribution of the industry to tax revenues is estimated. The third section describes how the industry is organized, including farming activities, processing and the distribution network. It contains also a brief description of the marketing side. It estimates the effective rate of taxation by categories of brands.

The second part contains an impact analysis of price and taxation policy based on a tobacco demand model, organized as follows. First, it presents the methodological aspects including data (annex 1) and specifications. Then, it presents the results of different simulations of tax/price increases on tobacco consumption and tax revenues. The report concludes with recommendations for further research.

# GENERAL DESCRIPTION OF THE TOBACCO MARKET

The tobacco market is described in the following three sections. The first deals with expenditures and consumption, the second concerns price policy, and the third describes the industry structure.

## PER CAPITA TOBACCO EXPENDITURES

National expenditure and consumption surveys were conducted in 1959–60, 1970–71, 1984–85, 1990–91 and 1998–99 by the Moroccan Direction de la Statistique. The results of these surveys include relatively detailed estimates of consumption and expenditure by category of product, income level and residence. In particular, tobacco and cigarette expenditure per household and per capita are estimated. Tables 1 and 2 present per capita expenditures and as shares of total expenditures. Table 3 shows the trend in expenditures in real terms and Table 4 summarizes data on expenditures by income levels. Table 4 is a tentative estimate of the reliability of the survey figures, based on a comparison with sales figures.

**Table 1. Average per capita expenditure on tobacco and cigarettes (current DH)**

(DH/capita/year)

| Year | Urban | Rural | National |
|---|---|---|---|
| 1959–60 | 10.70 | 3.40 | 5.30 |
| 1970–71 | 32.00 | 10.00 | 17.00 |
| 1984–85 | 106.85 | 43.35 | 70.82 |
| 1990–91 | 175.30 | 101.90 | 136.30 |
| 1998–99 | 243.80 | 129.00 | 191.00 |

Source: Direction de la Statistique

Tobacco expenditure in 2000 was DH 191 per capita on average, with big differences between urban and rural populations. On average, tobacco expenditure was 88% higher in urban areas. But these gaps overstate somewhat the differences in terms of tobacco intake.

Because cheaper tobacco products are smoked in rural areas, the gap in quantity is lower than the expenditure differentials. The gap in expenditure by household should also be lower, since family size is on average larger in rural areas.

**Table 2. Tobacco and cigarettes expenditure as per cent of total expenditure**

| Year | Urban | Rural | National |
|---|---|---|---|
| 1959–60 | 1.7 | 0.9 | 1.2 |
| 1970–71 | 2.3 | 1.5 | 1.9 |
| 1984–85 | 2.2 | 1.6 | 2.0 |
| 1990–91 | 1.9 | 2.2 | 2.0 |
| 1998–99 | 2.4 | 2.5 | 2.4 |

Source: Direction de la Statistique

The expenditure share doubled from 1.2% to 2.4% between the 1960s and recent years. This trend has been stronger in rural areas, where the expenditure share has more than doubled.

During the 1970s and 1980s, the national share remained stable at around 2%, hiding opposite trends between rural consumers (increasing) and urban ones (decreasing). From the early 1990s, in relative terms, the rural population tended to spend slightly more than the urban population. This trend appears clearly in Table 3 in which average expenditures in constant 2000 DH[1] have been computed.

**Table 3. Expenditure on tobacco and cigarettes (DH-2000/capita/year)**

| Year | Urban | Rural | National |
|---|---|---|---|
| 1959–60 | 93.33 | 29.66 | 46.23 |
| 1970–71 | 211.45 | 66.08 | 112.33 |
| 1984–85 | 210.57 | 85.43 | 139.57 |
| 1990–91 | 254.85 | 148.14 | 198.16 |
| 1998–99 | 248.89 | 131.69 | 194.99 |
| Ratio 98/59 | 2.67 | 4.44 | 4.22 |

Source: Direction de la Statistique and author's estimates

Average tobacco expenditures in rural areas multiplied by 4.4 during the past 40 years whereas the multiplying factor was 2.7 in urban areas. This change results from two effects: a price effect and a consumption effect. In terms of prices, we will show below that tobacco prices have increased at a higher rate than general inflation. As far as consumption is concerned, the increase in expenditure is related to a change in habits that has been largely influenced by the extension of the marketing network in rural areas.

Income levels have a relatively proportional effect on tobacco expenditure. The richest category (class 5 in the table below) spent 5.5 times more than the poorest one in tobacco. This is mainly explained by the difference of prices between imported and local brands. For 2000, for example, the unit price of imported cigarettes was 5.5 times higher than the unit price of local brands. With the exception of the richest category where cigarette expenditures are 2.1% of total expenditures, cigarette expenditure shares of total expenditure do not vary a lot across income categories, being around 2.7%.

[1] The inflation index is the official consumer price index (Direction de la Statistique).

**Table 4. Tobacco expenditure by expenditure level in 1998/99, DH/capita/year**

| Goods and services | Category of expenditure based on average annual expenditure per capita (*) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Total |
| Tobacco and cigarettes | 69.2 | 118.8 | 159.1 | 226.1 | 382.5 | 191.1 |
| Total expenditure | 2544.0 | 4155.0 | 5809.0 | 8385.0 | 18 232.0 | 7823.0 |
| Expenditure share | 2.7% | 2.9% | 2.7% | 2.7% | 2.1% | 2.4% |

Source: Direction de la Statistique and author's estimates

(*) Definition of expenditures categories

| Class | Level of expenditure per capita per year |
|---|---|
| 1 | Less than DH 3404 |
| 2 | From DH 3404 to DH 4911 |
| 3 | From DH 4912 to DH 6804 |
| 4 | From DH 6805 to DH 10 329 |
| 5 | DH 10 330 and more |

The ratio of tobacco expenditure to total expenditure (the total amount spent on tobacco products divided by total expenditure) is important for measuring the impact of tobacco tax (or price) increases on household welfare, one factor that policy-makers might wish to take into account when considering whether to increase the tax or prices of tobacco products. Indeed, if this share is large, an increase in prices could have a significant impact on household budgets. In the opposite case, if the income share is small, an increase in prices (or tax) does not have a large household budgetary impact. Table 4 shows that Morocco is in the latter situation, with 2.4% of household income spent on average on tobacco products in 1998–99. The impact of an increase in tax or prices would be less important for the richest quintile of households (class 5) than for the other expenditure quintiles.

Knowing tobacco product expenditures for the various categories as a share of total household expenditures allows us to estimate expenditure elasticity. This elasticity is a measure of the percentage change in tobacco expenditure as a result of a percentage change in income (proxied here by total household expenditure[1]). Analytically, the expenditure elasticity $\varepsilon_{\text{expenditure}}$ is:

$$\varepsilon_{\text{expenditure}} = \frac{\Delta D / D}{\Delta R / R}$$

where $\Delta D$ is the change in tobacco expenditure and $\Delta R$ the change in income (or total expenditure).

Table 5 evaluates this elasticity for the various levels of total expenditure. These elasticity estimates are calculated from the data in table 4 provided by the statistical office, rather than from household data. The changes in tobacco expenditure and income are calculated for each pair of income categories.

[1] We shall return to the evaluation of income elasticity in the section on the economic analysis of demand using time series (page 15).

**Table 5. Computation of the expenditure elasticity of tobacco (1998–99)**

| | Pairs of expenditure/income categories | | | | |
|---|---|---|---|---|---|
| | 2/1 | 3/2 | 4/3 | 5/4 | 5/1 |
| ΔD/D | 71.7% | 33.9% | 42.1% | 69.2% | 453% |
| ΔR/R | 63.3% | 39.8% | 44.3% | 117.4% | 616% |
| $\varepsilon_{expenditure}$ | 1.13 | 0.85 | 0.95 | 0.59 | 0.73 |

Source: Computations from data in table 4

On average, the expenditure elasticity of tobacco products is 0.73. This means that the income/expenditure share for these products decreases as total income increases. However, for the poorest classes (pairing of classes 1 and 2, for which the expenditure elasticity is higher than 1), the share of expenditure on tobacco products grows if income increases.

**Comparison between tobacco expenditure and health and education expenditure**

From the results of national expenditure and consumption surveys quoted above, it is also possible to compare changes in the average household expenditures on tobacco and cigarettes with changes in expenditures on health (medical care) and education. Table 6 presents this comparison.

**Table 6. Average expenditure on tobacco, health and education in real terms, DH-2000 per capita per year**

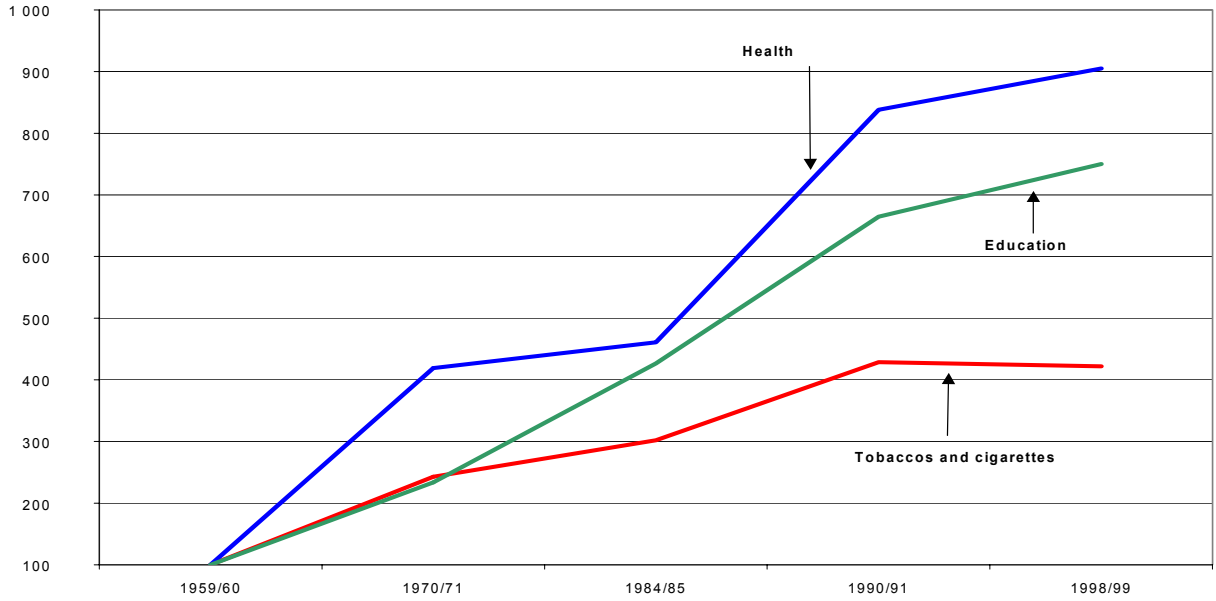
| | Tobacco/cigarettes | Health | Education |
|---|---|---|---|
| 1959–60 | 46.23 | 41.00 | 27.30 |
| 1970–71 | 112.33 | 171.80 | 63.82 |
| 1984–85 | 139.57 | 188.89 | 116.49 |
| 1990–91 | 198.16 | 343.54 | 181.44 |
| 1998–99 | **194.99** | 370.99 | 204.79 |
| Ratio 98/59 | 4.22 | 9.05 | 7.50 |

Source: Direction de la Statistique and author's estimates

Tobacco expenditures increased significantly in real terms, but less than health or education expenditures. Expressed in DH-2000, health expenditure and education expenditure increased by factors of 9 and 7.5 respectively while tobacco expenditure multiplied "only" by 4.2. Figure 1 shows this change, standardizing expenditure for all three categories at 100 in 1959–60.

It should be noted that surveys are thought to underestimate expenditure figures. This bias is not specific to Morocco and has been noted in other countries. The discrepancy concerns young consumers especially, who may be unwilling to admit to adult interviewers that they spend large amounts on cigarettes. Underestimation rates estimated at 30% to 50% are not unusual. To test whether this might be the case in Morocco, we compared sales data from the tobacco monopoly company (Régie de Tabacs) with estimates from the 1998/99 household expenditure survey. Table 7 presents the comparison, which includes estimated consumption of smuggled cigarettes, based on a study done by Arthur Andersen for the monopoly.

**Figure 1. Evolution of expenditure for tobaccos, health and education (1959–60 = 100)**




Source: Direction de la Statistique and author's estimates

**Table 7. Comparative study of consumption and sales for 1998**

| | Estimate | Unit |
|---|---|---|
| Average expenditure on tobacco and cigarettes (= *a)* | 191 | DH/capita/year |
| Population (1998) (= *b)* | 27,775,000 | |
| Total expenditure on tobacco and cigarettes $A = a \times b$ | 5305 | million DH |
| Purchases from Régie des Tabacs (internal sales only) (= *c)* | 7865 | million DH |
| Purchases of smuggled goods[1] (= *d)* | 653 | million DH |
| Total sales of tobacco and cigarettes $B = c + d$ | 8518 | million DH |
| Underestimate of total expenditure: $(B - A)/A$ | 61% | |
| Underestimate of total sales: $(B - A)/B$ | 38% | |

Source: Direction de la Statistique, Régie des Tabacs and author's estimates

The underestimate represents 61% of total expenditures or 31% of total sales. If we translate the total sales figure into per capita expenditures per year, the estimate would be 307 DH/capita/year, instead of 191 DH/capita/year. Despite this bias, the expenditure surveys remain the only source we have to study the impact of tobacco price policy on income groups.

Conclusions of section 1

Tobacco represents an increasing share of household expenditure: around 2.5% of total per capita expenditures in 1999 (corresponding to US$ 19) compared with only 1.2% in the 1960s. From the early 1990s, in relative terms, the amount spent by the rural population who

[1] The estimate of sales of smuggled cigarettes is based on a market study for Régie des Tabacs. For 2000, according to this study, 52 million packs were smuggled. Estimates for 1997 and 1998 are based on the 2000 ratio between smuggled and legal sales. For this estimate the price ratio between imported cigarettes and smuggled cigarettes is fixed at 1.4. With these hypotheses, the total non-duty market is estimated at DH 653 million.

are poorer than the urban population, has increased more. In real terms, tobacco expenditures have increased during the past 40 years. Since the early 1960s, per capita tobacco expenditures have multiplied by 4.4 in rural areas and 2.7 in urban areas. Income levels do not seem to affect expenditures shares, which remain uniform at around 2.7%, except for the richest income category, which spends a slightly lower share of total expenditure on cigarettes.

## TAXATION POLICY

The tobacco sector is one of the main taxpayers in Morocco, in terms of total amount but also in terms of growth rates. This section describes import regulations and duties, the internal structure of taxation, the overall contribution of tobacco to tax revenue and an estimate of effective rates of taxation of different brand categories.

### Import regulations

The basic rule on tobacco imports is the following: "the entry of tobacco leaves or processed tobacco is forbidden in Morocco unless it is for the Régie des Tabacs"[1]. The concession contract between the government and the company stipulates that the latter benefits from a monopoly in trade and processing of tobacco in Morocco. Table 8 shows the import duties on tobacco products. The ad valorem duty and the supplementary taxes are applied only to individuals bringing cigarettes and other tobacco products into Morocco. On the basis of these tariffs, the total amount of import duty paid by Régie des Tabacs is estimated at near DH 138 million (around US$ 12.5 million) for 2000.

**Table 8. Import duties (%)**

| *Product* | Basic tariff | Ad valorem duty (%)* | Supplementary taxes |
|---|---|---|---|
| Unprocessed and raw tobacco | 17.5 | | |
| Cigarettes | 25.0 | 65 | DH 85.35/1000 units |
| Cigars | 25.0 | 65 | DH 369.15/100 units |
| Cigarillos | 25.0 | 65 | DH 18.25/100 units |
| Cut tobacco, snuff, chewing | 25.0 | 65 | DH 33.80/kg |
| Nicotine | 17.5 | | |

(*) The ad valorem duty is applied to the selling price in Morocco for similar products.
Source: Administration des Douanes et des Impôts Indirects

### Domestic taxation

The largest part of the fiscal contribution by the tobacco sector is through excise taxes. The monopoly tax is the heaviest one. It is based on the amount of sales of finished products and its rate is 65% of the retail price. For 2000[2], this tax generated DH 5,418 million on a total taxable sales amount of DH 8,335 million[3]. The second largest fiscal contribution is the tax on profits (impôt sur les sociétés), raising "only" DH 254 million in 2000. The concession

[1] Régime des tabacs – code des douanes, chapter 15.
[2] See *Rapport de gestion—bilan 2000—Régie des Tabacs*.
[3] The turnover figure includes the amount of exempted sales. This sales are mainly export products that represent less than 0.1% of 2000's turnover.

contract between the government and la Régie des Tabacs includes a monopoly fee, representing 90% of the profits generated by the tobacco industry. The total amount for 2000 reached DH 152 million. Other contributions are the "common fund" (DH 76 million in 2000), assistance to Palestine (DH 53 million)[1] and other taxes and levies (DH 45 million in 2000). The tobacco industry is not subject to value added tax.

**Overall fiscal contribution**

The Régie des Tabacs has become an important tax contributor. Table 9 shows the overall fiscal contribution of the sector. The total fiscal contribution of the tobacco industry is slightly more than DH 6 billion; this represents 6% of current governmental revenues and 1.7% of GDP.

**Table 9. Fiscal contribution of the tobacco sector (1000 DH)**

| Fiscal instrument | 1999 | 2000 | % of total (average 1999/2000) |
|---|---|---|---|
| Monopoly tax | 5,320,680 | 5,417,759 | 88.4% |
| **Tax on profits** | 255,382 | 254,339 | 4.2% |
| Monopoly fee | 153,005 | 152,105 | 2.5% |
| Import duties | 123,857 | 137,860 | 2.2% |
| Common fund | 64,301 | 75,778 | 1.2% |
| Assistance to Palestine | 52,764 | 52,955 | 0.9% |
| Other taxes | 41,861 | 45,032 | 0.7% |
| Total contribution | 6,011,850 | 6,135,828 | 100% |
| Fiscal contribution/sales | 78.8% | 79.9% | 79.4% |
| Fiscal contribution/current fiscal receipts | 6.3% | 5.8% | 6.0% |
| Fiscal contribution/GDP | 1.8% | 1.7% | 1.7% |

Source: Régie des Tabacs and author's estimates

This level of fiscal burden explains the price structure of tobacco products in Morocco. Taxes and levies represent 73% of the average price of cigarettes. Local and imported inputs account for 8.4% of the price. Capital remuneration (including profits) and depreciation represent 7.8% of this price. The rest (around 11%) is shared between wages and marketing costs.

**Effective taxation**

Examination of the financial results by category of product allows the computation of effective rates of taxation. These rates show the existence of cross-subsidies (see box 1) between local black cigarettes on one hand and blond and imported products on the other, in spite of a uniform rate of apparent taxation of 65%. These computations consider only the excise tax, which represents the bulk of the fiscal burden.

[1] For the Palestine tax, local cigarettes are taxed at DH 0.05/pack and imported cigarettes at DH 0.10/pack.

Cross-subsidization

The term cross-subsidization is used with reference to public enterprises, to denote any subsidization of losses on one activity or service with the profits from another. Cross-subsidization occurs in particular in multiproduct regulated firms when losses in one line of business are funded from "supernormal profits" on other products sold by firm. The multiproduct framework is also relevant when the company supplies different brands of a single product, such as the Régie des Tabacs. ("Supernormal profits" denotes a return which exceeds the minimum necessary to induce the firm to remain in business.)

Source: Pearse DW, ed. The MIT dictionary of modern economics. Cambridge, Massachusetts, MIT Press, 1986.)

The effective taxation rate would be important if Régie des Tabacs were to be privatizated. Indeed, in the case of privatization accompanied (or preceded) by a liberalization of the sector, the unprofitable/subsidized products, intended essentially for the poorest consumers, would be unlikely to benefit from the same treatment as at present, with cross-subsidies between categories of product, and prices fixed by the government.

To estimate the effective taxation rate by category of product, let us determine at first in an analytical way some relationships between the prices with tax, the prices without excise tax, the rates of excise tax and the profit (or loss) by category of product. This is necessary because Moroccan excise taxes are based on the official retail prices that are set by government each year and not on ex-factory prices as is done elsewhere.

Let *i* be the category of product (plain black, filter black, blond Moroccan or imported products). For the category *i*, define variables as follows:

$Q_i$ : the quantity sold (in packs)
$M_i$ : the total profit (or loss) on sales $q_i$
$m_i$ : the average profit (or loss) (DH/pack)
$p_i$ : the retail price with excise tax (DH/pack)
$p'_i$ : the retail price without excise tax (DH/pack)
$t_i$ : the amount of the excise tax (DH/pack)

We have:
$t_i = \alpha . p_i$ and $p'_i = p_i - t_i = (1 - \alpha)p_i$
where $\alpha$ is the rate of tobacco tax (excise tax) on the price $p_i$ (here $\alpha = 65\%$).
The tax rate $\beta$ applied to the price without tobacco tax $p'_i$ is given by the following expression:
$\beta = t_i/p'_i = \alpha/(1 - \alpha)$ (here $\beta = 186\%$ for $\alpha = 65\%$)
The price without tobacco tax $p'_i$ is given by the following expression:
$p'_i = p_i/(1 + \beta)$

The average profits (or losses) $m_i$ are generated by the application of the prices $p'_i$. This price system is translated by cross-subsidies between the categories of product. As we will see in the table below, $m_1$ and $m_2$ are negative (losses for the blacks) while $m_3$ (Moroccan blond) and $m_4$ (imported products) are positive (profit).

The problem consists in determining a price system $p''_i$ which would be translated by a profit (or loss) $m$ equivalent for all the categories of products, $m$ being the weighted average profit (or loss) per pack.

The weighted average profit (or loss) per pack $m$ is given by:

$m = (M_1 + M_2 + M_3 + M_4)/(q_1 + q_2 + q_3 + q_4)$

The total profit (or loss) $M_i$ is:

$M_i = q_i.p'_i - C_i$ where $C_i$ is the production cost of the quantity $q_i$.

The price system $p''_i$ allowing a uniform profit (or loss) $m$, without cross-subsidies, should satisfy the following condition (for every $i$):

$q_i p''_i - C_i = q_i m.$

By replacing in this last expression $C_i$ by $q_i p'_I - M_i$ and $M_i$ by $q_i m_i$ and by cancelling the $q_i$, we obtains the following expression:

$p''_i = p'_i + (m - m_i)$

With this new price system, the rate of effective tax $\beta_i$ applied to the price without tax and the rate of effective tax $\alpha_i$ applied to the price with tax are given respectively by the following expressions:

$\beta_i = t_i/p''_i = \alpha.p_i/p''_i$

$\alpha_i = \beta_i/(1 + \beta_i)$

Table 10 presents an evaluation of the effective taxation by category of products by reference to the previous expressions.

**Table 10. Evaluation of the effective taxation by category of product**

| | Unit | Plain black cigarettes | Filter black cigarettes | Moroccan blond cigarettes | Imported products | Total |
|---|---|---|---|---|---|---|
| Total profit (or loss) on sales ($M_i$) | 1000 DH | –25,814 | –18,173 | 558,683 | 206,155 | 720,851 |
| Sold quantity ($q_i$) | 1000 packs | 195,900 | 131,950 | 263,350 | 94,100 | 685,300 |
| Average profit (or loss) ($m_i$) | DH/pack | –0.13 | –0.14 | 2.12 | 2.19 | 1.05 |
| Retail price with tax ($p_i$) | DH/pack | 5.20 | 6.53 | 14.60 | 28.00 | 12.16 |
| Retail price without excise tax ($p'_i$) | DH/pack | 1.82 | 2.28 | 5.11 | 9.80 | 4.25 |
| Retail price without excise tax and without crossed subsidies ($p''_i$) | DH/pack | 3.00 | 3.47 | 4.04 | 8.66 | 4.25 |
| Rate of effective tax ($\beta_i$) | | 113% | 122% | 235% | 210% | 186% |
| Rate of effective tax applied to the price with tax ($\alpha_i$) | | 53% | 55% | 70% | 68% | 65% |
| Retail price with excise tax and without crossed subsidies ($p''_i$+tax) | DH/pack | 8.58 | 9.93 | 11.55 | 24.75 | 12.16 |
| Ratio ($p''_i$ + tax)/$p_i$ | | 1.65 | 1.52 | 0.79 | 0.88 | 1.00 |

Source: Régie des Tabacs and author's estimates

If the financial results are globally positive with an average gross margin of DH 1.05/pack (for the fiscal year 2000), they are differentiated according to the category of product. The Moroccan black (with or without filter) registered a loss of the order of DH 0.13 or DH 0.14/pack while the profit realized on the Moroccan blond was DH 2.12/pack and that on the imported products was DH 2.19/pack. The price system fixed by the government induces cross-subsidies between the categories of product and is translated by an effective taxation differentiated according to the category of product although the rate of apparent taxation is the same for all products (65%).

The previous results show that the effective taxation is not the official announced one of 65% on the retail price. t is "only" 53% for the Moroccan black cigarettes without filter and 55% for the Moroccan black with filter as it reaches at 70% for the Moroccan blond and 68% for the imported products.

*Conclusions of section 2*

Taxes and levies represent 73% of the average price of cigarettes in Morocco. Local and imported inputs account for 8.4% of this price. Capital remuneration and depreciation represent 7.8% of this price. The rest (around 5%) is shared between wages and marketing costs. Taxes on tobacco represent some 6% of total government expenditures. Effective rates of taxation of categories of brands differ from the official ones because the official decision on retail prices is taken independently of industry real costs.

## ECONOMIC STRUCTURE OF THE TOBACCO INDUSTRY IN MOROCCO

The tobacco industry in Morocco has three components: agricultural, processing and distribution. Each one of these activities is described below to give an indication of the economic weight of the industry.

### Tobacco farming

*Trends*

Modern tobacco farming was introduced in 1918 in the Moulay Bousselham region in the northwest of the country, but it really took off in the 1940s in the Gharb region in the west. Since the country's independence from France in 1956, tobacco farming has been extended to the regions of El Hajeb, Ouezzane and the Rif. Later, to reduce the variability of output it was extended to the large-scale irrigated perimeters. Nowadays, it is located in the pre-Rif and the Middle Atlas regions and in the irrigated perimeters of Doukkala, Gharb, Loukkos, Haouz and Sous-Massa. The farming subsector involves around 7,000 producers. On average a total land area of 4,500 ha is planted with tobacco. Régie des Tabacs is the sole buyer.

*Regulation of farming activity*

The Régie decides its needs each year and gives permits to plant to farmers accordingly. The monopoly has several collection centres scattered throughout the producing areas in Morocco. Farmers usually deliver their production to these centres. Table 11 shows the number of centres by region.

**Table 11. Tobacco collection centres**

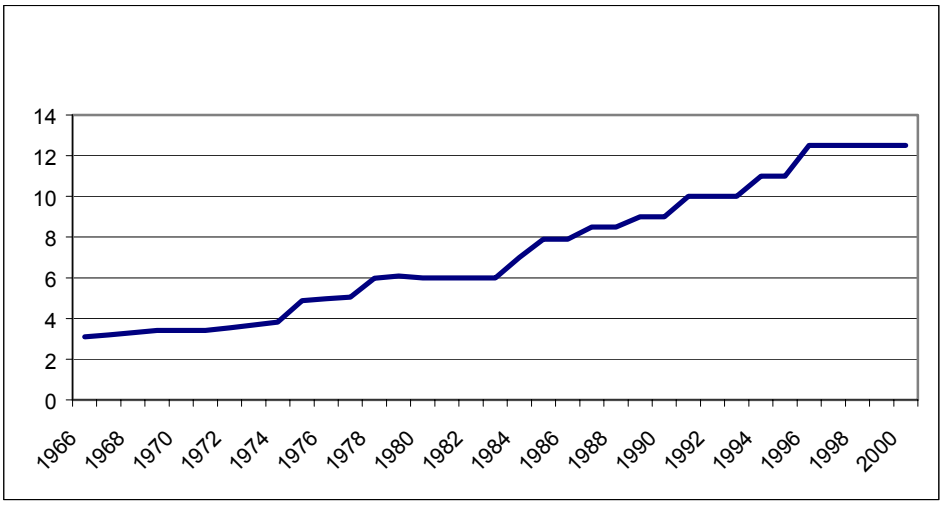
| Area | Number of centres |
|---|---|
| El Hajeb | 4 |
| Ouazzane | 7 |
| Gharb | 1 |
| El Jadida | 1 |
| Marrakech | 1 |
| Agadir | 1 |
| **Total** | **15** |

Source: Régie des Tabacs

The Régie des Tabacs has also a standard contract fixing the price and the technical obligations of the farmer and of the Régie. The average price paid by the Régie during 1996–2000 was around DH 11.5 per kilo for tobacco leaves. The total value of the crop reaches DH 15 000 per ha. Farmers received from the Régie around DH 82 million (in current value or DH-2000 64 million in constant value) on average during 1996–2000.

Figure 2 below shows the trend in nominal prices since 1966. From 1966 to 1974, prices increased smoothly from DH 2.5/kg to DH 4/kg. From 1974 to 1996, prices were on average adjusted each two years by an increase of DH 1–2 per kilogram.

**Figure 2: Trend in prices paid to farmers for tobacco leaf (in DH/kg)**




Source: Régie des Tabacs

*Value added estimates*

Value added per hectare is estimated at DH 13 300 (see annex 1), which gives an aggregate for the value added during tobacco farming activities of DH 61 million for 2000.

**Tobacco imports**

Raw tobacco imports reached on average 9,000 tonnes during 1980–99. Cigarette imports varied from a minimum of 900 tonnes in 1982 to a maximum of 3,000 tonnes in 1994.

Despite the yearly variation in the composition of imports, most of the increase in leaf imports is expected to be the Virginia and the Burley types, reflecting the increase in demand for light

type cigarettes. The state owned monopoly is the sole importer of leaf tobacco and tobacco products[1].

The Régie des Tabacs has a pre-established list of traditional suppliers which are contacted whenever a tender is issued. Selection is based on samples and prices. Normally, the monopoly issues three international tenders per year. The first tender is normally issued in February–March and is for Virginia, Burley and Java tobacco types. The second tender occurs usually during the May–June period and is for the Bahia and Saint Dominica types. The tender for Carmen and Oriental types usually occurs in September–October. The monopoly usually buys supplies to last 12–15 months.

Normally, 80% of the import value is paid at loading. The balance is paid after the product arrives in Moroccan ports and following grading and quality control. The 20% balance is often paid off with a credit of up to 90 days.

**Tobacco processing and distribution activities**

*History of the tobacco trade in Morocco*

The first attempt to institutionalise the business of tobacco in Morocco goes back to 19th century when Moulay Abderrahmane (1812–59) established control of the tobacco business to improve the income of the state. In 1906, the Algesiras Act fixed in its articles 72, 73 and 74 the conditions for the tobacco monopoly in Morocco. The first auction took place in 1910, and the first concession for the tobacco monopoly in Morocco was registered for the benefit of Mr Léon Weil, who transferred his rights to the Société Internationale de Régie Co-intéressée des Tabacs du Maroc for a duration of 40 years with an option to repurchase by the Moroccan government at the end of 20 years. The first factory opened one year later in Tangiers followed by two more in Casablanca and Kénitra further to an agreement of 1 August, 1931. An amendment of 15 November 1947 to the agreement of 1931 extended the concession for a duration of 20 years until 31 December1967. The contract was not renewed, and Morocco created a corporation, the Régie des Tabacs, with which an agreement was made on 31 December 1967 concerning a monopoly on the culture, purchase, manufacture and marketing of tobacco in Morocco.

The analysis of past performance of the monopoly shows an investment policy tending to increase local processing capacity, an aggressive marketing policy based on fine-tuned adaptation to consumers' habits and tastes and on the expansion of the sales network. In spite of these policies, the monopoly has not been able to increase total sales during the past five years. The financial results have improved despite sluggish sales because of official price increases.

*Increasing processing capacity*

The Régie des Tabacs has four factories and an agro-industrial entity. The factory of Aïn Harrouda and the beating centre of El Moudzine were equipped with modern equipment from the start, and other units were progressively modernized (Table 12). The volume of tobacco processed increased from 3 tonnes/hour in 1970 to 6 tonnes/hour today. The speed of manufacture increased from 1,500 cigarettes/minute to 8,000 cigarettes today at the Aïn

[1] Purchases were made through the Maghreb Board for Tobacco Purchases, which included Tunisia and Morocco, till the late 1990s.

Harrouda factory. The Aïn Harrouda factory was opened in 1994 and cost DH 900 million. It occupies an area of 10 hectares, of which 45,000 m² covered. It has a capacity of 18 billion cigarettes a year and produces all of the filters needed in Morocco. It has machines that manufacture 5,000, 7,000 and 8,000 cigarettes per minute and that make 3300 filters per minute, and packing lines that handle 400 packs per minute.

**Table 12. Evolution of production by manufacturing unit (in tonnes)**

| Manufacturing unit | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|
| Aïn Harrouda | 5421 | 5506 | 4971 | 4949 | 5134 |
| Casablanca | 2862 | 2899 | 3019 | 2782 | 2716 |
| Kénitra | 2016 | 2272 | 2532 | 2154 | 2076 |
| Tétouan | 2427 | 1975 | 2045 | 2021 | 2039 |
| Agadir | 43 | – | – | – | – |
| Total | 12 769 | 12 652 | 12 567 | 11 906 | 11 965 |

Source: Régie des Tabacs

*Aggressive marketing policy*

At the time of its creation, the Régie des Tabacs marketed a range of about 60 products, including some 40 Moroccan brands, representing 97% of the market. Today, 74 products are marketed by the Régie des Tabacs, of which 23 are made locally and 51 imported. Ten products account for 96% of sales volume and 97% of the turnover (Tables 13 and 14). Of these 10 products, the seven that are processed locally generate 70% of the total sales value.

**Table 13. Ranking of sales of main brands in terms of volume**

| Brand | Sales 2000 (1000 packs) | Market share (%) | Cumulative market share (%) |
|---|---|---|---|
| Marquise | 235,974 | 34.1 | 34.1 |
| Casa Sport | 195,412 | 28.2 | 62.2 |
| Olympic Bleue RS | 99,395 | 14.3 | 76.6 |
| Marlboro KS | 56,713 | 8.2 | 84.8 |
| Winston KS | 21,775 | 3.1 | 87.9 |
| Olympic Bleue KS | 17,610 | 2.5 | 90.5 |
| Marvel Souple | 17,440 | 2.5 | 93.0 |
| Marlboro KSL | 11,687 | 1.7 | 94.7 |
| Maghreb | 6,572 | 0.9 | 95.6 |
| Marquise Lights | 4,946 | 0.7 | 96.3 |

Source: Régie des Tabacs

**Table 14. Ranking of sales of main brands in terms of turnover**

| Brand | Sales 2000 (1000 DH) | Share in total sales (%) | Cumulative share (%) |
|---|---|---|---|
| Marquise | 3,421,637 | 40.8 | 40.8 |
| Marlboro KS | 1,587,974 | 18.9 | 59.7 |
| Casa Sport | 1,016,146 | 12.1 | 71.8 |
| Olympic Bleue RS | 646,072 | 7.7 | 79.5 |
| Winston KS | 609,703 | 7.3 | 86.8 |
| Marlboro KSL | 327,245 | 3.9 | 90.7 |
| Marvel Souple | 279,040 | 3.3 | 94.0 |
| Olympic Bleue KS | 114,465 | 1.4 | 95.4 |
| Marquise Lights | 71,731 | 0.9 | 96.3 |
| Maghreb | 46,007 | 0.5 | 96.8 |

Source: Régie des Tabacs

Certain segments of market are not at present covered by the range of products of the Régie des Tabacs. These products are black upmarket cigarettes, blond low-priced cigarettes and blond upmarket cigarettes. The change in turnover by group of products between 1996 and 2000 (Table 15) shows that the most important relative increase was registered by the group of imported products, with a growth of 17%, against 12% for Moroccan blacks and only 5% for Moroccan blonds.

**Table 15. Turnover by group of product (1000 DH)**

| **Groups of products** | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|
| Plain black cigarettes | 988,332 | 1,032,041 | 1,166,358 | 999,185 | 1,008,912 |
| Filter black cigarettes | 669,453 | 677,579 | 727,069 | 832,811 | 852,120 |
| Total Moroccan black | 1,657,785 | 1,709,620 | 1,893,427 | 1,831,996 | 1,861,032 |
| Moroccan blond cigarettes | 3,622,290 | 3,660,477 | 3,410,582 | 3,635,982 | 3,814,757 |
| Other Moroccan products | 32,906 | 30,525 | 32,858 | 36,374 | 37,424 |
| Total Moroccan products | 5,312,981 | 5,400,622 | 5,336,867 | 5,504,352 | 5,713,213 |
| Imported products | 2,240,936 | 2,200,826 | 2,528,079 | 2,681,310 | 2,621,800 |
| Total taxable turnover | 7,553,917 | 7,601,448 | 7,864,946 | 8,185,662 | 8,335,013 |
| Exempt products | 3,830 | 3,844 | 4,916 | 4,013 | 7,658 |
| General total | 7,557,747 | 7,605,292 | 7,869,862 | 8,189,675 | 8,342,671 |

Source: Régie des Tabacs

*Sales network of the Régie des Tabacs*

The Régie des Tabacs has 25 sales centres, divided into five zones or regional managements. These centres serve about 20,000 tobacco shops (compared with only about 9,600 in 1968). The distributive network was extended by the creation of new distribution centres (Laayoune, Fès, Casa III, Béni Mellel, Khouribga and souk Larbaa) and by the reconstruction of other centres (Rabat, El Jadida, Settat, Oujda and Marrakech). The Régie des Tabacs is the main distributor and wholesaler, and its own network covers 87% of the market. The other 13% of the sales network is served by other wholesalers approved by the company, who already have a distribution infrastructure, which reduces Régie des Tabacs' distribution costs.

*Value added structure of the tobacco industry*

Table 16 summarizes the value structure by main activities and components.

**Table 16. Value added by the tobacco industry (2000) Million DH**

| Value added component | Agriculture | Processing and distribution | Total | % |
|---|---|---|---|---|
| Labour | 27.1 | 489.9 | 517.0 | 6.9% |
| Taxes | | 6,139.9 | 6139.9 | 81.4% |
| Other factors | 33.6 | 848.4 | 882.0 | 11.7% |
| Total value added | 60.7 | 7,478.2 | 7538.9 | 100.0% |
| Percent of total | 0.8% | 99.2% | 100.0% | |

Source: Régie des Tabacs

The tobacco industry generated DH 7.5 billion in 2000[1], amounting to 2.1% of the GDP. This contribution is equivalent to the contribution of the fishing industry in Morocco. Creation of value is mainly due to processing and distribution activities (99%).

*Conclusions of section 3*

The state company (Régie des Tabacs) is, by law, the only buyer and seller of tobacco products, so holds a monopoly and monopsony. The farming subsector involves around 7,000 producers. On average a total land area of 4,500 hectare are planted with tobacco. The gross revenue of these activities including retailing through the licensed network was DH 8.3 billion in 2000. Between 1996 and 2000, average annual growth was 2.5%. This growth was due mainly to price increases—the volume of sales has decreased slightly (1.8% per year during the same period). Despite the efforts of the monopoly to expand processing capacity and its marketing policy, overall consumption has stagnated during recent years, probably because of the rising prices.

# IMPACT ANALYSIS OF TOBACCO PRODUCT PRICE/TAX INCREASES

The purpose of this part is to analyse the impact on consumption and tax revenues of price/tax increases of tobacco products. It begins with an analysis of demand for cigarettes in Morocco over the period 1965 to 2000. It tries to identify explanatory factors for this demand and to study more particularly the relation between trends in the average consumption of cigarettes per adult and the average real prices of cigarettes in order to deduce the price elasticities. Then, it uses a demand model to simulate the effects that further price and tax increases would have.

## DATA SOURCES AND METHODOLOGY

### Consumption of cigarettes

The data on total consumption of cigarettes in Morocco $C$ is obtained from the data on production $P$, imports $I$ and exports $E$ [$C = P + I - E$ ]. The USDA website gives data on consumption of cigarettes between 1960 and 1995 for a range of countries including Morocco.[2] This data was updated using data from the Régie des Tabacs and Office des Changes. The data series on total consumption of cigarettes allowed us to compute average consumption by adults (15 years and more) using demographic data published by the Direction de la Statistique. This consumption does not take account of other smoked substances and goods smuggled into Morocco.

### Cigarette prices

[1] Including duties on imports of the Régie des Tabacs.

[2] Web-based data sources:
http://apps.nccd.cdc.gov/nations/economics/consumption.asp?nationCode=504&nationName=Morocco has data from 1971 to 1997.
United States Department of Agriculture, Economic Research Service, Tobacco Statistics (94012) April 1994 and updated electronically in June 1996. http://usda.mannlib.cornell.edu/data-sets/specialty/94012/

The price series come from the yearbooks of the Direction de la Statistique. These give the official prices by brand in dirhams per pack. These prices are expressed in nominal terms. From these prices by brand, an average price for cigarettes is computed taking into account the quantities sold by category of product. For 1995–2000, weightings are derived from the quantities sold by the Régie des Tabacs (annual reports). For the other years, the structure of 1995 is applied while taking into account the introduction of new brands. To take account of inflation, prices are expressed in real terms. Real prices are computed starting from the nominal prices and using a deflator based on cost of living indexes. However, this deflator (2000 = 100) presents a certain number of weaknesses from a statistical point of view. We know in particular that this index relates only to the principal cities (urban) and that the number of articles in the cost of living index has changed (111 articles in 1958–59, 210 articles in 1972–73 and 385 articles for 1989). But it remains useful for revealing real long-term price trends.

**Tax on tobacco**

The data on tobacco tax come from the Régie des Tabacs (over the period 1990–2000), the Direction de la Statistique, the annual reports of the Bank Al Maghrib, finance laws, and the statistics of the International Monetary Fund (the IMF), published in government finance statistics yearbooks between 1965 and 1989. For 1965–68, the products of the Société Internationale de Régie Co-intéressée des Tabacs du Maroc, predecessor of the Régie des Tabacs, were examined. The data on total tax from tobacco were then translated into dirhams per pack by dividing by the quantities consumed and finally expressed in real terms using the deflator.

**Incomes**

To derive the average income per capita, one of the determinants of consumption of cigarettes, we used per capita gross domestic product, expressed in real terms from 1980. GDP data were available from the Direction de la Statistique for a longer period (1965-2000) than gross income data, which were available only for the years 1969-1999. GDP is strongly correlated with gross income over the period for which both data are available.

## FORMULATION OF THE DEMAND FOR CIGARETTES

The quantity of cigarettes consumed is a function of price and income. Figures 3 and 4 illustrate clearly these correlations over a long period.

Beyond the annual fluctuations (no smoothing has been carried out on the series), one distinguishes two principal periods: the first, from 1965 to 1981, during which the average price of cigarettes in real terms dropped by 18% per annum on average (and by 35% over just the period 1965–78), and the average consumption of cigarettes per adult grew by 48% per annum on average. The second period (1981–2000) was characterized by another trend: the real price of cigarettes increased by 24% per annum on average and the consumption of cigarettes dropped by 25% per annum on average. Per capita GDP increased by 2.8 % during 1965–77 compared with only 1.8 % during 1977–91 before stagnating during the 1990s.

Before studying the econometric relation between the consumption of cigarettes and their price, let us carry out a test to determine whether the price may be regarded as an exogenous variable whose value is determined independently, or treated like endogenous variable whose value is determined within the model. To test for price endogeneity, we use the Hausman

*Figure 3. Consumption and price of cigarettes in Morocco (1965–2000)*

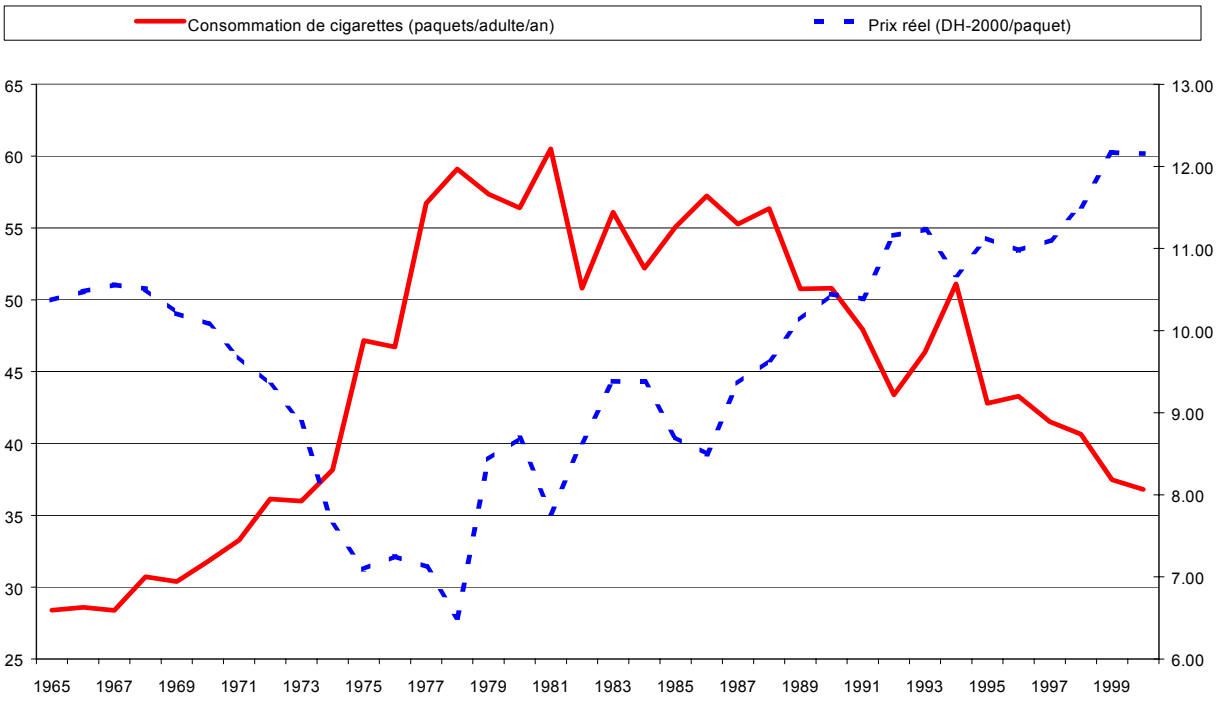
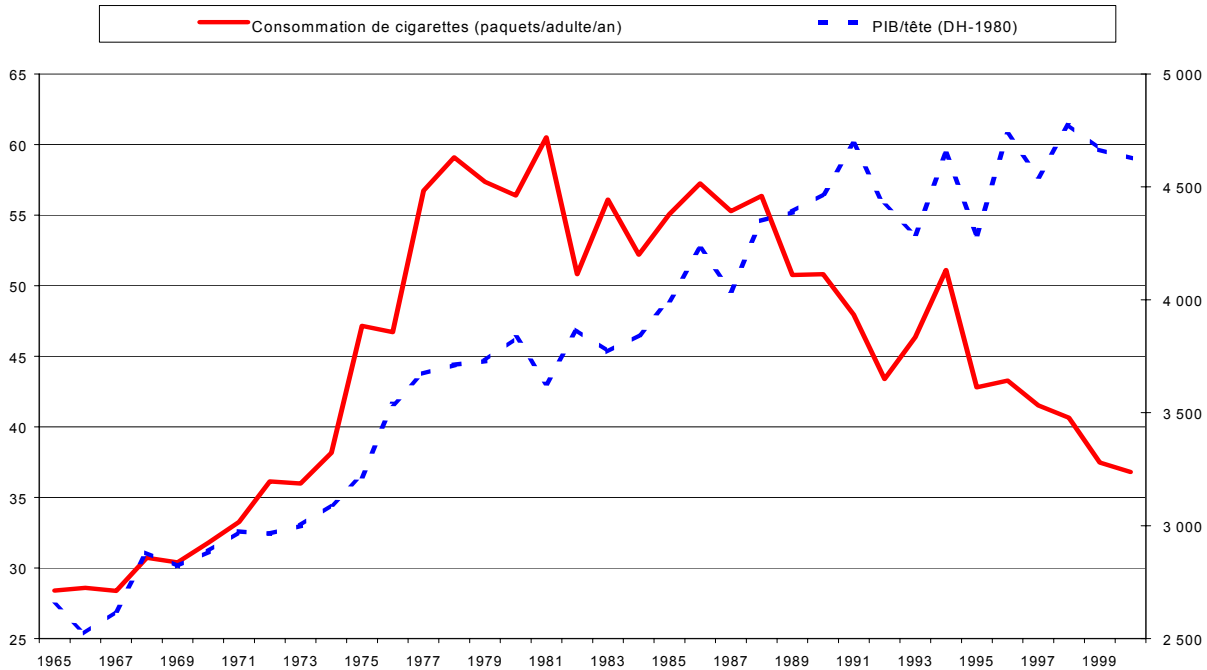



**Figure 4. Cigarette consumption and GDP per capita (DH-1980) in Morocco, 1965–2000**




Source: Created by author, using data sources cited in text

test.[1] Using this procedure with the data for Morocco produced the following results:
A first estimate of the demand function was derived using ordinary least squares: $C_t = f(P_t, R_t, L_t)$ The estimated value of the constant term was 4.29, and the estimated price coefficient $bP_t$ was $b = -4.29$, with var($b$) = 0.59. In this equation, $C_t$ represents the consumption of cigarettes, $P_t$ the price, $R_t$ is per capita income and $L_t$ is a variable representing the trend of the all institutional determinants relating to the use of cigarettes (mention of the danger on the packs, prohibition on smoking in public places, etc.).

The price is then regressed on the variable "tax" (dirhams per pack) and the world price of cigarettes (using the average price of cigarettes imported by Morocco as the proxy for the world price). A new vector of prices $P'_t$. is estimated based on the coefficients of this regression. We estimate another demand function using price vector $P'_t$ and the other variables. With these estimates, the statistic $m$ of the Hausman test is then computed: $m = 69.91 > \chi^2_{1-\alpha}(1) = 6.63$ for $\alpha = 1\%$. The hypothesis that price is exogenous is thus rejected with a probability greater than 99% (= 1 – α); the price is endogenous, and the use of ordinary least squares estimation would give skewed estimates in particular for the elasticities of price and income. A regression in two stages (two-stage least-squares) is recommended for this category of model. We tested various formulations of the demand function, including one which assumed that price was exogenous.

## FORMULATIONS OF THE MODEL

There are two traditional models used to estimate a function of demand for cigarettes: static and dynamic (addictive demand models). The latter supposes that the demand in a given period is affected by the demand in the previous period (myopic addiction) or both demand in the past and in the future (rational addiction). For each type of model, various forms of the demand function were tested: linear, double log and two-stage least-squares, and various exogenous variables were introduced. Only the most significant models are presented below. However, no formulation incorporating rational addiction is tested. It should be noted that other researchers have not found significant differences in the estimates derived from various model formulations. The formulations selected do not take account of possible effects due to smuggling and consumption (substitution) or use of other substances (cannabis, other drugs). Table 17 presents the results of the regression for various forms of demand function for cigarettes in Morocco. The dependent variable is the average consumption of cigarettes per adult (15 years and more) expressed in packs of 20 cigarettes per year as a function of various explanatory variables.

[1] This standard statistical test is described and referenced in the Toolkit for the Analysis of the Economics of Tobacco Control, Tool 3: Demand Analysis by Nick Wilkins, published on-line by the World Bank at http://www1.worldbank.org/tobacco/pdf/Demand.pdf

**Table 17. Regressions of consumption of cigarettes per adult in Morocco (1965–2000)**

| Independent variable | Model 1<br>Linear<br>OLS | Model 2<br>Double log<br>OLS | Model 3<br>Linear<br>2-SLS | Model 4<br>Linear<br>2-SLS |
|---|---|---|---|---|
| Constant | 29.046**<br>(5.590) | –0.084<br>(–0.163) | 32.625**<br>(5.027) | 34.662**<br>(5.611) |
| Real price for cigarettes (DH-2000/packet) | –2.780**<br>(–5.146) | –0.514**<br>(–5.163) | –3.416**<br>(–5.186) | –3.460**<br>(–5.245) |
| GDP/capita (DH 1980) | 0.00413**<br>(3.127) | 0.319**<br>(2.973) | 0.00664**<br>(3.496) | 0.00535**<br>(3.571) |
| Past consumption (packs/adult) | 0.606**<br>(6.771) | 0.635**<br>(7.276) | 0.461**<br>(3.987) | 0.524**<br>(5.162) |
| Law[a] | | | –0.747<br>(–1.062) | |
| Summary statistics for regression | | | | |
| Adjusted $R^2$ | 0.913 | 0.932 | 0.910 | 0.909 |
| Standard error | 2.993 | 0.006 | 3.051 | 3.066 |
| Elasticity | | | | |
| Short-run price elasticity | –0.595 | –0.514 | –0.732 | –0.674 |
| Long-run price elasticity | –1.511 | –1.408 | –1.357 | –1.536 |
| Short-run income elasticity | +0.347 | +0.319 | +0.558 | +0.403 |
| Long-run income elasticity | +0.881 | +0.874 | +1.036 | +0.918 |

Note: Student *t*-statistics are in brackets
** Coefficients significant at 1%
a: "Law" is a variable representing changes in the strength of various institutional factors (anti-smoking policies and measures) affecting cigarette consumption (Law($t$) = 0 for $t < 1993$; Law(1993) = 1 and Law(t) = Law($t$ – 1) + 0.5 for $t > 1993$).

**Simulations**

Let us take, by way of illustration, the results of models 2 and 4 (for example) and carry out simulations in order to evaluate the impact of raising of the prices of cigarettes or the tax on tobacco. With the results of model 2, the demand function is:
$\log C_t = -0.084 - 0.514\log P_t + 0.319\log R_t + 0.635\log(C_t - 1)$
For 2000, there are the following parameters:
Consumption of cigarettes: $C_{2000}$ = 36.80 packs/adult
Average price of cigarettes: $P_{2000}$ = DH 12.156/pack
Tax on the tobacco: $I_{2000}$ = DH 7.853/pack (65% of the price)
Revenue from tax on the tobacco: $PI_{2000}$ = DH 5418 million
Initially, we will carry out two simulations. The first considers the effects of increasing the average price of cigarettes by 10%; the second simulation evaluates the impact of increasing the tax on tobacco by 10%.

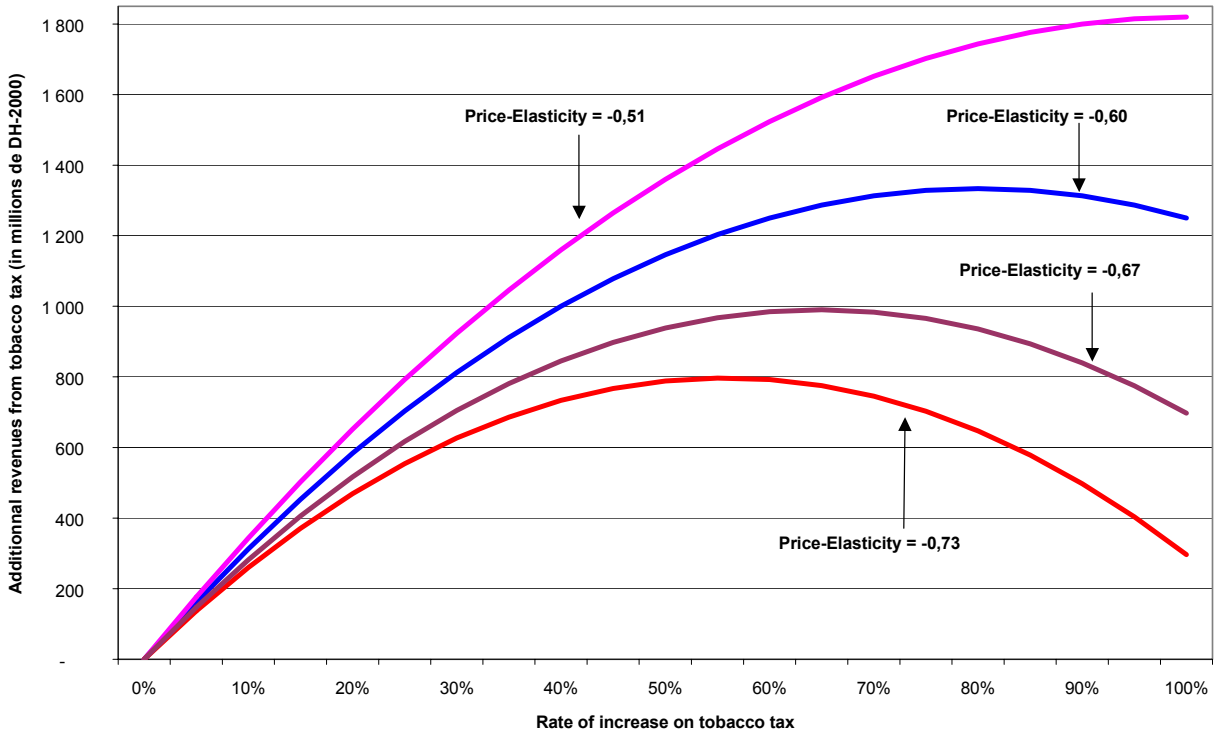
1) Assume that the average price of cigarettes paid by the consumer increases by 10%. The price in 2000 would change then from DH 12.156/pack to $P'_{2000}$ = DH 13.372/pack, that is to say an increase of DH 1.216/pack. This can be compared to an increase in tax on tobacco that resulted in the same level of price increase: the new tax would become $I'_{2000}$ = 7.853 + 1.216 = DH 9.068/pack and the rate of tax on the tobacco would pass change from

65% to 67.8% (= 9.068/13.372). Raising the price by 10% is thus equivalent to an increase in tax on cigarettes of 15.5% (passing from DH 7.853 to DH 9.068/pack). Consumption by adults would become $C'_{2000}$ = 34.91 packs/adult (a fall of 5.14%) and the revenues from taxes would reach $PI'_{2000}$ = DH 5935 million (an increase of 9.5% compared with the basic case).

2) Assume that tax on cigarettes increases by 10%.
Then, the new tax level would become $I''_{2000}$ = 7.853 + 0.785 = DH 8.638 /pack. The new price would be $P''_{2000}$ = DH 12.941 /pack, that is to say an increase of 6.5% compared to $P_{2000}$; the rate of tax would change from 65% to 66.7% (= 8.638/12.941). Consumption per adult would become $C''_{2000}$ = 35.58 packs/adult (a drop of 3.32%). Tax revenues would reach $PI''_{2000}$ = DH 5762 million (increase of 6.35%).

Before evaluating the impact in the short or the long term, let us study the impact in the short run of various rates of tax on tobacco on the revenue generated. We use the results of various models which correspond to different price elasticity, to see the sensitivity of tax revenue changes to different levels of price elasticity. The results of these simulations are shown in Figure 5. This graph illustrates the so-called Laffer curve, which shows how total tax revenues would change as the rate of taxation changes, and shows clearly the tax rate that would maximize tax revenues.

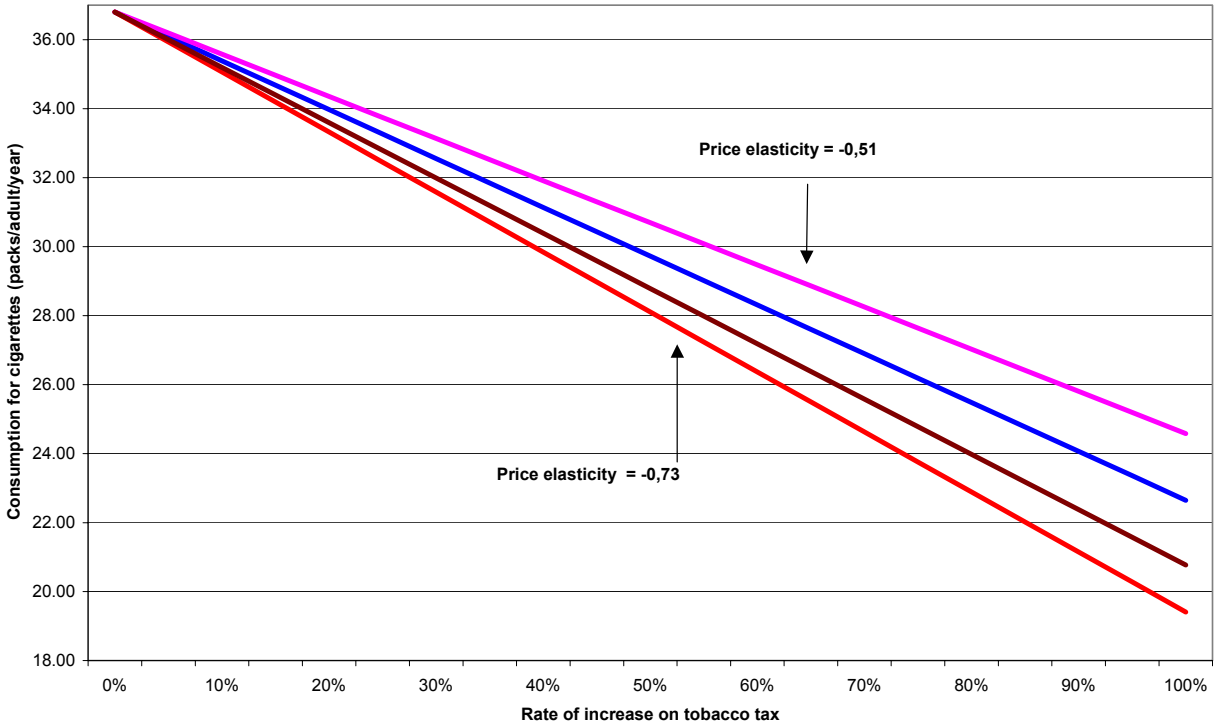
**Figure 5. Additional tax revenues according to the rate of increase of tobacco tax**




It shows in particular that the "Laffer point"—the point at which revenue from taxes begins to fall as the rate of taxation increases, is located at an increase in tobacco tax of more than 50% in the case of strong price elasticity (–0.73) or of 90% of tax on tobacco in the case of weak price elasticity (–0.51). These rates of increase are considered unlikely under current conditions in Morocco.

Clearly, increasing the price of tobacco (say by between 5% and 25%) would not lead to a fall in tax revenue, at least in the short run. By way of illustration, an increase of 15% of tax on tobacco can be translated, in the short run, by an increase in tax revenue ranging from DH 350 million to DH 500 million, and would decrease the average consumption of cigarettes per adult by 2 or 3 packs per year, as illustrated in Figure 6, which shows the change in consumption of cigarettes according to the rate of tobacco tax for different price elasticities.

**Figure 6. Consumption of cigarettes according to the rate of increase on tobacco tax**




3) Impact in the short or the long term

In this simulation, we will assume a rate of inflation of 2% per year, and use this as a basis for calculating the increase in tobacco tax: equivalent to an increase in the tobacco tax of 3.1%. The tobacco tax would thus pass from 65% in 2000 to 68% in 2005 and about 72% in 2010. We assume that GDP per capita will be maintained at the level observed in 2000. Tables 18 and 19 simulate the change in the average consumption of cigarettes by adults and the revenue from taxes on tobacco under this scenario.

**Table 18. Impact of raising prices of cigarettes by 2% per year (model 2)**

Short-run price elasticity: –0.51
**Long-run price elasticity: +1.41**

| Year | Consumption of cigarettes | | | Revenues from tobacco tax | | |
|---|---|---|---|---|---|---|
| | Packs/adult | Annual variation | Cumulated variation | Revenues (million DH) | Annual variation | Cumulative variation |
| 2000 | 36.80 | | | 5418 | | |
| 2001 | 36.73 | –0.2% | –0.2% | 5718 | 5.5% | 5.5% |
| 2002 | 36.32 | –1.1% | –1.3% | 5978 | 4.6% | 10.3% |
| 2003 | 35.69 | –1.7% | –3.0% | 6214 | 3.9% | 14.7% |
| 2004 | 34.94 | –2.1% | –5.1% | 6435 | 3.6% | 18.8% |
| 2005 | 34.13 | –2.3% | –7.3% | 6624 | 2.9% | 22.3% |
| 2006 | 33.28 | –2.5% | –9.6% | 6808 | 2.8% | 25.7% |
| 2007 | 32.42 | –2.6% | –11.9% | 6992 | 2.7% | 29.1% |
| 2008 | 31.56 | –2.6% | –14.2% | 7177 | 2.6% | 32.5% |
| 2009 | 30.71 | –2.7% | –16.5% | 7366 | 2.6% | 36.0% |
| 2010 | 29.88 | –2.7% | –18.8% | 7562 | 2.7% | 39.6% |

Source: Author's calculations

**Table 19. Impact of raising prices of cigarettes by 2% per year (model 4)**

Short-run price elasticity: –0.67
Long-run price elasticity: +1.54

| Year | Consumption of cigarettes | | | Revenues from tax on the tobacco | | |
|---|---|---|---|---|---|---|
| | Packs/adult | Annual variation | Cumulated variation | Revenues (million DH) | Annual variation | Cumulative variation |
| 2000 | 36.80 | | | 5418 | | |
| 2001 | 35.87 | –2.5% | –2.5% | 5583 | 3.0% | 3.0% |
| 2002 | 34.56 | –3.6% | –6.1% | 5689 | 1.9% | 5.0% |
| 2003 | 33.03 | –4.4% | –10.2% | 5750 | 1.1% | 6.1% |
| 2004 | 31.36 | –5.1% | –14.8% | 5775 | 0.4% | 6.6% |
| 2005 | 29.59 | –5.6% | –19.6% | 5744 | –0.5% | 6.0% |
| 2006 | 27.76 | –6.2% | –24.6% | 5679 | –1.1% | 4.8% |
| 2007 | 25.86 | –6.8% | –29.7% | 5579 | –1.8% | 3.0% |
| 2008 | 23.92 | –7.5% | –35.0% | 5441 | –2.5% | 0.4% |
| 2009 | 21.94 | –8.3% | –40.4% | 5261 | –3.3% | –2.9% |
| 2010 | 19.91 | –9.3% | –45.9% | 5038 | –4.2% | –7.0% |

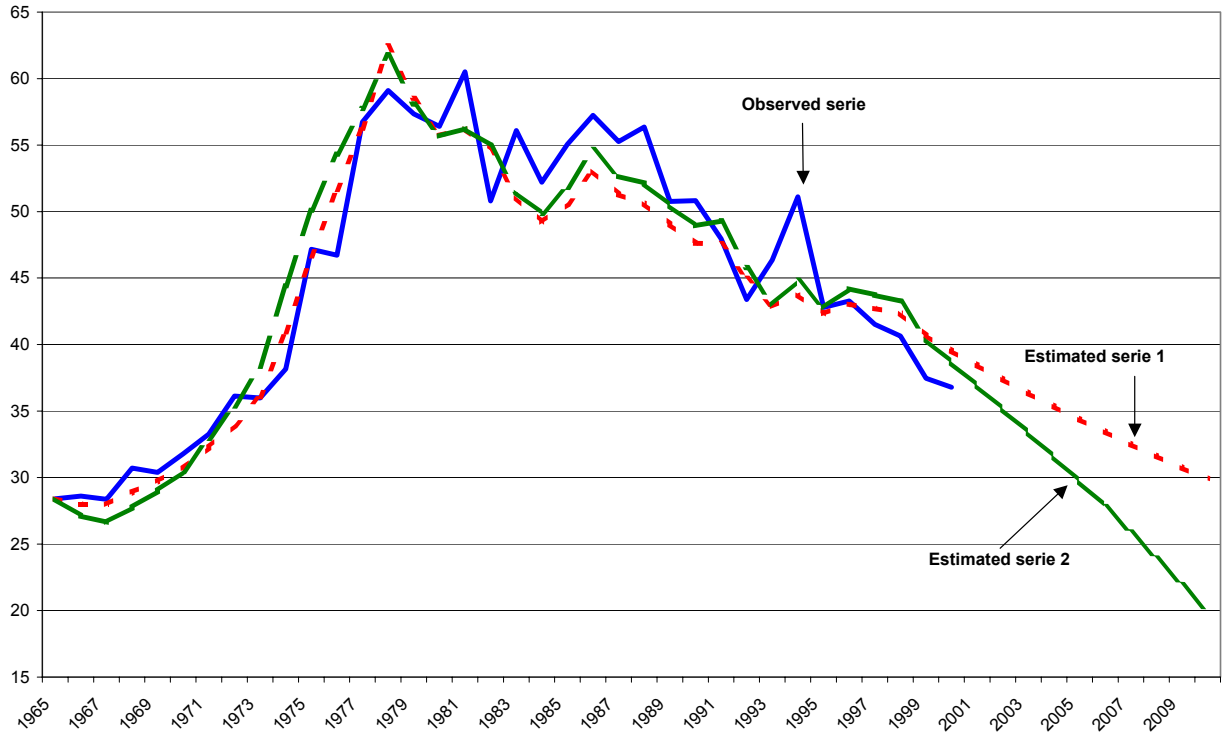
Source: Author's calculations

*Effect on consumption*

An increase in the cigarette price could result obviously in a fairly substantial reduction in the average consumption of cigarettes. The recent trend of a continuous decline in average consumption of cigarettes by adults would continue even with a price increase in real terms slightly lower than that observed during 1981–2000 (2.4% a year on average compared with 2% in the present simulations). Annual consumption would reach 30–34 packs per adult in 2005 instead of about 37 packs at present.

The figure below shows observed and estimated series of consumption for cigarettes (series 1 for model 2 and series 2 for model 4).

**Figure 7. Average consumption of cigarettes (packs/adult/year)**




Source: Régie des Tabacs, USDA and author's calculations

*Effect on revenue from the tobacco tax*

In the short run, revenue from tobacco taxes will increase, as a result primarily of increase in the adult population (+2.4% per year on average between 2000 and 2010) which causes total sales of cigarettes to increase, despite the decline in average per capita consumption. On the other hand, in the long run and in the case of a relatively high long-run price elasticity (1.54), revenue from tobacco tax could peak in 2005 and return to the current level by about 2008. In the case of a relatively low elasticity (–1.41) revenue from tobacco tax would continue to increase even after 2010.

## CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The economic issues addressed in this study were the impact of increasing tobacco taxes/prices on consumption, tax revenue, employment and poverty. To answer these questions, the study conducted three types of investigation: analyses of expenditure and consumption data, taxation policy, and industry organization. Based on this knowledge, an econometric study based on time-series data was conducted to estimate the parameters of tobacco demand in Morocco.

## CONCLUSIONS

First, a policy of increasing tobacco taxes is effective in reducing tobacco consumption. A tax rise of 10% would decrease demand for cigarettes (per adult) by 3.3%.

Second, within moderate ranges of increase, this policy has also a positive impact on government revenues. Our study suggests that a tax rise of 10% would increase revenue from taxes by about 6%.

Third, the employment effect of a consumption reduction will be moderate for the following reasons. First, the tobacco farming industry is quite small in terms of land use (4,500 hectares out of 9 million hectares of farm land) and in terms of market share in total supply (around 70% of raw tobacco is imported). This means that if tobacco consumption is reduced, there will be little or no negative effect on rural labour markets, since most or all of the reduction in demand for raw tobacco could be accommodated by reducing imports. Second, the processing industry is capital-intensive, with only 1,000 employees, spread around different units. This means that a reduction in processing activity will not have much effect on specific urban labour markets. Moreover, total sales continue to increase, and the effect of the per capita reduction in consumption is to slow the increase a little, not to cause a fall in sales.

Fourth, the impact on the poor of tax increases remains a complex question to answer in the absence of surveys on tobacco consumption among different income groups. The income elasticities have been estimated based on relatively poor data (particularly for income proxies). Tobacco appears from this analysis as a normal good for which income elasticity is positive and less than 1. This estimate was confirmed by the results of the 1999 expenditures survey. Economic theory and analysis in other countries shows that low income people will tend to react more strongly to price increases, and will reduce their consumption by more than more affluent consumers. This will lower the relative tax burden borne by poorer smokers. This is an aggregate effect, however. Some smokers will continue to smoke as much as before the price increase, and will therefore spend more of their income on cigarettes and bear a higher tax burden. But smokers who cut back their consumption or quit altogether benefit in two important ways: the more they cut their consumption, the more disposable income they release for other uses, and they will benefit from a lower risk of tobacco-attributable illness and premature death.

## FURTHER RESEARCH

To fill the main gaps remaining in the study of tobacco economics in Morocco, three priorities emerge.

*Better knowledge of consumption*

If the tax increase strategy is to work, certain risks must be avoided. Consumers must not switch to cheaper brands; or overall consumption would not change, or would change less. In Morocco, it is also important to take into account the regional dimension since the bulk of smuggling takes place in the northern and the southeast regions. It is also very important to improve knowledge of the consumption behaviour of the poorest groups in the population. Better knowledge of the substitution effect, the regional effect and the income level effect on price elasticities will improve the fine tuning of the impact analysis of taxation, but would require additional data collection. Without this knowledge, it is necessary to establish a

specific monitoring system in order to monitor the impact on substitution, regions and income groups each time there is a tax increase.

*Privatisation*

In addition to these topics, it is necessary to analyse the effects of the ongoing process of privatisation of the tobacco monopoly. This initiative is not compatible with the cross-subsidies that exist now between the different brands. As the study showed, the effective rate of taxation is less for local tobacco products and higher for imported brands. In case of privatisation, it is likely that relative prices will change, if cross-subsidies are reduced or phased out. The impact on consumption and poor consumers could be quite significant. Indeed, in the case of privatisation accompanied (or preceded) by a liberalization of the sector, the brands bought by poorest consumers, which are currently subsidized, would not benefit from the same treatment as at present. However, if cheap brands increased in price, this could have a beneficial effect from a public health point of view, in discouraging consumption.

*Economic cost of tobacco-induced diseases*

In this study, we have not taken into account the economic cost of tobacco-related diseases on health expenditure and on labour productivity. As a consequence, we are not able to estimate the full benefits of reducing tobacco intake on government incomes and on economic activity in general. Studies in other countries have found these effects to be substantial.[1]

[1] See Jha and Chaloupka (eds) Tobacco Control in Developing Countries, OUP for the World Bank and World Health Organization, 2000.

# ANNEX 1. PRODUCTION COSTS AND VALUE ADDED IN TOBACCO FARMING ACTIVITIES (MOROCCO), 2000

| | Amount | **Source** | Observations |
|---|---|---|---|
| Land preparation (DH/ha) | **904** | Ministry of Agriculture + our estimate | [1] |
| Inputs (DH/ha) | 2442 | Ministry of Agriculture + our estimate | [2] |
| Transportation (DH/ha) | 294 | Ministry of Agriculture + our estimate | [3] |
| Total of production costs (DH/ha) | 1442 | 904 + 10% * 2442 + 294 = 1441.7 | |
| | | | |
| Total value of crop production (1000 DH) | 64 170 | Régie des Tabacs + our estimate | [4] |
| Cultivated acreage (ha) | 4352 | Ministry of Agriculture + our estimate | Average 1992–2000 |
| Crop production value (DH/ha) | 14 745 | 64 170 × 1000/4352 = 14 745.4 | |
| Value added (DH/ha) | 13 304 | 14 745.4 – 1441.7 = 13 303.7 | |

Observations:
[1]: The 1994 value (770 DH/ha) was expressed in DH-2000 using CPI.
[2]: The 1994 value (2080 DH/ha) was expressed in DH-2000 using CPI. For these inputs we assume moreover that only 10% are supported by tobacco growers, the rest being financed by the Régie des Tabacs.
[3]: The 1994 value (250 DH/ha) was expressed in DH-2000 using CPI.
[4]: The total value of crop production was assimilated to the value of local purchase cost by the Régie des Tabacs. The local purchase costs between 1996 and 2000 were expressed in DH-2000. So, DH 64 170 255 is the average of these purchase costs.

# ANNEX 2. AVERAGE CONSUMPTION OF CIGARETTES, AVERAGE PRICE OF CIGARETTES, TAX ON TOBACCO AND GDP PER CAPITA. MOROCCO, 1965–2000

| Year | Average consumption of cigarettes (packs of 20 per adult) | Real prices (DH-2000/pack) | Tax on tobacco (DH-2000/pack) | GDP/capita (DH-1980) |
|---|---|---|---|---|
| 1965 | 28.40 | 10.37 | 4.22 | 2649 |
| 1966 | 28.60 | 10.48 | 4.35 | 2523 |
| 1967 | 28.38 | 10.56 | 4.65 | 2623 |
| 1968 | 30.72 | 10.51 | 4.87 | 2881 |
| 1969 | 30.40 | 10.21 | 4.99 | 2820 |
| 1970 | 31.79 | 10.08 | 4.87 | 2885 |
| 1971 | 33.27 | 9.68 | 4.45 | 2974 |
| 1972 | 36.14 | 9.33 | 4.59 | 2964 |
| 1973 | 35.98 | 8.88 | 4.02 | 3000 |
| 1974 | 38.16 | 7.63 | 3.73 | 3094 |
| 1975 | 47.16 | 7.09 | 3.06 | 3218 |
| 1976 | 46.71 | 7.25 | 2.92 | 3539 |
| 1977 | 56.73 | 7.12 | 3.17 | 3673 |
| 1978 | 59.10 | 6.51 | 3.01 | 3712 |
| 1979 | 57.36 | 8.43 | 3.15 | 3729 |
| 1980 | 56.40 | 8.70 | 4.00 | 3833 |
| 1981 | 60.51 | 7.78 | 3.20 | 3632 |
| 1982 | 50.81 | 8.64 | 3.77 | 3868 |
| 1983 | 56.09 | 9.38 | 4.15 | 3770 |
| 1984 | 52.20 | 9.38 | 3.98 | 3845 |
| 1985 | 55.07 | 8.70 | 3.74 | 3998 |
| 1986 | 57.24 | 8.50 | 3.87 | 4225 |
| 1987 | 55.27 | 9.36 | 4.73 | 4042 |
| 1988 | 56.36 | 9.64 | 4.83 | 4350 |
| 1989 | 50.76 | 10.13 | 5.66 | 4389 |
| 1990 | 50.82 | 10.45 | 5.84 | 4470 |
| 1991 | 47.94 | 10.39 | 6.44 | 4689 |
| 1992 | 43.40 | 11.16 | 7.56 | 4416 |
| 1993 | 46.36 | 11.23 | 7.07 | 4292 |
| 1994 | 51.11 | 10.68 | 6.66 | 4647 |
| 1995 | 42.79 | 11.12 | 7.26 | 4290 |
| 1996 | 43.28 | 10.97 | 7.22 | 4731 |
| 1997 | 41.52 | 11.10 | 7.27 | 4548 |
| 1998 | 40.64 | 11.52 | 7.25 | 4776 |
| 1999 | 37.47 | 12.17 | 7.87 | 4665 |
| 2000 | 36.80 | 12.16 | 7.85 | 4627 |

# ANNEX 3. RESULTS OF REGRESSIONS

MODEL 1

**Descriptive Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| CONS | 45.0481 | 10.1398 | 36 |
| RPRICE | 9.6473 | 1.4676 | 36 |
| RINCOM | 3788.5278 | 707.6641 | 36 |
| CONS_1 | 44.8783 | 10.3313 | 36 |

**Correlations**

| | | CONS | RPRICE | RINCOM | CONS_1 |
|---|---|---|---|---|---|
| Pearson Correlation | CONS | 1.000 | -.504 | .514 | .923 |
| | RPRICE | -.504 | 1.000 | .358 | -.332 |
| | RINCOM | .514 | .358 | 1.000 | .599 |
| | CONS_1 | .923 | -.332 | .599 | 1.000 |
| Sig. (1-tailed) | CONS | . | .001 | .001 | .000 |
| | RPRICE | .001 | . | .016 | .024 |
| | RINCOM | .001 | .016 | . | .000 |
| | CONS_1 | .000 | .024 | .000 | . |
| N | CONS | 36 | 36 | 36 | 36 |
| | RPRICE | 36 | 36 | 36 | 36 |
| | RINCOM | 36 | 36 | 36 | 36 |
| | CONS_1 | 36 | 36 | 36 | 36 |

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | CONS_1, RPRICE, RINCOM[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: CONS

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .959[a] | .920 | .913 | 2.9932 | .920 | 123.222 | 3 | 32 | .000 | 2.765 |

a. Predictors: (Constant), CONS_1, RPRICE, RINCOM

b. Dependent Variable: CONS

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3311.833 | 3 | 1103.944 | 123.222 | .000[a] |
| | Residual | 286.687 | 32 | 8.959 | | |
| | Total | 3598.520 | 35 | | | |

a. Predictors: (Constant), CONS_1, RPRICE, RINCOM

b. Dependent Variable: CONS

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 29.046 | 5.291 | | 5.490 | .000 | 18.269 | 39.823 | | | | | |
| | RPRICE | -2.780 | .540 | -.402 | -5.146 | .000 | -3.880 | -1.679 | -.504 | -.673 | -.257 | .407 | 2.455 |
| | RINCOM | 4.127E-03 | .001 | .288 | 3.127 | .004 | .001 | .007 | .514 | .484 | .156 | .294 | 3.407 |
| | CONS_1 | .606 | .089 | .617 | 6.771 | .000 | .424 | .788 | .923 | .767 | .338 | .300 | 3.337 |

a. Dependent Variable: CONS

**Coefficient Correlations[a]**

| Model | | | CONS_1 | RPRICE | RINCOM |
|---|---|---|---|---|---|
| 1 | Correlations | CONS_1 | 1.000 | .730 | -.814 |
| | | RPRICE | .730 | 1.000 | -.736 |
| | | RINCOM | -.814 | -.736 | 1.000 |
| | Covariances | CONS_1 | 8.004E-03 | 3.527E-02 | -9.62E-05 |
| | | RPRICE | 3.527E-02 | .292 | -5.25E-04 |
| | | RINCOM | -9.62E-05 | -5.25E-04 | 1.741E-06 |

a. Dependent Variable: CONS

**Collinearity Diagnostics[a]**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | |
|---|---|---|---|---|---|---|---|
| | | | | (Constant) | RPRICE | RINCOM | CONS_1 |
| 1 | 1 | 3.933 | 1.000 | .00 | .00 | .00 | .00 |
| | 2 | 4.862E-02 | 8.994 | .01 | .07 | .00 | .16 |
| | 3 | 1.488E-02 | 16.256 | .26 | .01 | .33 | .03 |
| | 4 | 3.247E-03 | 34.805 | .73 | .92 | .67 | .80 |

a. Dependent Variable: CONS

**Residuals Statistics[a]**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 27.5353 | 60.6389 | 45.0481 | 9.7275 | 36 |
| Residual | -6.8301 | 6.7914 | 1.115E-14 | 2.8620 | 36 |
| Std. Predicted Value | -1.800 | 1.603 | .000 | 1.000 | 36 |
| Std. Residual | -2.282 | 2.269 | .000 | .956 | 36 |

a. Dependent Variable: CONS

MODEL 2

**Descriptive Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| LOGC | 3.7811 | .2388 | 36 |
| LOGPRICE | 2.2547 | .1599 | 36 |
| LOGINCOM | 8.2216 | .1965 | 36 |
| LOGC_1 | 3.7761 | .2445 | 36 |

**Correlations**

| | | LOGC | LOGPRICE | LOGINCOM | LOGC_1 |
|---|---|---|---|---|---|
| Pearson Correlation | LOGC | 1.000 | -.473 | .622 | .940 |
| | LOGPRICE | -.473 | 1.000 | .273 | -.309 |
| | LOGINCOM | .622 | .273 | 1.000 | .697 |
| | LOGC_1 | .940 | -.309 | .697 | 1.000 |
| Sig. (1-tailed) | LOGC | . | .002 | .000 | .000 |
| | LOGPRICE | .002 | . | .054 | .033 |
| | LOGINCOM | .000 | .054 | . | .000 |
| | LOGC_1 | .000 | .033 | .000 | . |
| N | LOGC | 36 | 36 | 36 | 36 |
| | LOGPRICE | 36 | 36 | 36 | 36 |
| | LOGINCOM | 36 | 36 | 36 | 36 |
| | LOGC_1 | 36 | 36 | 36 | 36 |

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | LOGC_1, LOGPRICE, LOGINCOM[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: LOGC

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .968[a] | .938 | .932 | 6.243E-02 | .938 | 160.041 | 3 | 32 | .000 | 2.717 |

a. Predictors: (Constant), LOGC_1, LOGPRICE, LOGINCOM

b. Dependent Variable: LOGC

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.871 | 3 | .624 | 160.041 | .000[a] |
| | Residual | .125 | 32 | 3.897E-03 | | |
| | Total | 1.996 | 35 | | | |

a. Predictors: (Constant), LOGC_1, LOGPRICE, LOGINCOM

b. Dependent Variable: LOGC

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | -8.40E-02 | .514 | | -.163 | .871 | -1.132 | .964 | | | | | |
| | LOGPRICE | -.514 | .099 | -.344 | -5.163 | .000 | -.716 | -.311 | -.473 | -.674 | -.228 | .440 | 2.271 |
| | LOGINCOM | .319 | .107 | .263 | 2.973 | .006 | .100 | .538 | .622 | .465 | .131 | .250 | 3.997 |
| | LOGC_1 | .635 | .087 | .650 | 7.276 | .000 | .457 | .813 | .940 | .789 | .322 | .244 | 4.092 |

a. Dependent Variable: LOGC

**Coefficient Correlations[a]**

| Model | | | LOGC_1 | LOGPRICE | LOGINCOM |
|---|---|---|---|---|---|
| 1 | Correlations | LOGC_1 | 1.000 | .724 | -.854 |
| | | LOGPRICE | .724 | 1.000 | -.716 |
| | | LOGINCOM | -.854 | -.716 | 1.000 |
| | Covariances | LOGC_1 | 7.624E-03 | 6.289E-03 | -8.008E-03 |
| | | LOGPRICE | 6.289E-03 | 9.895E-03 | -7.650E-03 |
| | | LOGINCOM | -8.01E-03 | -7.650E-03 | 1.153E-02 |

a. Dependent Variable: LOGC

**Collinearity Diagnostics[a]**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | |
|---|---|---|---|---|---|---|---|
| | | | | (Constant) | LOGPRICE | LOGINCOM | LOGC_1 |
| 1 | 1 | 3.993 | 1.000 | .00 | .00 | .00 | .00 |
| | 2 | 5.899E-03 | 26.017 | .00 | .20 | .00 | .07 |
| | 3 | 1.053E-03 | 61.588 | .22 | .33 | .00 | .24 |
| | 4 | 1.000E-04 | 199.815 | .78 | .46 | 1.00 | .69 |

a. Dependent Variable: LOGC

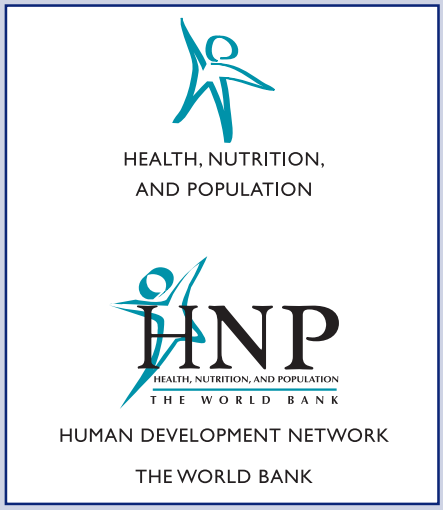
**Residuals Statistics[a]**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 3.3355 | 4.1429 | 3.7811 | .2312 | 36 |
| Residual | -.1232 | .1369 | 2.344E-16 | 5.969E-02 | 36 |
| Std. Predicted Value | -1.927 | 1.565 | .000 | 1.000 | 36 |
| Std. Residual | -1.974 | 2.192 | .000 | .956 | 36 |

a. Dependent Variable: LOGC

Two-stage least squares: MODEL 3
Dependent variable.. CONS
Listwise deletion of missing data
Multiple R.95950
R square.92064
Adjusted R square.91040
Standard error 3.05093
Analysis of variance:
DF sum of squares mean square
Regression 43 347.3726836.84316
Residuals 31 288.55269.30815
F = 89.90437 Signif F =.0000
----------Variables in the equation----------
Variable B SE B Beta T Sig T
RPRICE-3.416408.658820-.494471–5.186.0000
RINCOM.006640.001899.4633993.496.0014
LAW-.747156.703745-.094492–1.062.2966
CONS_1.460882.115593.4695863.987.0004
(Constant) 32.6249856.4903115.027.0000
Correlation matrix of parameter estimates
RPRICE RINCOM LAW CONS_1
RPRICE 1.0000000-.5605789-.0937438.6372341
RINCOM-.56057891.0000000-.6198556-.8838323
LAW-.0937438-.61985561.0000000.4884522
CONS_1.6372341-.8838323.48845221.0000000
Covariance Matrix of Parameter Estimates
RPRICE RINCOM LAW CONS_1
RPRICE.43404319-.00070134-.04346344.04852851
RINCOM-.00070134.00000361-.00082838-.00019401
LAW-.04346344-.00082838.49525655.03973458
CONS_1.04852851-.00019401.03973458.01336174

Two-stage least squares: MODEL 4
Dependent variable.. CONS
Listwise deletion of missing data
Multiple R.95771
R Square.91721
Adjusted R square.90944
Standard error 3.06641
Analysis of variance:
DF sum of squares mean square
Regression 33 333.28181111.0939
Residuals 32 300.89099.4028
F = 118.16576 Signif F =.0000
----------Variables in the equation----------
Variable B SE B Beta T Sig T
RPRICE-3.459767.659582-.500747–5.245.0000
RINCOM.005350.001498.3733913.571.0011
CONS_1.523512.101409.5333995.162.0000
(Constant) 34.6619516.1777485.611.0000
Correlation Matrix of Parameter Estimates
RPRICE RINCOM CONS_1
RPRICE 1.0000000-.7920584.7863683
RINCOM-.79205841.0000000-.8486895
CONS_1.7863683-.84868951.0000000
Covariance matrix of parameter estimates
RPRICE RINCOM CONS_1
RPRICE.43504778-.00078271.05259821
RINCOM-.00078271.00000224-.00012894
CONS_1.05259821-.00012894.01028378

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