"DETERMINING THE OPTIMAL EXCISE RATE: EXAMPLE OF UKRAINIAN TOBACCO INDUSTRY"

by

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Abstract

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In this paper, I developed a model of efficient excise taxation in the Ukrainian tobacco industry. Efficiency was considered from the government's viewpoint where the government is aiming at maximizing tax proceeds. However, the government is also interested in reducing consumption of the harmful good (i.e. cigarettes). In Ukraine, the achievement of these objectives is hampered by the easy availability of illegal cigarettes. The majority of smuggled cigarettes originates in Russia, due to existence of rather transparent borders between the countries. Therefore, the markets of the two countries are interconnected.

The econometric part of my research is based on three regressions. First, a demand function for cigarettes was estimated. The elasticity of demand with respect to the excise rate was found to be –0.37. Second, a Laffer curve was estimated for the tobacco industry. The curve shows a relationship between the excise rate and excise revenues, and has a normal shape predicted by the economic theory. My estimates show that current excise rates in Ukraine are well below the revenue-maximizing level. Third, a price equation for the industry was estimated which allowed determining the mark-up in the industry. The last estimate showed that the government could increase the excise rate without driving producers out of the market since the average mark-up is significant.

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GLOSSARY

Ad-valorem excise taxation

Excise taxation system, under which the excise tax is calculated as a percentage of the price of a particular good. Hence, the higher the price, the more is paid in taxes.

Myopic behavior model

This model assumes that while making their decisions, consumers do not care about future effects of their present decisions. Hence, the effect of present decisions on future utility is ignored. In modelling addictive behavior, one needs to include past consumption as a regressor in the demand function, while future consumption is not included in the model.

Rational behavior model

This model assumes that consumers fully realize the effect of their present consumption decisions on future utility. In the case of cigarettes, for example, consumers realize future harm from smoking. Hence, while making a decision to smoke today, consumers take into account negative future effects (i.e., harm to their health and habit formation) of such a decision. Consequently, in econometric models, one needs to include both past and future consumption as regressors in the demand function.

Specific excise taxation

Excise taxation system, under which the excise tax is imposed in fixed monetary amount per some quantity of a good. In the cigarette industry, the tax is usually paid per 1000 sticks. Hence, the amount of the tax paid does not depend on the price.

Ukrtutun

The Ukrainian Association of tobacco growers and cigarette producers. The Association includes ten major cigarette-producing factories. This works similar to a business association.

Chapter 1

INTRODUCTION

To some economists, the problem I investigate in my research (i.e. excise taxation) may seem to be very specific and unimportant. However, excise taxation is one component of the overall tax system of a country. So, one should understand that without improvements in each specific area of the tax system, it is next to impossible to improve the overall system, which is crucial for any economy in transition. Each area of taxation should deserve attention, because improvements in the overall tax system are determined by changes in each particular sub-area. Hence, I do not consider my research as a purely theoretic exercise, but rather as an attempt to address one particular policy problem on a scientific basis. Unless all specific problems are solved properly, it is impossible to ensure success of the overall tax reform.

Until the present, Ukrainian authorities have paid little attention to issues of excise taxation of different goods, and no scientific base for determining excise rates has been developed. Meanwhile, excise taxes represent a very important part of the tax system in a country and usually have certain additional objectives (e.g., influence the demand for a certain good).

As a rule, excise taxes are imposed on a number of specific goods that usually have inelastic demands[1]. This characteristic of the demand makes the goods especially attractive for raising budget revenues from indirect taxes (excises) on those goods. In addition, the government may have other objectives: e.g.,

[1] For a detailed discussion of different issues of excise taxation see, for example, Institute for transition economics (2000).

reducing consumption of particular goods through indirect increases in their prices using the excise tax. Hence, under the "optimal excise rate", I understand the rate that ensures maximization of government revenues, while the government is also interested in determining the effect of its excise policy on the demand for a particular good.

As with all taxes, the government should be careful in imposing high excise rates since an extremely high price (caused by high excise taxes) may lead to a sharp drop in the demand and, consequently, in the budget revenues. As the theory suggests[2], an initial increase in the tax rate will lead to higher budget revenues, while further increases may cause the revenues to shrink.

The objective of determining excise rates becomes even more important if consumers are able to switch away from taxed goods. If, for example, similar illegal (and hence, untaxed) products are easily available in the market, the effect of taxation may be different, since consumers would switch to cheaper untaxed goods if legal products become more expensive due to higher tax rates. In this case, setting an extremely high excise rate may lead not only to lower budget revenues, but to unchanged consumption as well, since the majority of consumers may switch to illegal (and usually cheaper) products.

The tobacco industry is a good example of an industry where excise taxation is present and where all the indicated features and objectives usually exist. That is why in my research, I investigate excise taxation in the Ukrainian tobacco industry.

In Ukraine, the tobacco industry makes up over 17% of the food industry, and contributes about 3% of total budget revenues (ICPS, 2000). Hence, on the one hand, from the economic point of view the industry is important for the

[2] See, for example, Varian (1999).

Ukrainian economy as a source of budget revenues; on the other hand, the government tries to limit tobacco consumption due to health considerations. Thus, it is clear that proper tax "regulation" is needed to ensure achievement of these two objectives.

In Ukraine, excise taxation does not seem to be effective, since excise rates are set by the government under the lobby of different interested parties[3]. For example, non-filter cigarette producers vote for a lower excise on non-filter cigarettes and higher excise for filter cigarettes. For filter cigarette producers the interests are the opposite. At the same time, some authorities insist on imposing extremely high excise rates to cope with smoking (however, they typically forget about the problem of smuggling[4]). Moreover, the government itself may be tempted to rise excise rates in order to increase tax proceeds. These factors tend to make government policy unstable and inefficient.

As a result of such insufficiently considered actions in excise taxation, it is possible to predict that the state health care policy fails and the government does not maximize its revenues while about 30% of the market is covered by illegal (and often poor-quality) products (ICPS, 2000).

Thus, in my research, I will try to develop a model, which takes into account major peculiarities of Ukraine's tobacco market and allows to determine the excise rate that enables achievement of the indicated objectives (i.e. maximize budget revenues and reduce cigarette consumption). Consequently, in my research, I will investigate the relationship between the excise tax on the one hand, and government revenues, cigarette consumption, and firms' profits – on the other. The reason for such a broad scope of my research is the necessity to

[3] See Business Newspaper (2001).

[4] An important feature of the Ukrainian tobacco market is that illegal tobacco products can relatively easily enter the market (particularly from Russia). See Business Newspaper (2001).

consider all involved groups (i.e. government, consumers, and producers) in order to develop an effective policy. Such policy is aimed at (1) maximizing tax proceeds, (2) reducing cigarette consumption, and (3) ensuring profits to producers to keep them operating in the market.

The paper is organized as follows. Chapter 2 provides a profile of the Ukrainian tobacco industry and market. The theoretical model is derived in chapter 3. Chapter 4 represents an empirical part of my research. Here, the theoretic model is estimated and evaluation of the current Ukrainian excise policy is given. Finally, chapter 5 concludes.

Chapter 2

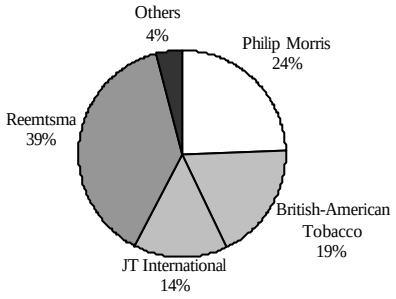
PROFILE OF UKRAINE'S TOBACCO MARKET[5]

Before conducting theoretic and empirical analysis of excise taxation in the tobacco industry, one should understand major peculiarities of the market for cigarettes in Ukraine. Hence, in this section, I describe major features of Ukraine's tobacco market that should be taken into account in further research.

In Ukraine, 23 factories have licenses for producing tobacco products. However, only 17 factories are operating now. Out of those 17, ten factories are members of the Ukrainian association of tobacco producers ("Ukrtutun"). Those ten factories account for over 99% of the industry's output. The ten factories in turn can be divided into two groups: (1) factories owned by multinational enterprises (MNE)—5 factories producing about 96% of total output; and (2) factories without foreign capital (see Figure 1). It is obvious that MNEs dominate in the market (concentration in the market is rather high) and production at the factories without foreign capital is shrinking, while the major competition exists among MNEs. The large share of MNEs in cigarette production (and hence, in budget revenues) makes the multinationals especially powerful in lobbying their interests.

[5] This chapter is mainly based on the analysis provided in ICPS (2000).

FIGURE 1. MNEs in the Ukrainian tobacco market (production shares) – 2000



Source: "Ukrtutun"

Under "Others" one should understand factories without foreign capital. Those factories operated when Ukraine was a part of the Soviet Union. Now, they still use outdated equipment and mainly produce old soviet non-filter cigarette brands.

All tobacco factories owned by MNEs work with wholesale firms (about 600 entities) in different regions of Ukraine. Each MNE directly works with 35-45 wholesale firms that operate in different regions of Ukraine. Usually their activities are conducted in a particular region (oblast). If a wholesale firm works with a producer, the latter can set the upper limit of the price, which can be charged by the wholesaler. Wholesalers have a certain chain of retail distributors within the region.

Unfortunately, not much information is available on wholesale firms. Moreover, cigarette consumption patterns seem to differ among different regions. These two factors result in the impossibility to make any estimates based on the data for wholesale firms.

Since their entry into the Ukrainian market, MNEs have used mixed strategy: (1) they promoted old soviet brands (which were already popular) while improving their quality and producing "modified" cigarettes (for example introducing filter cigarettes) under the same brand name, and (2) started production of international brands in Ukraine (for example, Marlboro, Magna, L&M, Chesterfield, etc.). Similar strategy has been used by MNEs operating in Russia, which means that products produced in the two countries are almost the same, and consumers in each country can easily substitute them (see below).

In the cigarette production, MNEs (that dominate the market) use mainly imported raw tobacco (the major exporter is the USA). Since the quality of domestic-grown tobacco is rather low, imported raw tobacco is used even for production of non-filter cigarettes (that are generally cheaper and of lower quality). The cost of imported raw tobacco constitutes a significant share of total production costs. Hence, I may predict that cigarette prices in Ukraine are very sensitive to changes in the exchange rate of the hryvnia with respect to the US dollar.

Production capacity of the ten factories—members of "Ukrtutun" is 75.63 billion sticks annually. However, capacity has been significantly underutilized during 1990s, partially due to existence of illegal import.

An important feature of the Ukrainian cigarette market is extensive illegal activities. Currently, illegal imports account for about 30% of total consumption. Illegal cigarettes originate in Russia and Moldova, which is caused by excise tax differentials. Usually, cigarettes are legally bought in Russia or Moldova and then illegally transported to Ukraine without paying taxes to the Ukrainian budget. For example, legally produced non-filter cigarettes cost two times less in Russia than in Ukraine. After the cigarettes are illegally imported to Ukraine, their retail price

in the black market constitutes approximately two-thirds of the price of non-filter cigarettes legally sold in Ukraine[6].

Another important issue is excise taxation in Ukraine. The excise tax is paid by producers. The procedure is as follows. Before a particular month, tobacco factories submit applications to the State Tax Administration where they indicate the number of excise stamps they will need in the following month (this is based on factories' estimates regarding production volumes). After producing cigarettes, excise stamps are put on each pack. Then cigarettes are sold to wholesalers. After the month is over, producers submit a report to the State Tax Administration where they indicate the amount of cigarettes sold and here excise payment takes place.

In Ukraine, cigarettes are subject to specific excise taxation. This means that the amount of the tax does not depend on the price of cigarettes and producers pay a fixed amount (in hryvnias) per one thousand sticks (for example, 10 hryvnias per 1000 sticks). Before 2000, excise tax had been calculated in EUROs. During the previous years, excise rates (calculated in EUROs) changed only from year to year and were constant during one particular year. During this period, the excise rate remained the same for filter and non-filter cigarettes. In practice, excise tax was paid in hryvnias according to the NBU exchange rate. The amount of the excise tax in hryvnias was calculated at the beginning of each quarter based on the NBU exchange rate and remained constant during the quarter. This important feature needs to be taken into account while processing the corresponding data.

Finally, I should mention that even cigarette producers in Ukraine lack proper estimates of consumption, and the influence of taxation (and prices) on the demand and budget revenues. Even the problem of smuggling has not been

[6] See ICPS (2000).

properly analyzed. This is mainly explained by high costs of conducting such research and surveys. Consequently, any scientific approaches towards these issues are missing. Hence, my research will be one of the first attempts to address these problems. However, this also represents a weakness of my research, because it is impossible to compare my results with any other research, since the latter is missing.

With all this information in mind, I am ready to develop a theoretic model relevant to the Ukrainian market. This will be done in the following chapter.

Chapter 3

THEORETIC FRAMEWORK

Previous Theoretic Findings

As was mentioned above, the scope of my research is broad since I try to consider the general environment in which excise taxation takes place. Hence, I try to estimate the impact of excise taxation on budget revenues, while also considering the effect of taxation on consumers and producers. Such approach allows to evaluate general effectiveness of the excise taxation policy and determine possible directions of the policy.

In their papers, other researchers typically analyzed one of the problems set in my research: either they were concerned with tax revenues, or cigarette consumption, or firms' profits. So, till present, I have not found a comprehensive research where all the three issues were analyzed. However, the articles I have already read contain useful information and method descriptions related to different aspects of my research. The majority of literature deals with the issue of cigarette consumption and its effect on people's health. At the same time, majority of the papers was devoted to cigarette consumption in developed countries and hence, the effect of taxation on budget revenues was mainly ignored (since in developed countries, excise proceeds make-up a small share of tax revenues).

In order to determine the impact of taxation on budget revenues, it is necessary to get an idea of the demand for cigarettes. Tax proceeds will be largely dependent upon the reaction of consumers to changes in the tax rate (and hence, prices). Therefore, the first issue in my research is estimation of cigarette demand.

Basically, economists distinguish between two groups of models where an addictive good is involved. The two groups are "myopic behavior models" and "rational behavior models".[7] When consumers are "rational", they take into account all future effects of their present consumption (they maximize life-time utility). In the case of cigarettes, consumers realize future harm and utility of their present consumption decisions. That is, present consumption will also depend upon future consumption.

On the contrary, "myopic behavior" models assume that consumers do not realize (or pay attention) to future effects. The only thing that matters is the addiction of consumers. This means that when consumers increase their demand in the current period, it will be difficult for them to stop consuming the good in the future even if the price grows. Hence, present cigarette consumption will depend upon past consumption (since cigarettes represent an addictive good) and not upon future consumption. Such feature of the cigarette demand makes the long-term elasticity of demand higher.

It is reasonable to assume that "myopic behavior" model is more relevant to Ukraine's tobacco market, since mainly, the public is not aware of the long-term harmful effects of smoking and there were no well-developed programs for informing people and youth, in particular, about these effects. Hence, in my estimations I will test the hypothesis of consumers' "myopic behavior".

As opposed to estimates for highly developed countries[8], where the price elasticity of cigarette demand is in the range from –0.4 to –0.6, the elasticity tends to be higher for low-income countries (from –0.8 to –1) since here, consumers

[7] See, for example, Grossman, M., et al (1998), and Galbraith and Kaiserman (1997).

[8] See, for example, Harris E., Jeffrey (1994).

are more price sensitive[9]. Hence, one should expect the elasticity of demand for Ukraine to be closer to one.

In the view of the problem of smuggling, it is possible to use one important explanatory variable while estimating a demand function: an incentive to smuggle. This is represented by the difference in excise rates between two neighboring states (countries). Some successful attempts were made in estimating demand functions using this regressor (among others) and it turned to be statistically significant[10]. Baltagi and Levin (1986) used almost the same approach. In their study for the US, they included the price of cigarettes in neighboring states while estimating cigarette demand for each particular state. Excluding this regressor will lead to the price elasticity estimate being biased upward.

After determining factors that influence the demand for cigarettes in Ukraine, I will turn to the major issue of my research – determining the relationship between the excise tax rate and government revenues. Here, the concept of the Laffer curve will be used. According to theory[11], when the tax rate is increased, tax proceeds start growing. However, after a certain point is reached, further increases in the tax rate will cause the proceeds to shrink, since consumers will adjust their behavior. Consequently, tax proceeds are determined by the tax rate on the one hand, and factors that influence the demand for a certain good – on the other.

Finally, I will try to determine the impact of excise taxation on producers' profits. In case currently, producers receive small profits, an increase in the tax rate may lead to the situation when some firms find it unprofitable to operate in the Ukrainian market. If some producers leave the market, the government will

[9] Chaloupka, et al (2000).

[10] See Thursby G., Jerry; Thursby C., Marie. (1994).

[11] See, for example, Sachs, J., Larrain, F. (1993).

definitely lose in terms of tax proceeds. As was described earlier, concentration in the market is rather high, and hence, each firm has some market power. Since, firms do not typically report their profits, it would be reasonable to somehow estimate the average mark-up in the industry.

One way of estimating the mark-up was described in Sumner (1981). The author proposed a simple method of estimating the mark-up without direct measurement of producer costs. Hence, the major problem (i.e. determining producer costs) of such estimates is avoided. Using a simple proof, Sumner (1981) showed that "the coefficient of the tax rate term in a price equation identifies the ratio of price to marginal cost". According to this methodology, all one needs to do is to estimate an equation where the price is determined as a function of some explanatory variables[12]. Moreover, based on the coefficient of the tax rate, it is possible to estimate the average firm-level price elasticity of demand. According to Sumner (1981), the following equality holds:

$$\theta_j = \eta_j/(\eta_j+1)$$

where η_j is the firm-level price elasticity of demand, and θ_j is the coefficient of the tax rate term in a price equation.

The methodology proposed by Sumner (1981) will help me determine the mark-up (i.e. profits) in the Ukrainian tobacco industry. If the mark-up is significant, the government may be in a position to increase the excise tax rate if found necessary.

In my research, I will not consider such issues as advantages and disadvantages of specific and ad valorem excise taxes. However, one thing is worth noting. Many articles and books were devoted to the issues of excise taxation, including ad

[12] Similar methodology was used in Delipalla, S., O'Donnell, O. (1999).

valorem, specific, and mixed taxation.[13] As the evidence suggests, implementation of different taxation methods depends on the government objectives. In my research, I assumed two basic goals of Ukraine's government: to raise revenues and reduce cigarette consumption. In this case, specific excise taxation is more relevant. According to some researches[14], an increase in a specific tax leads to a larger increase in cigarette prices as compared to the ad valorem tax. Hence, it is more powerful in distracting people from smoking and does not cause significant losses to producers since the major share of excise tax is transferred to consumers[15] (which in turn, ensures state budget revenue inflow).

Developing a Theoretic Model Relevant to the Ukrainian Market[16]

As described above, in my research, I will analyze the situation from the viewpoint of the government, consumers, and producers. However, the major topic of my research is to estimate the revenue-maximizing excise rate. The focus on maximizing tax proceeds is explained by the fact that governments (especially in low-income countries) are mainly concerned with raising revenues from taxation, while other objectives (e.g. reduce consumption of certain goods) are of lower priority. Nevertheless, I will start developing a theoretic model from deriving a demand function. Such logic is justified, since determining factors that influence cigarette demand in Ukraine will facilitate deriving the relationship between the excise rate and tax proceeds. After determining factors influencing the demand, it will be possible to derive a Laffer curve for the tobacco industry

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[13] See, for example, Chaloupka, F., et al (2000), and Oxford Economic Forecasting and International Tax and Investment Center (2001) .

[14] See Delipalla, S., O'Donnell, O. (1999).

[15] Ibid.

[16] In this paper, I do not analyze the effect of excise taxation and government policy on different consumer groups. Hence, the issues of wealth distribution and equity are not discussed here. In my model, the government is interested in maximizing tax proceeds while also caring about the *general* reduction in cigarette consumption. The issues of wealth distribution and equity are discussed, for example, in Friedman, M. (1952) and Break, G. (1954).

since tax proceeds depend both on the tax rate and consumption patterns. Hence, below I derive three sub-models.

The first sub-model (consumer) aims at determining factors influencing cigarette demand in Ukraine. The second sub-model (government) will be built on the basis of information obtained from the first sub-model. The government sub-model is used for deriving a Laffer curve, which shows the relationship between the tax rate and tax proceeds. Finally, the third sub-model (producer) is aimed at determining the impact of excise taxation on producers (and their profits in particular). The reason for introducing this last model lies in the fact that if the government decides to increase the excise rate significantly, some producers may leave the market if their activity becomes unprofitable. This in turn may negatively affect potential budget revenues.

Consumer model

This model is used for determining consumers' reaction on changes in the excise rate. Since no data is available on consumption of cigarettes in Ukraine, the only possibility is to use legal sales as a dependent variable. However, this may not pose significant problems if the effect of smuggling is taken into account. As some researches showed,[17] it is still possible to obtain reliable estimates of the demand function if attention is paid to the smuggling problem.

As mentioned above, to estimate the correct price (or tax) elasticity of demand there is a need to consider smuggling. One possibility is to include the "incentive variable". This incentive variable is represented by the difference in cigarette prices (or in my case – in excise tax rates) in two neighboring countries.[18] Hence, it measures the potential profit from smuggling. It is assumed that cigarettes in

[17] See for example Sung, Hai-Yen et al (1992).

[18] Baltagi, B., Levin, D. (1986).

the two countries are of similar quality (which is true for Ukraine and its neighboring countries) and the only factor that causes smuggling is the tax differential. The larger is the potential profit, the more incentives will smugglers have to bring illegal products to the country with higher taxes.

In the case of Ukraine, majority of illegal products comes from Russia[19], which is explained by the existence of rather transparent borders between the two countries. Hence, I include the difference between the excise rates in Ukraine and Russia as an explanatory variable. However, one modification of the incentive variable could be the ratio of the two excise rates. This modified variable will have the same meaning, while it may be suitable for some model specifications.

One peculiarity of smuggling is that it takes time for smugglers to identify the difference or change in taxes (and hence, prices) and to establish channels for distribution of illegal products. Consequently, a change in the excise rate in Russia will not influence Ukrainian market immediately. Instead, some time will pass before the effect will be felt in the Ukrainian market. One example when there was a dramatic drop in the Russian excise tax, is the financial crisis of 1998. After the depreciation of the ruble, the excise tax in Russia fell in real terms and in hryvnia equivalent. As tobacco producers claimed, after the crisis, the massive inflow of illegal cigarettes started after 4-5 months. Hence, it is reasonable to incorporate this information into my model.

There could be other explanations why extensive smuggling does not occur immediately after the opportunity of extracting profits occur. First of all, consumers may be "brand-addicted". This means that a consumer is used to smoking a particular cigarette brand. Hence, if his "favorite" brand becomes relatively more expensive, the consumer my not switch to other cheaper

[19] See ICPS (2000).

(smuggled) brands immediately. Instead, the consumer will look for a smuggled brand that is more close to his taste. This process will take some time, and the consumer will switch to smuggled cigarettes after a certain period of time.

Another reason is the necessity to transport smuggled goods to more distant regions. As it was observed[20], initially, smuggled cigarettes entered the markets of Eastern oblasts of Ukraine that are located directly at the border with Russia. Now, these markets are extensively supplied by smugglers. However, in order to extend their markets, smugglers need to move to other oblasts, which are more distant. This requires establishing new distribution chains in other oblasts, which in turn requires certain expenditures and time.

Typical models of demand for any good include price as a main regressor. However, in my research, I am more interested in the effect of the excise tax on the demand for cigarettes. Hence, the demand should be modeled using the excise rate as an explanatory variable. Of course, this does not allow explicit inclusion of the price variable in my model because of the likely correlation between the price and the excise rate. Instead, I will need to include factors that influence (determine) the price among which is the excise tax.

The most common factors that influence cigarette demand include income, demand in the previous periods (according to the myopic behavior model and existence of the addiction to cigarettes), and the price[21]. In my case, the price variable will be replaced by the excise tax and the exchange rate of the hryvnia with respect to the US dollar. The reason for including the exchange rate lies in the fact that cigarettes in Ukraine are mainly produced from imported raw tobacco (the main exporter is the USA). Since the cost of tobacco accounts for a

[20] ICPS (2000).

[21] See Becker G. et al (1994).

significant share of the total costs, fluctuations in the exchange rate reflect changes in the price of the major input (i.e., tobacco). Consequently, depreciation of the hryvnia will increase the price of tobacco, which in turn will lead to higher cigarette prices.

However, in Ukraine, US dollars play another role. It is acknowledged in many researches[22] that Ukrainians extensively use dollars as a store of wealth. Hence, while a depreciation of the hryvnia will increase cigarette prices (and decrease the demand) it will likely have another effect. Actually, a depreciation of the hryvnia means that consumers become wealthier, since their wealth in hryvnia equivalent grows. Consequently, the exchange rate of the hryvnia with respect to the US dollar will have two opposite effects: on the one hand, a depreciation of hryvnia will reduce cigarette demand, due to higher prices, while on the other hand, the depreciation will foster cigarette demand, due to increased wealth of Ukrainian consumers.

Although it was often assumed in previous research that the price (or in my case, its substitutes) influences consumers' behavior in the same period, it is very likely that consumers will not react to price changes immediately. This may happen due to the existence of smoking habit (or addiction) and slow reaction of consumers to market changes (which is true for the Ukrainian market).

Some estimates[23] show that Ukrainian consumers tend to respond to price changes with a lag equal to one period. In the cigarette market, one possible explanation to this may be the fact that numerous cigarette retailers do not raise their prices simultaneously. Instead, some of them prefer to keep their prices

[22] See, for example, UEPLAC (2000).

[23] For example, a complex macroeconomic model for Ukraine is estimated by the International Center for Policy Studies in the framework of one of its ongoing projects. These estimates support the hypothesis that Ukrainian consumers tend to react to price changes with a lag equal to 1 period.

unchanged for some period of time in order not to distract consumers and even gain from their increased market share. Hence, an increase in the price may leave current consumption unchanged, while it will influence future consumer decisions.

Taking into account the analysis and assumptions given above, it is possible to derive the following equation for estimation of cigarette demand in Ukraine[24]:

$$Dom\_sales_t = a_1 + a_2*Excise_t + a_3*Excise_{t-1} + a_4*DY_t + a_5*Dom\_sales_{t-1} + a_6*(Excise_t / Rus_{t-4}) + a_7 US_t + a_8 US_{t-1}$$

where Dom_sales stands for domestic sales (calculated as domestic production + imports – exports); Excise is the excise rate in Ukraine; DY – consumption expenditures by households; Rus – excise rate in Russia (the major illegal exporter of cigarettes to Ukraine); US – exchange rate of the hryvnia with respect to the US dollar.

Of course, this is a schematic representation of the exact econometric model. The exact number of lags in each variable will be determined later, as well as the form of the curve (linear or non-linear)[25].

One should expect a_2 and a_3 to be negative since an increase in the corresponding variables represent an increase in the cigarette price. The sign of the coefficients in front of the US variable may be either positive, or negative. This is explained by the fact that Ukrainians consider dollars as the main store of wealth. Hence, an increase in US (depreciation of the hryvnia) will raise the hryvnia value of "savings" accumulated in dollars which represents an increase in people's wealth.

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[24] Since I am mainly interested in estimating the elasticity of the demand with respect to the excise rate, I will estimate this equation in the logarithmic form.

[25] This depends on the peculiarities of the market and consumer behavior. A priori economic analysis does not allow to establish the exact form of the demand function.

Higher level of wealth will tend to increase people's demand for consumer goods and cigarettes, in particular. Thus, the sign of this explanatory variable (US) will depend on which effect dominates: higher price of cigarettes (due to higher price of raw tobacco) reducing demand, or higher wealth increasing demand.

The sign of the a_6 coefficient is expected to be negative. This is the discussed above "incentive variable". It is clear that the higher the ratio of the two excise rates, the more smuggled goods will enter Ukrainian market and more consumers will consume them. Of course, this will negatively affect legal domestic sales.

Other coefficients should be found positive. Higher consumption expenditures will increase demand for consumer goods and cigarettes, in particular. Lagged consumption variable (Dom_sales_{t-1}) will also have a positive effect on current sales due to the addiction effect. In general, addiction implies that higher consumption today will increase future consumption.

Government model

After determining factors influencing cigarette demand, I can turn to the main topic: deriving the relationship between the excise rate and budget revenues. Hence, the so-called "government model" is aimed at estimating the relationship between the excise rate and excise tax revenues. The concept is known as the Laffer curve. According to the theory[26], when the tax rate is increased tax revenues grow up to a certain point. At this point, tax revenues are maximized and further increase in the tax rate will reduce tax revenues. Hence, I need to apply this model to the Ukrainian tobacco industry[27].

[26] See, for example, Varian (1999).

[27] Note that only legal cigarettes are taken into account while calculating tax revenues.

Due to the indicated features of the Laffer curve, the equation describing the model cannot be linear because as the theory predicts, the corresponding curve slopes upward, reaches its maximum, and, finally, declines. The dependent variable is excise tax revenue, which is easily calculated given that Ukraine has specific excise taxation.

Tax revenues naturally depend on the tax rate. However, on the other hand, revenues are influenced by the demand. If taxes are raised significantly, the price of the taxed good is likely to grow causing the demand to shrink. In addition, the above-mentioned specific features of addictive goods will influence the Laffer curve equation.

It was mentioned earlier that consumers of addictive goods may not react immediately to price (or tax) changes. If for example, changes in the tax rate do not affect current demand (which is likely in case of cigarettes), an unanticipated increase in the tax rate may cause revenues to grow sharply in the current period, while they will be reduced in the next period when consumers finally change their behavior (in this case – reduce demand) after the tax increase. Thus, it is reasonable to include both current and past excise rates as explanatory variables in the Laffer curve equation for the tobacco industry.

In addition to the excise rate, there is a need to include explanatory variables that influence the demand for legal cigarettes. In particular, as was described above, if smuggling is not taken into account, the estimated coefficients are likely to be biased. Hence, in order to estimate "pure" effect of the excise rate on tax revenues, the incentive variable will be included as an additional regressor. This will be included in the same form as in the demand function (see above).

To make the model complete, I will include other factors influencing cigarette demand. These are consumption expenditures and the exchange rate of the hryvnia with respect to the US dollar.

Taking into account previous analysis, it is possible to construct a simple version of the Laffer curve for Ukraine's tobacco industry:

$$Rev\_t_t = b_1 + b_2*Excise_t\text{^}2 + b_3*Excise_{t-1} + b_4*Excise_{t-1}\text{^}2 + b_5*(Excise_t / Rus_{t-4}) + b_6*DY_t + b_7*US_t + b_8*US_{t-1}$$

where Rev_t represent excise tax revenues; Excise – is the excise rate in Ukraine; Rus – is the excise rate in Russia; DY – consumption expenditures by households; and US – the exchange rate of the hryvnia with respect to the US dollar.

According to my earlier analysis and assumptions, b_2 is likely to be positive since consumers will not react immediately and an increase in the tax rate will increase tax revenues in the current period. b_3 and b_4 will have opposite signs since the past excise rate affects demand and, consequently, revenues. These coefficients account for the specific shape of the Laffer curve. b_5 is expected to be negative since an increased incentive to smuggle will reduce legal sales and hence, budget revenues (as described above). b_6 is expected to be positive, since higher consumption expenditures will increase cigarette demand and hence, budget revenues (see above). Finally, the coefficients in front of the US variable can be positive or negative depending on which effect (price change or wealth) dominates.

Producer model

The third sub-model (i.e. producer) is aimed at estimating average profits in the industry. Specifically, my objective is to estimate the average mark-up. Here, I will

use the methodology proposed by Sumner (1981) and described above. Hence, after estimating the price equation, I will be able to determine the mark-up in the industry on the basis of the coefficient of the tax rate variable in the price equation. It is worth mentioning that other methods were developed as well[28] to estimate the mark-up and market power of producers in an industry. However, these methods are also based on estimates of the price equation.

Hence, the key element of this model is the price equation. This equation shows the relationship between the price and factors that determine the price. Usually, the average price is used as a dependent variable. In Ukraine, it is possible to predict that cigarette prices are mainly determined by taxes (and excise tax in particular) and the exchange rate of the hryvnia with respect to the US dollar.

The reason for including the exchange rate was described earlier. Since cigarette production depends on imported raw tobacco, any changes in the exchange rate will affect the price of this key input. This, in turn, will affect the price of the output (i.e. cigarettes).

Another factor that is likely to influence cigarette prices is labor costs. However, no statistics are available on wages in this particular industry, and the average wage in the whole economy is unlikely to represent the true picture. Due to the exclusion of this important variable, there may be a need to control for possible autocorrelation.

Hence, I will estimate the following equation:

$$PRICE_t = c_1 + c_2*(EXCISE/50)_t + c_3*US_t$$

[28] See, for example, Delipalla, Sophia; O'Donnell, Owen (1999).

Where PRICE is the average price per pack of cigarettes; EXCISE/50 – is the excise rate per pack of cigarettes[29]; US – is the exchange rate of the hryvnia with respect to the US dollar.

In this equation, one should expect both c_2 and c_3 to be positive, since a higher tax and a depreciation of the hryvnia (growth in the US variable) represent an increase in the cost of production. Under the higher costs, producers will charge higher prices for their products.

What I am interested in, is the coefficient c_2. As described above, this coefficient is an estimate of the ratio of the price to the marginal cost of production. In order to obtain an estimate of the mark-up in the tobacco industry, I will need to subtract 1 from c_2.

Now, when the three theoretic models are derived, I can turn to the empirical part of my research.

[29] Prices are given for a pack of cigarettes, while the excise tax is calculated per 1000 sticks. Dividing the excise rate by 50 (since 1000 sticks is equivalent to 50 packs) will give me the excise rate per one pack of cigarettes.

Chapter 4

EMPIRICAL RESULTS

Data Description

While estimating the three sub-models (i.e. consumer, government, and producer), I used monthly data for the period from January 1997 to December 2000 for a total of 48 observations. This period was chosen because up to 1997, the tobacco industry had been well regulated and tobacco producers started to exhibit "market behavior" thereafter. Prior to this, producers had been increasing production and developing their capacities, and hence, any conclusions based on the 1991-1996 period are likely to be unreliable. Moreover, starting approximately in 1996-1997, reliable statistical data are available.

For a detailed description of data sources and transformations see Appendix D.

Model Estimation Results

Consumer model

Using the previously derived theoretic model, I will determine the relationship between the excise rate and domestic sales and obtain an estimate of the corresponding elasticity. The estimation output produced by the EViews software and the exact model specification are given in Appendix A. As can be seen, all coefficients are significant at 10% level of significance. Also note that all coefficients have correct (expected) signs.

A number of model specifications was tried[30] and the best one is given in the Appendix. Quadratic variables were used where appropriate to account for possible non-linearity.

As was predicted, Ukrainian smokers do not react immediately to excise (and price) changes. Instead the lagged variable is used. This means that an increase in the excise rate will not cause an immediate decline in the demand. Instead, consumers will react in the following period. The elasticity of demand with respect to the excise rate was found to be –0.37. Note that this figure represents the "pure" effect of the excise rate on consumption since the problem of smuggling was taken into account using a separate regressor.

As was argued by tobacco producers, changes in the excise rate in Russia affect Ukrainian market after a certain period of time. It was estimated that the lag equals 4 months. As can be seen, the elasticity of legal sales in Ukraine with respect to the incentive variable equals -0.12. This means that 1% increase in the incentive variable leads to 0.12% decrease in legal sales of tobacco products in Ukraine (because these consumers switched to illegal products).

My estimates supported the idea of the myopic behavior of Ukrainian smokers. The coefficient of lagged domestic sales is positive and significant. This implies that higher consumption in the past will tend to increase current consumption due to the existence of habit or addiction.

As I suspected, at the current values, the net effect of the exchange rate is positive. This implies that the wealth effect described above dominates the effect of the higher cigarette price. When the hryvnia depreciates, consumers increase their demand probably due to their increased wealth.

[30] For other possible specifications see Appendix E.

Real consumption expenditures (a measure of the household income) have a net positive effect on consumption as it was predicted by the theory[31].

Government model

Here, the Laffer curve for the tobacco industry was estimated. For the estimation output and exact specification of this model see Appendix B. As can be seen, all coefficients are statistically significant at 5% level of significance.

The signs of the coefficients correspond to those predicted earlier in this paper. Since the demand estimations showed that consumers do not react immediately to changes in the market, excise revenues increase in the period when the excise rate is raised. However, in the following period, consumers adjust their behavior and domestic sales fall. A closer look at the equation shows that the estimated Laffer curve has a regular shape predicted by the theory with one global maximum corresponding to the revenue-maximizing excise rate.

As was predicted, the incentive variable negatively affects budget revenues. When smugglers have more incentives to smuggle, the market for illegal products expands and hence, domestic sales fall. This in turn implies lower budget revenues. This feature was first observed while estimating the demand function.

Other included variables (i.e. real consumption expenditures and hryvnia/US dollar exchange rate) have expected signs as well. This again was observed for the first time while estimating the demand function. Note also that as in the demand function, the overall effect of the exchange rate is positive (at present values).

[31] However, note that the income elasticity of the demand in Ukrainian cigarette market is higher than in more developed countries (see Reinhardt, F., Giles, D. (1999)) where it was estimated to be around 0.2. Hence, my estimates support the hypothesis that consumers in low-income countries are more sensitive to changes in their incomes.

This again supports the idea that wealth effect dominates the effect of higher cigarette prices.

Producer model

The estimated producer model is given in Appendix C. As can be seen, all coefficients are statistically significant even at 1% level of significance. Moreover, the coefficients have expected (predicted) signs.

My estimates showed that the coefficient of the tax rate variable equals approximately +1.54. This implies that the average mark-up in the Ukrainian tobacco industry is about 54%. Using the formula given in Sumner (1981) ($\theta_j = \eta_j / (\eta_j + 1)$), I can calculate the average firm-level price elasticity of demand. For the Ukrainian tobacco industry this is equal to approximately –2.85. These two estimates clearly show that Ukrainian cigarette producers on average receive significant profits and have relatively strong market power.

Evaluation of the Current Ukrainian Excise Policy and Policy Implications

Now, I will turn to analyzing the current excise policy in Ukraine. Based on my estimates, it is possible to draw several conclusions about the effectiveness of such policy, and provide some recommendations on its improvement.

The Laffer curve estimated above makes it possible to calculate whether the government maximizes its revenues. In case the current excise policy is not optimal and the government should change the excise rate, the demand function will show the effect of such changes on the consumption of cigarettes. Finally, having the prediction of the producer profits on the basis of the producer model aimed at estimating the mark-up in the industry, will allow me to forecast the effect of such policy changes on cigarette producers.

Straightforward calculations show that excise taxation in Ukraine is sub-optimal. In my simulation, I took all values (except for the excise rate) as of December 2000. Substituting these values into the estimated Laffer curve and leaving only one independent variable (i.e. the excise rate) produces the following picture. The revenue-maximizing excise rate equals approximately 9.5 constant 1995 hryvnia per 1000 stick[32]. At the same time, the excise rate as of December 2000, equaled approximately 3.6 constant hryvnia per 1000 stick. Hence, the actual excise rate was 2.6 times lower than the revenue-maximizing rate. Consequently, if the government increases the excise rate to the theoretically predicted revenue-maximizing value, budget revenue will grow by 6.3 million constant 1995 hryvnia per month.

Performing the necessary calculations using the demand function allows me to obtain some additional results. If the excise rate is increased up to 9.5 hryvnia, consumption of cigarettes will drop by approximately 59%. At the same time, consumption of illegal cigarettes will rise by about 19.8%.

Of course, such results should be interpreted with care. Such a huge drop in consumption (59%) may seem unrealistic. However, the estimated elasticity of the demand with respect to the excise rate is in line with estimates for other countries[33]. However, we are nevertheless unlikely to observe such changes in consumption since:

- Such a huge jump in the excise rate will definitely change the coefficients in my estimated equations. Given such a jump, one will need to re-estimate all equations and the new results may turn to be completely different (consumers

[32] In other words, all monetary variables in my model are inflation-adjusted (i.e., expressed in real terms).

[33] See Chaloupka, F., et al (2000).

are likely to change their behavior). It is impossible to obtain reliable estimates, if you deal with such dramatic changes in any variable.

- After such a huge increase in the excise rate, I can predict that consumers will adjust their behavior slower (it is unlikely that 59% of addicted consumers will quickly quit smoking). Hence, the lag will not equal one. Meanwhile, the following factors will tend to increase cigarette demand thus counteracting the excise increase: a gradual increase in the overall level of household income, depreciation of the hryvnia, and inflation (as CPI increases, the variables expressed in constant terms (e.g., excise rate) will fall).

- It is possible that some consumers will switch to self-made cigarettes.

Despite the indicated limitations, some conclusions can be drawn from my research:

1) It is in government's interests to increase the excise rate in the tobacco industry. This will definitely increase state budget revenues.

2) Besides increasing tax proceeds, such policy will reduce cigarette consumption in Ukraine, which will help implement the state health care policy. An increase in the excise rate (and hence, in the price) will reduce smoking among the most price-sensitive groups of consumers. These are, first of all, young people[34].

3) The observed trend of increasing household income will promote cigarette consumption. However, given the specification of the Laffer curve, the optimal excise rate will not change due to growing incomes. At any excise rate households will simply smoke more, which will ensure higher tax

[34] See Grossman, M., et al (1998).

proceeds. If the major goal is maximizing budget revenues, there is no need to change the optimal excise rate due to growing household incomes.

4) There is an urgent need to implement administrative measures to counteract smuggling. In terms of my model, successful anti-smuggling policy will result in the reduced coefficient in front of the incentive variable. For example, increased protection of the state border will make it difficult for smugglers to bring illegal products to Ukraine. Hence, at each value of the incentive variable, there will be less illegal products in the Ukrainian market. As a result of the anti-smuggling policy, state budget revenues will grow, while less criminal activity will take place.

5) On average, cigarette producers receive significant profits. Hence, I can predict that even under the higher excise rate (which will reduce producers' sales) producers will be able to extract some profits and still remain in the market.

Chapter 5

CONCLUSIONS

In this paper, I developed a theoretic model of efficient excise taxation of cigarettes in Ukraine. Efficiency was considered from the government's viewpoint. In my model, the government is aiming at maximizing its revenues, while also trying to reduce consumption of such a harmful good as cigarettes. In addition, Ukraine's cigarette market is subject to extensive smuggling, which results in the necessity to control for this important factor while conducting any estimates.

The general model was split into three sub-models: government model aiming at determining the relationship between the excise rate and budget revenues; consumer model aiming at determining the effect of excise taxation on cigarette consumption; and producer model aiming at estimating average profits in the industry.

The government model showed that the current excise rate is far below the revenue-maximizing rate (Ukraine is on the upward-sloping portion of the Laffer curve). Hence, budget revenues can be significantly increased if the excise rate is increased.

From the consumer model, I can conclude that increased excise rate will indeed reduce cigarette consumption (which is the goal of the state health care policy), while also increasing the amount of illegal products consumed. At the same time, higher household income tends to increase demand for consumer goods and cigarettes in particular. My model also supports the hypothesis of consumers'

"myopic behavior", which means that consumers exhibit addictive behavior, while not caring about future effects of their present consumption decisions.

Finally, the producer model showed that the average mark-up in the tobacco industry is significant. Hence, the claims of cigarette producers that their profits are minimal (and they need lower excise rates) are not justified. This again supports the idea of the necessity to increase the excise rate.

Hence, based on my estimates the following recommendations and conclusions can be made:

1) It is in government's interests to increase the excise rate in the tobacco industry. This will increase state budget revenues.

2) Besides increasing tax proceeds, such policy will reduce cigarette consumption in Ukraine, which will help implement the state health care policy.

3) There is an urgent need to implement administrative measures to counteract smuggling. As a result of the successful anti-smuggling policy, state budget revenues will grow, while less criminal activity will take place.

4) On average, cigarette producers receive significant profits. Hence, even under the higher excise rate (which will reduce producers' sales) producers will be able to extract some profits and still remain in the industry.

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APPENDIX A. ESTIMATION OUTPUT: DEMAND FOR CIGARETTES IN UKRAINE

Dependent Variable: LOG(DOM_SALES)
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.117110	1.632081	1.297184	0.2028
LOG(EXCISE(-1))	-0.374864	0.199871	-1.875528	0.0688
LOG(DOM_SALES(-2))	0.178263	0.097099	1.835882	0.0746
LOG(US(-1))	3.120598	1.056833	2.952783	0.0055
LOG(US(-1))^2	-1.298763	0.422626	-3.073080	0.0040
LOG(DY)	0.937096	0.180657	5.187166	0.0000
LOG(DY(-1))	-0.429698	0.188458	-2.280066	0.0286
LOG(EXCISE(-1)/RUS(-4))	-0.121752	0.065262	-1.865599	0.0703

R-squared	0.739327	Mean dependent var	8.468519
Adjusted R-squared	0.688640	S.D. dependent var	0.174947
S.E. of regression	0.097620	Akaike info criterion	-1.652503
Sum squared resid	0.343068	Schwarz criterion	-1.328105
Durbin-Watson stat	2.204812	F-statistic	14.58626
		Prob(F-statistic)	0.000000

Variables:

DOM_SALES – domestic sales of legal cigarettes in Ukraine
EXCISE – real excise rate per 1000 cigarettes in Ukraine
RUS - real excise rate per 1000 cigarettes in Russia
US – exchange rate of the hryvnia with respect to the US dollar
DY – real consumption expenditures in Ukraine

APPENDIX B. ESTIMATION OUTPUT: LAFFER CURVE FOR UKRAINE'S TOBACCO INDUSTRY

Dependent Variable: REV_T
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-39973.69	11799.02	-3.387881	0.0017
EXCISE	4413.206	913.3285	4.832003	0.0000
EXCISE(-1)^2	-195.7598	88.91744	-2.201590	0.0340
EXCISE(-1)/RUS(-4)	-1048.341	310.4264	-3.377100	0.0017
DY	6.344860	1.814644	3.496477	0.0012
US(-1)	23538.11	8999.621	2.615455	0.0128
US(-1)^2	-3114.914	1164.290	-2.675378	0.0111

R-squared	0.923689	Mean dependent var	19718.40
Adjusted R-squared	0.911314	S.D. dependent var	6644.781
S.E. of regression	1978.828	Akaike info criterion	18.16331
Sum squared resid	1.45E+08	Schwarz criterion	18.44716
Durbin-Watson stat	2.182865	F-statistic	74.64287
		Prob(F-statistic)	0.000000

Variables:

REV_T – real excise-tax revenue (thousand hryvnia)
EXCISE – real excise rate per 1000 cigarettes in Ukraine
RUS - real excise rate per 1000 cigarettes in Russia
US – exchange rate of the hryvnia with respect to the US dollar
DY – real consumption expenditures in Ukraine

APPENDIX C. ESTIMATION OUTPUT: PRICE EQUATION

Dependent Variable: PRICE
Method: Least Squares

Sample(adjusted): 1997:02 2000:12
Included observations: 47 after adjusting endpoints
Convergence achieved after 17 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.148651	0.023701	6.271966	0.0000
EXCISE/50	1.537088	0.158430	9.702028	0.0000
US	0.037705	0.005650	6.673427	0.0000
AR(1)	0.829983	0.092921	8.932093	0.0000

R-squared	0.988239	Mean dependent var	0.395679
Adjusted R-squared	0.987419	S.D. dependent var	0.092641
S.E. of regression	0.010391	Akaike info criterion	-6.214433
Sum squared resid	0.004643	Schwarz criterion	-6.056974
Durbin-Watson stat	2.090674	F-statistic	1204.397
		Prob(F-statistic)	0.000000

Inverted AR Roots	.83

Variables:

PRICE – weighted average price of one pack of cigarettes in Ukraine
EXCISE/50 – real excise rate per one pack of cigarettes in Ukraine
US – exchange rate of the hryvnia with respect to the US dollar

APPENDIX D. DATA DESCRIPTION AND SOURCES

DOM_SALES

- domestic sales of legal cigarettes in Ukraine (million sticks). This was calculated as domestic production + imports – exports. Data on production and exports was obtained from the Ukrtutun Association (Business association of Ukrainian tobacco producers). Data on imports was obtained from the State customs service of Ukraine and State statistics committee.

DY

- real consumption expenditures of households (million hryvnia). This was calculated as nominal consumption expenditures/CPI. Data on nominal consumption expenditures was obtained from the State statistics committee. CPI is estimated by ICPS.

EXCISE

- real excise rate for cigarettes in Ukraine (hryvnia per thousand sticks). This was calculated in the following way: for 1997-1999 – excise rate in EUROs * hryvnia/EURO exchange rate / CPI; for 2000 – excise rate in hryvnias / CPI. Excise rates were taken from the law of Ukraine "On excises" and subsequent amendments to the law. Hryvnia/EURO exchange rate was obtained from the NBU official Internet site.

PRICE

- real weighted average price of cigarettes (hryvnias per pack). Nominal prices for different types of cigarettes were obtained from the State Statistics Committee of Ukraine. Average nominal prices were calculated as average prices where market shares of different types of cigarettes were used as weights. Finally, dividing average nominal prices by CPI yields real average prices.

REV_T

- real excise tax revenues (thousand hryvnias). This was calculated as (domestic production + imports) * EXCISE (as defined above).

RUS

- real excise rate for cigarettes in Russia (hryvnia per thousand sticks). This was calculated as average excise rate in Russia * hryvnia/ruble exchange rate / CPI in Ukraine. Since in Russia, different excise rates are used for different types of cigarettes, their average was calculated. Data on Russian excise rates was taken from the law of Russian Federation "On excises" and subsequent

amendments to the law. Hryvnia/ruble exchange rate was obtained from the NBU official Internet site.

US

- exchange rate of the hryvnia with respect to the US dollar. The exchange rate was obtained from the NBU official Internet site (www.bank.gov.ua. Last accessed 15.04.2001).

APPENDIX E. ALTERNATIVE ESTIMATES OF THE DEMAND FUNCTION[35]

1)
Dependent Variable: LOG(DOM_SALES)
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.053937	1.735219	1.183676	0.2445
LOG(EXCISE(-1))^2	-0.023353	0.192913	-0.121053	0.9043
LOG(EXCISE(-1))	-0.308830	0.581933	-0.530696	0.5990
LOG(DOM_SALES(-2))	0.177192	0.098853	1.792472	0.0817
LOG(US(-1))	3.085609	1.109896	2.780090	0.0087
LOG(US(-1))^2	-1.287463	0.438581	-2.935517	0.0058
LOG(DY)	0.936207	0.183328	5.106731	0.0000
LOG(DY(-1))	-0.422043	0.201282	-2.096770	0.0433
LOG(EXCISE(-1)/RUS(-4))	-0.120032	0.067681	-1.773488	0.0848

R-squared	0.739436	Mean dependent var	8.468519
Adjusted R-squared	0.679878	S.D. dependent var	0.174947
S.E. of regression	0.098984	Akaike info criterion	-1.607467
Sum squared resid	0.342924	Schwarz criterion	-1.242519
Durbin-Watson stat	2.208940	F-statistic	12.41548
		Prob(F-statistic)	0.000000

[35] Based on these estimates, the best model specification was chosen. Also note that the coefficients of the major variables do not change much when the model specification is changed.

2)
Dependent Variable: LOG(DOM_SALES)
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-39.79742	14.45961	-2.752317	0.0092
LOG(EXCISE(-1))	-0.496616	0.175554	-2.828856	0.0076
LOG(RUS(-4))	0.121752	0.065262	1.865599	0.0703
LOG(DOM_SALES(-2))	0.178263	0.097099	1.835882	0.0746
LOG(USD(-1))	15.08265	4.947950	3.048263	0.0043
LOG(USD(-1))^2	-1.298763	0.422626	-3.073080	0.0040
LOG(DY)	0.937096	0.180657	5.187166	0.0000
LOG(DY(-1))	-0.429698	0.188458	-2.280066	0.0286

R-squared	0.739327	Mean dependent var	8.468519
Adjusted R-squared	0.688640	S.D. dependent var	0.174947
S.E. of regression	0.097620	Akaike info criterion	-1.652503
Sum squared resid	0.343068	Schwarz criterion	-1.328105
Durbin-Watson stat	2.204812	F-statistic	14.58626
		Prob(F-statistic)	0.000000

3)
Dependent Variable: LOG(DOM_SALES)
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.879400	1.686682	1.114258	0.2726
LOG(EXCISE(-1))^2	-0.119322	0.066510	-1.794036	0.0812
LOG(DOM_SALES(-2))	0.170457	0.097052	1.756345	0.0875
LOG(US(-1))	2.776359	0.935143	2.968913	0.0053
LOG(US(-1))^2	-1.175321	0.380465	-3.089166	0.0039
LOG(DY)	0.932434	0.181353	5.141533	0.0000
LOG(DY(-1))	-0.392495	0.191489	-2.049700	0.0477
LOG(EXCISE(-1)/RUS(-4))	-0.119241	0.066987	-1.780078	0.0835

R-squared	0.737339	Mean dependent var	8.468519
Adjusted R-squared	0.686266	S.D. dependent var	0.174947
S.E. of regression	0.097991	Akaike info criterion	-1.644907
Sum squared resid	0.345684	Schwarz criterion	-1.320508
Durbin-Watson stat	2.200548	F-statistic	14.43696
		Prob(F-statistic)	0.000000

4)

Dependent Variable: LOG(DOM_SALES)
Method: Least Squares
Date: 04/13/01 Time: 12:25
Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.770237	1.593303	1.111049	0.2739
LOG(EXCISE(-1))	-0.411920	0.193032	-2.133944	0.0397
LOG(DOM_SALES(-2))	0.176269	0.098450	1.790448	0.0818
LOG(US(-1))	3.055579	1.065045	2.868967	0.0068
LOG(US(-1))^2	-1.287862	0.425233	-3.028603	0.0045
LOG(DY)	0.959208	0.179750	5.336351	0.0000
LOG(DY(-1))	-0.398257	0.189753	-2.098822	0.0429
LOG(EXCISE(-1)/RUS(-4))^2	-0.037534	0.021177	-1.772416	0.0848

R-squared	0.737069	Mean dependent var	8.468519
Adjusted R-squared	0.685943	S.D. dependent var	0.174947
S.E. of regression	0.098042	Akaike info criterion	-1.643879
Sum squared resid	0.346039	Schwarz criterion	-1.319481
Durbin-Watson stat	2.199527	F-statistic	14.41685
		Prob(F-statistic)	0.000000

5)
Dependent Variable: DOM_SALES
Method: Least Squares

Sample(adjusted): 1997:05 2000:12
Included observations: 44 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2123.359	2207.839	-0.961736	0.3428
EXCISE(-1)	-639.6305	923.8927	-0.692321	0.4933
EXCISE(-1)^2	20.87303	91.75867	0.227477	0.8214
DOM_SALES(-2)	0.155169	0.108190	1.434225	0.1604
DY	2.231067	0.509490	4.379017	0.0001
DY(-1)	-0.827859	0.548028	-1.510615	0.1399
US(-1)	4035.936	1829.568	2.205950	0.0340
US(-1)^2	-546.6263	230.0436	-2.376185	0.0231
EXCISE(-1)/RUS(-4)	-175.9944	75.16020	-2.341590	0.0250

R-squared	0.702182	Mean dependent var	4832.224
Adjusted R-squared	0.634110	S.D. dependent var	815.6385
S.E. of regression	493.3703	Akaike info criterion	15.42065
Sum squared resid	8519500.	Schwarz criterion	15.78559
Durbin-Watson stat	2.151330	F-statistic	10.31520
		Prob(F-statistic)	0.000000