TAX POLICY IMPACT ON CONSUMPTION OF TOBACCO PRODUCTS IN CROATIA

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Abstract

This paper analyses the influence of excises increase and various non-price related measures on tobacco consumption. Therefore various regression models with different dependent and independent variables will be built, with the purpose of showing both their individual and cumulative impact. In all the models the price is definitely the most significant variable, but there are differences in price influence on consumption, depending on which series of cigarettes it relates to. That is logical because of the large difference in excises on different series of cigarettes. From other countries' experience and the results of regression models used in this paper the most important conclusion is that the impact of excise duty is significant, however for building more representative models detailed data over a longer period of time is needed. Unfortunately in Croatia such data are not collected systematically.

Key words: excises, price, tobacco, regression model, consumption, cigarettes, Croatia

1 Introduction

Cigarettes and other tobacco products are taxed in almost every country in the world. Even countries which are not inclined to government intervention in the market tax tobacco products as an easy source of revenue, which causes relatively small disturbances on the market.

Interest in regulation of consumption of tobacco products has grown suddenly over the past two decades, and has occupied the attention of many politicians. Although at

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first sight it seems that these regulations relate to an attempt to reduce consumption, the reasons are varied. Whilst some regulations relating to limitation of use, health warnings and limited advertising, try to reduce consumption directly, laws related to increased excise duty have two opposing effects. One is the fiscal effect of increased revenues to the state budget, and the other is the effect of reducing consumption by increasing the price. Precisely this second effect is debatable. That is to say, the increase in price of a product should, by the laws of economics, reduce consumption of that product. However the effect will not be sufficiently large if there is no close substitute, which is the case with tobacco products. The fact should also not be overlooked that tobacco products cause addiction, which further reduces the possibility of rapid adjustment through new, higher prices.

Several studies (WHO, 2003; Goel and Nelson 2008, Budak, Goel and Nelson 2006) have assessed the effect of various political measures on tobacco consumption. The results vary within and across categories depending on the postulates and population they relate to. Despite this, various measures probably have a synergic effect and they all rely on the fact that a comprehensive approach, which includes price and non-price measures, is most effective in reducing tobacco consumption. As in the world, in Croatia policies are based on both forms of measures. Despite laws relating to price measures, their effect in Croatia is small because those laws are not applied consistently, and often laws that are adopted are changed, in that stricter laws are repealed and milder ones are adopted. There are many reasons for this. Perhaps the best example is the law on the limitation of the use of tobacco products adopted on 22 October 2008, with an adjustment period of six months from the date it came into force (OG 125/08). The law was, that is to say, amended in under six months after the end of the adjustment period. For these reasons this study will pay more attention to price measures founded on an increase in excise duty.

Various regression models will be calculated and conclusions will differ due to the insufficient quality of data or the lack of data for a sufficiently long time period, but it will all confirm the hypothesis that an increase in excise and the consequent increase in price will reduce consumption.

In the second part of the text, policies to control tobacco consumption in Croatia will be presented, in the third there is a regression analysis of the effect of price and non-price measures on consumption of tobacco products in Croatia, and in the end there is a conclusion.

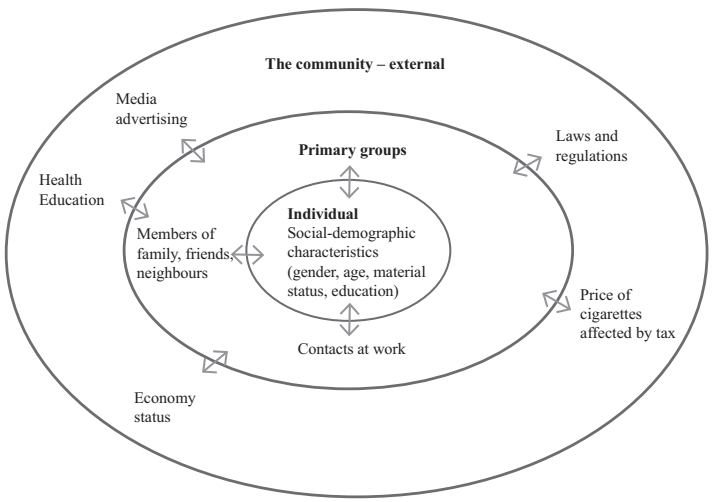
2 Policies to control tobacco in Croatia

In the last decades of the twentieth century, tobacco was regulated in Croatia by four laws: the Tobacco Act (NN 69/99), the Act on the Special Tax on Tobacco Products (NN 51/94, 56/95, 67/99, 136/02), the Occupational Health and Safety Act (NN 59/96) and the Act on Health Quality and Health Inspection of Food and Items for General Consumption (NN, 60/92, 1/96). Whilst the first two laws related mainly to growing and taxing tobacco and tobacco products, the second two laws contained elements to protect the population from the harmful effects of tobacco smoke. The Occupational Health and Safety Act prohibits smoking at work. However, companies and organizations have the right to

establish through internal acts in which rooms smoking is permitted, taking into account the right of non-smokers not to be exposed to tobacco smoke from their environment, as well as the danger of smoking in certain work processes (danger of fire etc). The Act on Health Quality and Health Inspection of Food and Items for General Consumption prohibits direct advertising of tobacco and tobacco products and regulated the quantity of tax and nicotine in cigarettes. From the end of 1999 the use of tobacco products has been primarily regulated by the Act on the Limitation of Use of Tobacco Products (NN 128/99, 137/04, 125/08). These acts primarily give weight to passive smoking which had not been regulated before.

The tobacco industry found loop holes in these acts and ways to avoid the legal provisions, and they advertised tobacco indirectly in various media (television, radio, advertising hoardings, newspapers and magazines). Under pressure from smokers, companies very often permitted smoking in most of the working area by their internal acts. On the other hand, all that time, excise duty was rising. However, to reduce smoking to a minimum, politicians need to take all factors into account in creating their policies. On Graph 1, there is a visual presentation of the primary and external factors which affect individuals in making decisions on smoking.

Graph 1 External effects of individual consumption of tobacco



Souce: Helakorpi et al. (2008)

According to WHO (2003), the basic recommendations to politicians are that programs to control tobacco should be comprehensive in order to minimize tobacco consumption and should include:

- constant price rises, in line with inflation
- comprehensive prohibition of advertising of tobacco products
- firm restrictions on smoking at work and in public places
- education and anti-smoking advertising campaigns
- improved labelling with warnings on products
- increased access to therapy related to giving up smoking

For tax policies to achieve the effect of reducing consumption, attention should be paid to the following:

- the special tax should be increased so much that the price of tobacco products is raised above the average rate of inflation and increase in income, in order to ensure a constant reduction in the ability of people to afford tobacco products;
- prohibition of all customs and tax free sales of tobacco products;
- redirecting a significant amount of government revenues, including those from tax on tobacco, into financing tobacco control programs;
- alignment of taxes and prices of all tobacco products to prevent exchange of one tobacco product for another

Excise duty has been imposed on tobacco products in Croatia since 1994 and so far the most frequent changes have been increases in the rate. Up to 1999 the level of excise duty differed in terms of the following groups of cigarettes: foreign, licensed, foreign in free zones, domestic hard packet, domestic soft packet. From 1999 cigarettes have been categorized into three series: A – popular series, B – standard and C – extra. The tax payers are the producers and importers of tobacco products, although most often the tax is paid completely by the end user[1]. Graphs 2 and 3 demonstrate this, showing how prices mainly move in the same direction as excise duty. Graph 2 shows the movements of series A cigarette prices in kunas and excise in the period from 1995 to 2007.

Graph 2 Price changes (left axis) and excise duty (right axis) for series A cigarettes, 1995-2007, in kunas

Source: author's calculation

[1] Data on how much excise duty the tax payer imposed on the retail price are not publicly available.

Graph 3 shows the movements of the relative amount of the retail prices of cigarettes and the mean value of excise in kunas for the period from 1995 to 2007.[2]

Graph 3 Movements of retail prices of cigarettes (left axis) and mean value of excise duty (right axis) 1995-2007, in kunas

Source: author's calculation

As a visual presentation of the effect of price measures (increase in tax) and non-price measures (laws) we will use Graph 4. The curve on the graph shows consumption, and the times when certain measures came into force are also drawn in on the graph. The measures are divided into those relating to changes to the level of excise duty on tobacco products or laws on the special tax on tobacco products (for the sake of this paper they will be marked as S.T.) and those relating to laws limiting the use of tobacco products (in this paper they will be indicated by: L.U.). The fact that the level of excise duty changed is not sufficient on its own, but is used in the form of whether there was a change and how large it was, so alongside Graph 4 is Graph 5 which shows the mean value of excise duty in the same period. From the graphs it is clear that the average excise duty is rising constantly, with the proviso that the largest rise clearly took place in the period from 2005 to 2007. On the other hand, consumption was constantly falling in the period from 1998 to 2001, and saw another brief fall in 2003-04.

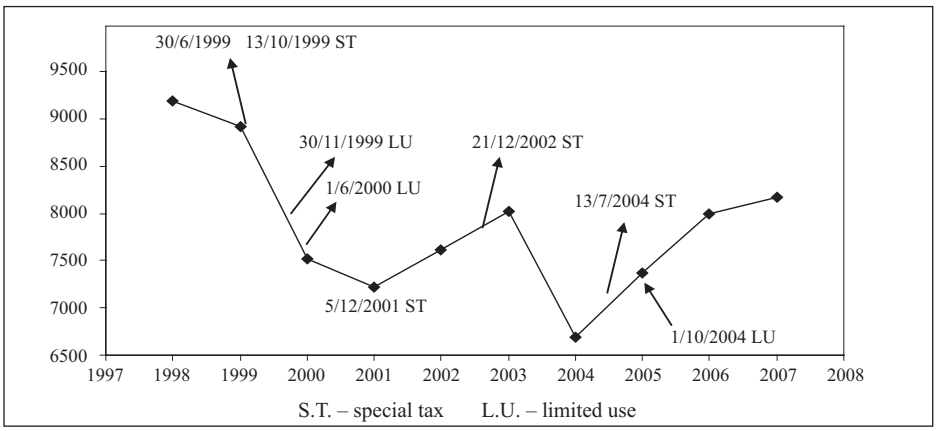
Although excise duty rose significantly in 2005, consumption in the previous period (up to 2005) in comparison with the later period, may be explained by the fact that laws were being passed at that time much more often, both relating to prices and those not relating to price, which affected the consciousness of smokers. The fact should also in no

[2] The CBS using the index reports on prices. The index is calculated from changes in prices in that for the index of the reference year the number 100 is taken (in our case the reference year is 1995) and the indexes of the other years are obtained by adding up the percentage changes to prices in that year in relation to the reference year with the value of the index in the reference year (which is 100).

way be overlooked that smoking has become increasingly less acceptable in society, especially in foreign countries.

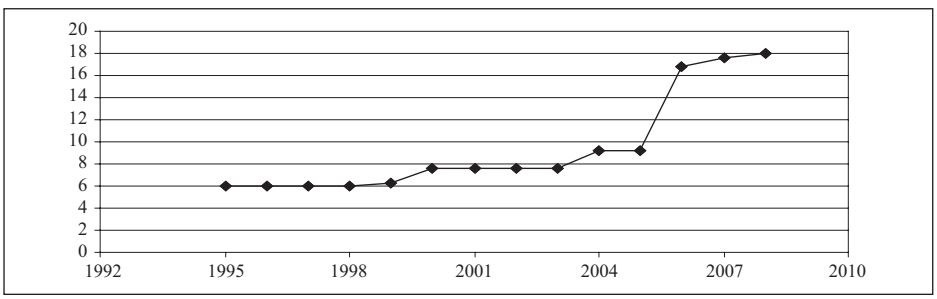
Several foreign studies have monitored the consumption of tobacco products and determined various influences on consumption. One of the most precise, in the sense of the representativeness of the models and conclusions, was conducted in California. That is to say, as a result of comprehensive policies to control tobacco, in the period from 1990 to 2006 a visible fall was recorded in consumption of tobacco products in California. Gilpin, Messere, White and Pierce (2006) studied how far the reduction in tobacco consumption per head of population related to a reduction in the number of people who started smoking, the number of people who stopped smoking and the number of people who cut down on their smoking. The data were divided into two time periods (1990-96 and 1996-2002).

Graph 4 Changes to consumption of tobacco products 1997-2007 in tons



Source: author's calculation

Graph 5 Changes to mean values of excise duty 1994-2007, in kunas



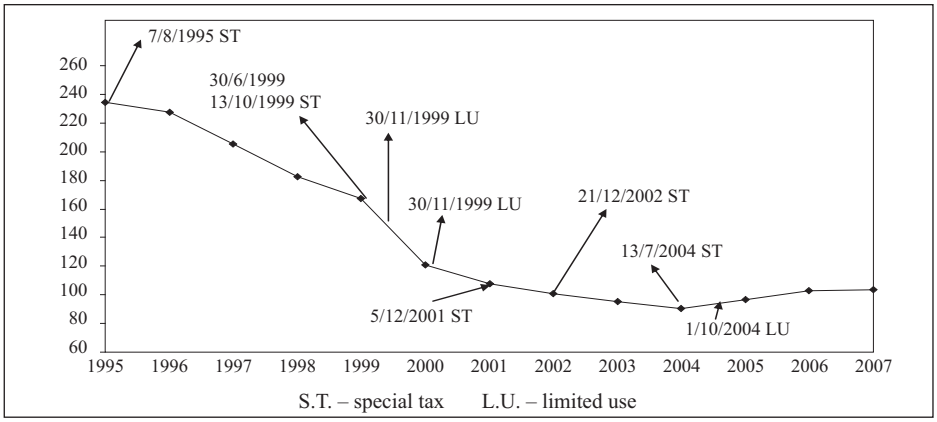
Source: author's calculation

In the first period the conclusion was that most of the fall was the result of a reduction in smoking by existing smokers and then a fall in the number of new smokers. In the second period, of the total reduction 22% consisted of those who had stopped smoking. The conclusion was that a campaign against smoking has the most significant effect over a longer period.

This occurs because smokers are able to maintain the necessary level of nicotine by smoking fewer cigarettes than usual. When they adjust to that lower level they become less addicted and the decision to stop smoking is easier.

Although the increase in excise does not have to be reflected completely on the end user, that is tax payers may bear some of the burden themselves, in the same way an increase in excise may be a good excuse for producers and importers to raise the price of cigarettes by more than the amount of the excise duty. Research into a 36% price rise of cigarettes in 1983 in the USA showed that, in terms of quantity, the main component of the increase was not the increase in excise but a major increase in the wholesale price by the major producers (Harris, 1987). It was similar in Croatia in 2007 when the price of cigarettes rose even though at that point there was no increase in excise duty. The effect of the increase in excise and the introduction of a law limiting the consumption of cigarettes is best seen in the example of consumption of the popular series A cigarettes[3]. That is to say, the lowest excise duties are imposed on that group, and their price is clearly the lowest. It is thought that the great majority of those who smoke these cigarettes are people with lower purchasing power. It is assumed that these individuals react more quickly and more strongly than others to a price rise. Graph 6 shows this best, especially in comparison with Graph 4.

Graph 6 Consumption of series A cigarettes 1995-2007 (in millions of boxes)



Source: author's calculation

[3] Regarding the series, the only available data for a longer period of time were for consumption in millions of packets for series A although it would be best to be able to present these results for all the series.

3 Regression analysis of the effect of price and non-price measures on consumption of tobacco products in Croatia

3.1 Methodology and sources used in calculating models

The methods by which an attempt will be made to establish the effect of policies to control tobacco for consumption are simply linear regression and multiple linear regression. Using linear regression, by the smallest square method, the best possible linear function of consumption is found (regression line). Table 1 shows the parameters obtained from the regression line.

Table 1 Results obtained by regression analysis

Regression line:	$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + ... + \hat{\beta}_n X_n$
Free coefficient – expected value of dependent variables when independent variables are equal to zero	$\hat{\beta}_0$
Coefficient with dependent variables – show absolute average change of dependent variables when independent variables grow by one unit	$\hat{\beta}_1, ..., \hat{\beta}_n$

Table 2 Indicators of success of the regression model

Determinant coefficient ($0 \leq R^2 \leq 1$; $R^2 = 0$, adjustment of weakest; $R^2 = 1$, adjustment of best)	R^2
Adjusted determinant coefficient (when there are several independent variables)	$\overline{R^2}$
Standard regression error	$\hat{\sigma}_{\hat{Y}}$
Length of time line (number of observations)	n
Total sum of square errors	SST
Regression sum of square errors	SSR
Sum of squares of random error	SSE
T- test for each parameter $\hat{\beta}_i$; Null hypothesis: $\hat{\beta}_j = 0$	Value T(n-(k+1)) statistics and p value. n- number of observations k- number independent variables
F- test with null hypothesis that each of $\hat{\beta}_i$ equals zero (in the case of several independent variables)	Value F statistics and p value

In order to obtain the regression model of excise and consumption or prices and consumption, the greatest problem is that consumption of tobacco products has only been monitored systematically since 2006 and data are available through the statistical reports of the CBS, *Production and visible domestic consumption of selected, most important products of PRODOCOM according to value sold of industrial production*. In order to be able to take a longer period of time, consumption was calculated from statistical reports of sales,

imports and exports for which comparable reports existed for the period from 1998-2007. Although this is not the best possible way of calculation, since it excludes the factors of illegal imports of cigarettes and also assumes that all cigarettes imported in a given year were also sold, probably that difference evens out through the years. For the independent variable of price the retail price index is used for cigarettes, calculated in comparison with 1994. For the independent variable of excise duty, the mean value of excise duty was taken for the series. Since the amount of excise varies depending on the series of cigarettes in question, it is clear that for many reasons it would be more realistic to develop a regression model according to the series of cigarettes. From the Rovinj tobacco factory (TDR) data was provided on consumption and price of series A and series B cigarettes (TDR 2008, 2008a). Unfortunately the data related to different time periods, but they were still used for some regression models, to show how far those models are representative.

Table 3 shows the following models with their dependent variables:

- M 2 dependent variables – consumption of series B cigarettes in million packets
- M 2.1 independent variable – price of series B cigarettes
- M 3 dependent variable - consumption of cigarettes in tons
- M 3.1 independent variable – retail price index
- M 3.1.1 independent variables – retail price index and laws
- M 3.2 independent variable – mean value of excise duty
- M 4 consumption of cigarettes in thousands of units
- M 4.1 independent variable – retail price index
- M 4.1.1 independent variables – retail price index and laws

3.2 Results of regression analysis

Tables 3 and 4 show the regression models calculated with different dependent variables (they are described below the title of the model), independent variables (written in the first column), and different lengths of time (n). The variables which relate to price policies are prices and excise duty, and the variables which related to non-price policies are "laws" which are given as dummy variables[4]. Below the sign of the model the regression line is given. In the line "constant" and in the lines of independent variables (price, excise and laws) the coefficients are given beside the variables, and beside them in brackets the P values are give of the T-statistics[5] . Table 3 shows the regression models which as dependent variables are taken by consumption of series A cigarettes (MODEL 1).

M 1.1 takes excise as a dependent variable, and it only differs from M 1.2 in the size of the series of data, that is M 1.2. is given to show that a series that is not much smaller gives much worse results. M 1.1.1. also takes laws as dependent variables. M 1.3. takes prices as a dependent variable, and M 1.3, takes prices and laws. Logarithmic models are used to show price and tax elasticity.

[4] The variable "laws" has a value of 1 if in a given year a law was passed relating to limitation of the use of tobacco products.

[5] p values of T-statistics for a certain coefficient show the level of probability at which we accept the hypothesis that the coefficient is equal to zero, that is that a certain independent variable does not cause a change in a dependent one.

Table 3 Regression model of consumption of Series A cigarettes, 1998-2008

Model (dependent variable)	**M1.1. (consumption of million packets A)**	**LOG M1.1.**	**M1.1.1.**	**LOG M1.1.1.**	**M1.2.**	**M1.3.**	**LOG M1.3.**	**M1.3.1.**	**LOG M1.3.1.**
Independent variable	$y = -14.36x + 212.2$	$y = -0.1x + 5.36$	$y = -15.39x_1 - 32x_2 + 232$	$y = -0.1x_1 - 0.2x_2 + 5.48$	$y = -0.22x + 103.6$	$y = -44.x + 660$	$y = -0.26x + 8.34$	$y = -42.44x_1 - 15.25x_2 + 661.4$	$y = -0.26x_1 - 0.1x_2 + 8.35$
Constant	212.2 (5.2E-06)	5.359 (4.67E-12)	231.87 (9.57E-06)	5.4825 (6.28E-11)	103.57 (5.87E-05)	660.041 (8.36E-05)	8.343 (1.91E-07)	661.427 (0.0001)	8.351 (5.65E-07)
Price – A						-44.028 (0.0006)	-0.259 (0.0006)	-42.44 (0.0009)	-0.256 (0.001)
Excise – A	-14.359 (0.01)	-0.095 (0.01)	-15.386 (0.006)	-0.102 (0.007)	-0.215 (0.894)				
Laws			-32.031 (0.182)	-0.199 (0.21)				-15.247 (0.423)	-0.08 (0.49)
R^2	0.461	0.46			0.03	0.674	0.673		
$\overline{R^2}$			0.463	0.448				0.634	0.626
$\hat{\sigma}_{\hat{Y}}$	41.614	0.278	39.763	0.268	9.94	32.358	0.216	32.816	0.221
n	13	13	13	13	8	13	13	13	13
SST	35,334	1.57	35,334	1.57	595.34	35,334	1.571	35,334	1.57
SSR	16,285	0.72	19,523	0.85	1.875	23,817	1.056	24,565	1.08
SSE	19,049	0.84	15,811	0.723	593.46	11,517	0.514	10,769	0.489
p value of F statistics			0.017	0.02				0.002	0.003

Source: author's calculation

Table 4 Regression models of consumption of series B cigarettes and total consumption of cigarettes, 1999-2008

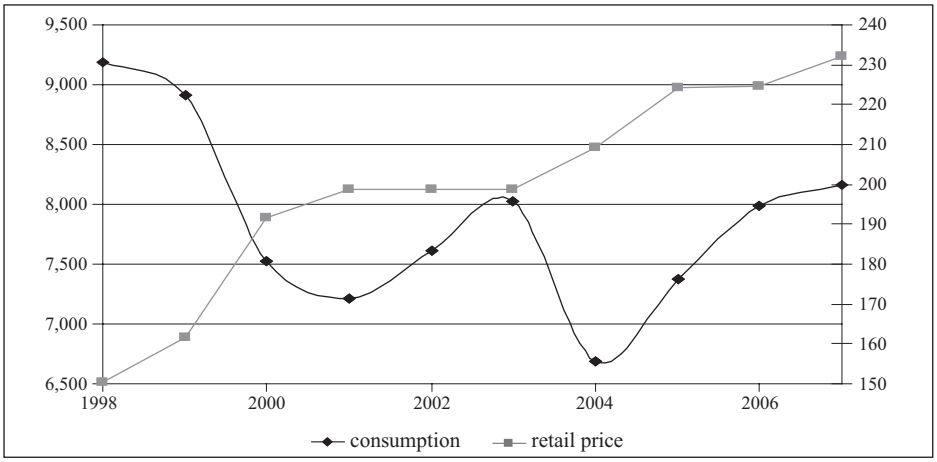
Model (dependent variable)	**M2.1. (consumption of million packets B)**	**M 3.1. (consumption, tons)**	**LOG M 3.1.**	**LOG M3.1.1**	**LOG M 3.2.**	**LOG M 4.1. (consumption, pieces)**	**M 4.1.1.**	**LOG M 4.1.1.**
Independent variable	$y = 4.36x + 174.91$	$y = -17.75x + 11.402$	$y = -0.002x + 9.4$	$y = -0.002x_1 - 0.07x_2 + 9.5$	$y = -0.002x + 8.98$	$y = -0.003x + 16.38$	$y = -25.48x_1 - 1.272.98x_2 + 13.542.220$	$y = -0.003x_1 - 0.17x_2 + 16.53$
Constant	174.909 (0.00065)	11.402 (9.98E-05)	9.392 (6.09E-11)	9.45 (4.33E-10)	8.98 (1.69E-13)	16.384 (5.39E-10)	13.542.220 (0.005)	16.53 (2.36E-09)
Price – B	4.362 (0.1)							
Retail price index		-17.746 (0.05)	-0.002 (0.07)	-0.002 (0.05)		-0.0026 (0.29)	-25.479 (0.164)	-0.003 (0.21)
Mean value of excise duty					-0.0023 (0.83)			
Laws				-0.07 (0.17)			-1.272.984 (0.166)	-0.17 (0.138)
R^2	0.334	0.38	0.35		0.05	0.135		
$\overline{R^2}$				0.368			0.21	0.2
$\hat{\sigma}_{\hat{Y}}$	12.721	633.86	0.08	0.07	0.1	0.187	1.300.812	0.169
n	9	10	10	10	10	10	10	10
SST	1,703	5,200,556	0.08	0.08	0.0825	0.326	1.94E+13	0.326
SSR	570	1,986,328	0.03	0.04	0.0005	0.044	7.52E+12	0.124
SSE	1,132	3,214,228	0.05	0.04	0.08207	0.282	1.18E+13	0.2
p value of F statistics				0.083			0.178	0.185

Source: author's calculation

In all models it was shown that consumption is negatively elastic in relation to price, excise and laws, although very low in terms of absolute values.[6] The largest absolute value was of price elasticity of consumption of series A cigarettes (-0.259) and it will be shown that that model was also the most representative (M 1.3). The determinant coefficient and the adjusted determinant coefficients were greatest in the models M 1 which as a dependent variable took consumption of series A cigarettes in million packets. The determinant coefficient is around 0.6 with the exception of model M 1.2, where it is extremely low at 0.03. As was mentioned before, this model was calculated to show that the result in the regression model with the same variables and values but a smaller series of data is much worse or it may be concluded that the model is not representative at all. This is precisely the reason why the other models, where data were not available for several years, do not show much representativeness.

The most representative model for Series A, model 1.3. shows that if the price of cigarettes increases by one kuna, consumption will fall by 44 million packets. From this logarithmic model the reduction was 25%, which also seems to be in line with the graphs, where it may be seen that consumption fell by 50%, and at the same time the price rose by about 4 kunas.

Graph 7 Movements of consumption (left axis, tons), and retail price index (right axis), 1998-2007



Source: author's calculation

According to the T-test, the most significant variable within model M 1 is the price of cigarettes, although excise duty proved to be very important too. Before Graph 2 shown it is shown that prices and excise duty for series A in principle move in the same directi-

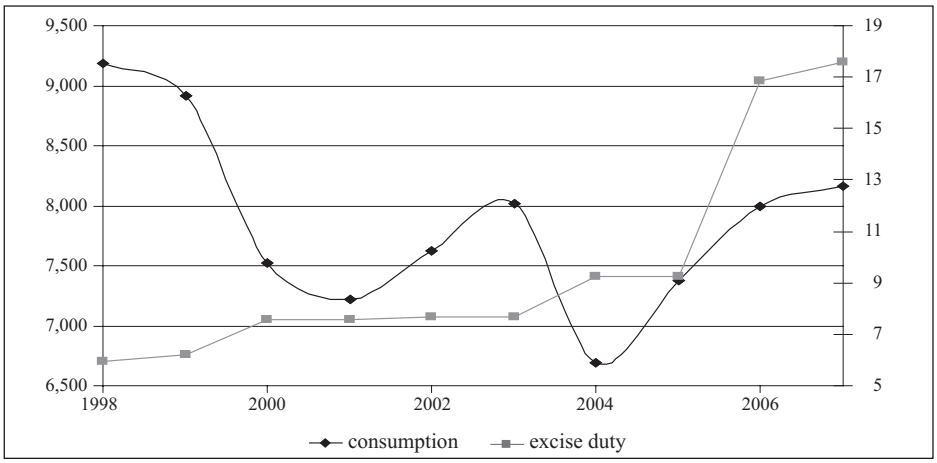
[6] Regression coefficients with independent variables, $\hat{\beta}_1,...,\hat{\beta}_n$, show absolute average change of dependent variables when the independent variable rises by one unit. Also, when we logarithmatize the original series of data they will prove suitable for a more precise calculation of elasticity. More precisely, they will show the average percentage change in dependent variables when the independent variable rises by one unit.

on, with the exception of the period from 2005 to 2007. Naturally the model using price as an independent variable is better, since consumers react to prices and not to excise duty. The variable "laws" proves to be less significant.

Model M 2 proved to be bad. The reason for this may be the small series of data or that this group of cigarettes are consumed most and it is assumed that a certain amount of people, due to growth of purchasing power and a rise in living standards, moved from the popular group of the cheapest cigarettes to consumption of the standard group.

Models M 3 and M 4 proved to be fairly unrepresentative. However, M 3, which takes quantity in tons as a dependent variable, is more representative, and the most significant independent variable was again shown to be the retail price index, and with 93% certainty it may be said that the variable "laws" causes a fall in consumption. More precisely if the retail price index rises by 1, which means that the retail price has risen by 1%, consumption will fall by 0.2%, and if in a certain year a law is passed to limit the use of tobacco products, consumption will be reduced by 7%.

Graph 8 Movements of consumption (left axis, tons) and excise duty (right axis, kunas), 1998-2007



Source: author's calculation

Although the models differ for the real reasons give, still a final visual presentation of the effect of excise duty (through the price) on cigarette consumption is shown in Graphs 7 and 8.

4 Conclusion

The only regression model which was really shown to be representative is the one relating to consumption of series A cigarettes. From the results it is clear that the reason for this is the quality and size of data. Many assumptions were confirmed from it, such as:

the negative and, in terms of absolute value, low price elasticity (for the reasons given before of addiction and lack of close substitutes), the small effect of the variable of laws, seen from the p value of the T statistics (for the reasons given before of the rapid changes in laws and the failure to implement them).

The other regression models are not so representative, since the data from M 1 are on a lower level (more detailed). Since different amounts of excise duty are imposed on various series of cigarettes it would be best to look at consumption by series. According to the collected experience of other countries, one of the important questions is what the reduction in consumption actually consists of. Is it that smokers have reduced the amount they smoke, is it non-smokers who have not even begun to smoke or smokers who have stopped smoking? This kind of data has not been collected in Croatia, and data on consumption of tobacco products have only been collected systematically since 2006, which at this time is too short a time period to create a regression model.

Various reasons for a fall in consumption of cigarettes are given. The regression models confirm the assumption that they do actually cause a fall in consumption since all of them, shown as variables, have a negative sign. Only systematic research, a longer period of time and a lower level of data may give an even better answer about how tax policies really affect cigarette consumption.

LITERATURE

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