Tobacco demand elasticity and fiscal policy – the case of Albania

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Abstract

Albania is one of the countries with highest smoking prevalence in Europe. Despite the seriousness of the smoking phenomena, there has been limited research on the smoking behavior including also determinant factors. Accordingly, motivated by the need to investigate the demand of tobacco in Albania, from which policies can be better tailored, and the scarcity of empirical studies, this paper is based on econometrical analysis of aggregate macro data with focus on demand price elasticity. The empirical analysis conducted on annually aggregate data for the time span 2006-2017 suggests that prices significantly affect tobacco consumption. More precisely, the estimated results suggest that tobacco demand is price inelastic, with demand being relatively more elastic in the long-run than in the short run. Namely, the price elasticity of tobacco ranges from -0.27 to -0.77 in long-run and from -0.007 to -0.107 in the short run. We recommend that the government should further engage in gradual increase of taxation, since empirical evidence confirms that this is an efficient strategy to reduce smoking.

1. Introduction

Whilst the determinants of consumer demand are extensively investigated on empirical ground, the investigation of tobacco products has been only recently investigated on developed countries and at a lesser extent on developing countries. This type of empirical research appears to be scarce in Albania, both at macroeconomic and microeconomic level, which is surprising given the smoking prevalence in Albania (59% in 2005 (WHO, 2015)).

The existing evidence from countries at all economic stages suggest that price increase on tobacco are effective in reducing smoking (Eozenou and Fishburn, 2007). This is considered not only as a tool to reduce or at least impact tobacco consumption but also for fiscal reasons for the government given the increasingly contribution of excises in the budget.

Accordingly, motivated by the need to investigate the demand of tobacco in Albania, from which policies can be better tailored, and the scarcity of empirical

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studies, this research undertakes an econometrical investigation using aggregate macro data in which consumption of cigarettes is regressed on economic determinants of smoking. The methodology adopted in this study is based on a quantitative approach. This approach is used for estimating the price elasticity and income elasticity of tobacco consumption. To estimate the price elasticities, a time-series model with aggregate data by Ross and Al-Sadat (2007) is considered in this paper. The aggregate data used for annual the time-series model cover the time period 2004-2017. The data has been obtained from Albania´s Customs Office, Ministry of Finance, Institute of Statistics and Eurostat.

This paper is structured as follows. After the introductory part, Chapter 2 focuses on the empirical approach followed in this study by analyzing the data and explaining the methodology. Chapter 3 presents the estimation results by interpreting their statistical and economic significance followed by several robustness checks. Finally, Chapter 4 concludes the analysis

2. Error Correction Model Empirical Approach

The basic analytical framework used to estimate the demand for cigarettes is the conventional model in a linear functional form suggested by Ross and Al-Sadat (2007), which regresses the aggregate consumption of cigarettes per adult on a list of demand characteristics including tobacco price, income and a set of policy tobacco control events. The proposed model is as follows:

$$Y_t = \beta_0 + \beta_1 X_{pt} + \beta_1 X_{gt} + \beta_1 X_{tct} + \varepsilon_t \quad (1)$$

Where Y_t denotes the aggregate consumption of cigarettes per

adult; X_{pt} denotes the real tobacco CPI; X_{gt} denotes the real GDP per capita and X_{tct} denotes the tobacco control policy and events. The aggregate consumption of cigarettes was first converted to per adult by using demographic data obtained by the Institute of Statistics (people aged 15 years and above, which is considered as the adult population in this study). Amongst the commonly used explanatory variables in tobacco literature, consumer price index (CPI) is considered a good variable to estimate the price elasticity of tobacco. Accordingly, this study uses *rtobcpi*, measured as the average CPI (Real tobacco CPI = Tobacco CPI/General CPI *100) for tobacco products provided by the Institute of Statistics in annual data. In addition, the price of the most popular cigarette brand in Albania was considered as an alternative measure of price (Albanian Customs Office, 2018). Accordingly, *slims* enters into the model as the real price of Carellia Slims cigarettes (price in Albanian Leks/pack).

Next, to estimate the income elasticity of demand, real income is measured by real GDP per capita in Albanian Leks (*rincome_l*). An alternative measure of income was also considered in this study (*i.e*. GDP per capita in Euro) to observe any potential variation due to the exchange rate (*rincome_e).* Another concern in this paper is how to take into account tobacco control policies which might be considered an important determinant of cigarette consumption. Accordingly, a dummy variable is included: *tlaw2* which takes the value 1 in the year a country

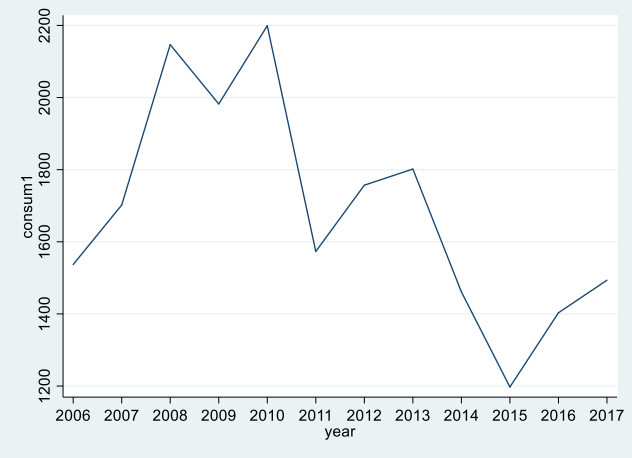
introduced a change in the tobacco legislation or tobacco control event, 0 otherwise.

Lastly, this paper has also considered two additional control variables which might impact the price elasticity of tobacco. First, male to female ratio (*malefemale)* is measured as the share of female population to male population (INSTAT, 2018). Second, gross enrolnment in tertiary education (*educ*) is measured as the ratio of the total enrolnment (regardless of age) to the population of the age group that officially corresponds to the tertiary education (World Bank, 2018).

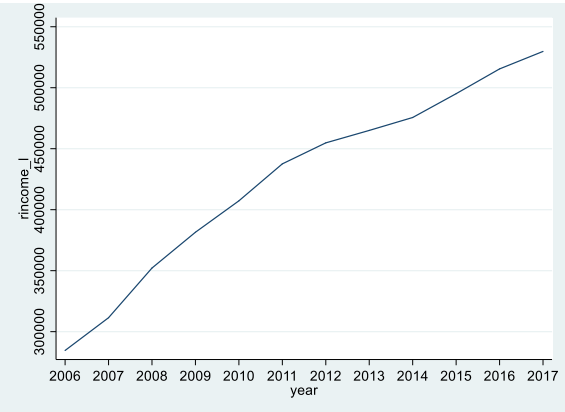
To empirically estimate the price elasticity and income elasticity of demand, this paper estimates several versions the basic analytical framework, by using different estimation methods and control variables, in search for the preferred specifications. Limited by data availability for longer time span, this study used the strategies proposed by Ross and Al-Sadat. (2007). The first strategy encompasses the regression of consumption of cigarettes on prices and income per capita in order to estimate the elasticities without considering an impact of any tobacco control event/policy (Model I). Second, the above model is augmented by tobacco policies event (Model II when using *tlaw2*).[2] However, in addition to the above models, this study considers an innovative approach by augmenting Model I with a male to female ratio, controlling for the male to female smoking prevalence (Model III/1) and tertiary education enrolment (Model III/2) This gives rise to the third strategy (Model III).

In order to avoid the effects of abnormal values in the estimation results, graphical diagnostics are used. A simple line graph suggests the presence of some aberrant values of consumption of cigarette. More precisely, year 2004 and 2005 are considered as outliers due to very different values in these two years in comparison to the trend of the consecutive years. A rationale for this might be the enforcement of institutional framework as the new government took power in 2005 and the change of methodology in measuring imports. According to the Albanian Customs Office, there might have been some measurement errors before the year 2006. Whilst for the 2004 and 2005, the problem of outliers might be easily visually detected (not shown in Figure 1), the data for year 2006 and further seem to be fine.

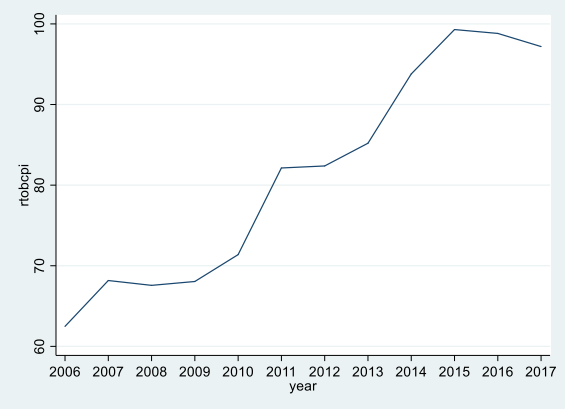
[2] Whilst Ross and Al-Sadat (2007) introduces an additional strategy which involves the use of a tobacco policy index, this paper does not include such index due to limited number of tobacco policies in the country. Usually, these types of indexes are used when a country applies various tobacco policies/events during the same periods of time.



(a)



(b)



(c)

Figure 1. The trend of consumption of cigarettes (panel a), real tobacco CPI (panel b) and real income (panel c), 2006-2017.

In terms of choosing the preferred model, as a first step, we investigated the stationarity of the time-series data in order to avoid the problem of spurious regression. To test for unit root, the Augmented Dickey Fuller test was applied on the dependent variable, control variables and all the alternative variables which was used for robustness check, including the price of the most popular brand of cigarettes, as listed in Table 1.

However, it should be noted that experiments with more lags when performing the Dickey-Fuller test yield inconclusive results regarding the stationarity of the series. Whilst for *consum1* and *rtobcpi* results of the above test tend to be consistent when using different number of lags, this does not happen with *rincome_l*. Although we usually used two lags to perform the Dickey-Fuller test, determining the number of lags should not rely on subjective judgment, especially in the case of our short series. Therefore, before applying the Dickey-Fuller test, the number of lags is determined by regressing the difference of our main variables of interest on lagged of that variable. Predicting the residuals and regressing them on their lagged values (without a constant) determines the number of lags needed to perform the Dickey-Fuller test (Kennedy, 2009).

The results of the Dickey-Fuller test are reported in Table 1. First, when the test is applied on the preferred dependent variable (*consum1*), the results suggest that this variable has a unit root, namely that cigarette consumption per capita is non-stationary. In order to purge nonstationarity, the first difference of the consumption is used.

Next, the same test performed on real tobacco CPI suggested that we cannot reject the null hypothesis that this variable exhibits a unit root. Likewise, the dependent variable, the use of the first difference appears to transform the real tobacco CPI from non-stationary to stationary. Next, another important variable used in Equation 1 is real income in Albanian leks. The test for unit root suggests that this variable has a unit root and is integrated at second order. Differencing *rincome_l* twice makes this variable stationary.

Table 1 Augmented Dickey Fuller test results

Variables	Augmented Dickey Fuller Test H_0: variable has a unit root (non-stationary) H1: variable does not have a unit root (stationary)		
Main variables of interest			
	Level	First Difference	Second Difference
consum1	Z(t) = -2.142	Z(t) = -2.849*	/
rtrobcpi	Z(t) = -0.724	Z(t) = -3.688**	/
rincome_l	Z(t) = -2.224	Z(t) = -1.261	Z(t) = -2.633*
Alternative variables and control variables			
slim	Z(t) = 0.746	Z(t) = -2.796*	/
malefemale100	Z(t) = -1.815	Z(t) = -1.092	Z(t) = -2.932
educ	Z(t)= -0.675	Z(t)= -1.322	Z(t)= -4.074

*** p<0.01, ** p<0.05, * p<0.1

Further, the Engle and Granger's cointegration test (1987) is performed in our model to test whether a one vector cointegration exist. If a cointegration relationship shall be found, then such relationship should be exploited by undertaking estimation in an Error Correction Model (ECM) framework (Kennedy, 2009). The existence of the latter suggests that the underlying variables in our model have both a short-run dynamics and long-run relationship. Having tested the variables for the existence of an integrated process of the first and second order and the existence of a cointegration process, the next step is to use the

Engle-Granger two-step approach (by testing the stationarity of the residuals) and to perform the Johansen Cointegration test in order to check for the number of cointegration equations. The results are shown in Table 2.

The test for cointegration takes the form of a unit root test of residuals resulting from estimation of the cointegrating relationship (Kennedy, 2009, p.303). By applying a Dickey-Fuller test to the residuals, the results displayed in Table 2 confirm that residuals are I(0), namely stationary. In terms of other diagnostics, the mean VIF ranging from 1.64 to 2.31, indicate that multicollinearity is not a problem. In terms of the autocorrelation, the Breusch-Godfrey LM test suggests that we fail to reject the null hypothesis, indicating that there is no problem of autocorrelation. Similar results were provided by the Durbin's alternative test for autocorrelation. The same procedure was followed for the second model when using the price of the most popular brand of cigarettes. Similarly, the Engle and Granger's cointegration test performed suggests that there is a short-run and long-run relationship, while the price of *slims* has the same order of cointegration as *rtobcpi.*

An important note of caution is in order when variables are of different order of integration. Whilst one might think of performing the Autoregressive Distributive Lag (ARDL), it is important to note that real income is integrated at second order, which renders invalid the application of this model due to the assumption that variables are either I(0) or I(1) (Nkoro and Uko, 2016). Therefore, we continue with the ECM to detangle both the short-run and long-run dynamics.

Table 2 Augmented Dickey Fuller test on residuals

	(1)	(2)	(3)	(4)
VARIABLES	consum1	consum1	consum1	consum1
rtobcpi	-52.86***	-55.79***	-59.91***	-53.79***
	(8.994)	(9.609)	(14.46)	(10.66)
rincome_l	0.00679***	0.00714***	0.00716***	0.00680**
	(0.00154)	(0.00160)	(0.00170)	(0.00208)
tlaw2		-79.55		
		(86.23)		
malefemale			5,954	
			(9,354)	
educ				1.302
				(8.242)
Constant	3,099***	3,226***	-2,506	3,109***
	(250.1)	(287.3)	(8,809)	(442.5)
D-F Residuals Z(t)	-12.813 ***	-13.563**	-13.804***	-12.442***	-2.809**
Mean VIF	8.93	6.89	13.05	9.26	2.31
Ramsey RESET F	0.92	0.6379	0.3814	0.645	0.3687
Breusch-Godfrey Chi2	0.768	0.559	1.013	0.676	0.112

p-value	0.3809	0.4545	0.3142	0.411	0.7383
Observations	12	12	12	12	11
R-squared	0.8370	0.8527	0.85449	0.8362	0.622

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To the complexity of accurately estimating the price elasticity is also added the potential prevalence of endogeneity. Whilst this problem is often neglected in the empirical research, it is however known in the theoretical literature of price elasticity. The cigarette price and quantity determined in the market are seemed to be endogenous because both the equilibrium is jointly determined in the market by the interaction of demand and supply. Econometrically, to test whether a potential endogenous variable is correlated with the disturbance term, the Hausman test is performed. However, due to small number of observations, this test could not be performed.

3. Error Correction Model Results

Because of different strategies undertaken in this paper, as explained above, this section reports four sets of results (Model I, II, III/1 and III/2) for both short-run and long-run price elasticities across different specifications by using different control variables, and income elasticities across the abovementioned models. Table 3 displays the results from the three models when using real tobacco CPI as a measure of tobacco price, whereas Table 5 displays the estimated results when using the price of the most popular cigarette brand.[3] A note of caution is in order when referring to the bootstrapped results, which could not be generated due to small number of observations (short time series)

Starting with the results presented in Table 3, it should be noted that the signs of the regression coefficients are usually as expected. The negative coefficient sign of the CPI supports the inverse association between cigarette consumption and price, while being consistent across all specifications (from Model I to III) and mostly significant at 5% level of significant. The price elasticity (Table 4) of tobacco is usually lower than one, indicating an elastic demand of tobacco. The coefficient size varies from -0.27 to -0.77 in the long-run, whereas in short-run the price elasticity varies from -0.076 to -0.107, subject to the specification. A note of caution is in order when referring to the short-run price elasticities of tobacco and their convergence to the long-run ones, which is usually known as the speed of adjustment. The lagged residual does show such adjustment. The coefficient on this variable is lower than one in absolute value and highly significant at 1% level of significance across all specifications. Namely, the results suggest that on average about 71% to 79% of the deviations from the long-run equilibrium will be corrected in the consecutive period. In terms of other determinants of tobacco demand, the results suggest that only enrollment in tertiary education is significant at 5% level of significance, though this effect appear to vanish in the long-run.

[3] Since the long-run elasticities are the same when using the mean and fitted values (with a small difference at the hundredth, we reported the one using the mean values of *consum*, *rtobcpi* and *rincome_l*.

Table 3. Regression results from Model I, II and III using real tobacco CPI.

VARIABLES	(Model I) consum1	(Model I) dconsum1	(Model II) consum1	(Model II) dconsum1	(Model III/2) consum1	(Model III/2) dconsum1	(Model III/1) consum1	(Model III/1) dconsum1
drtobcpi		-41.89**		-57.77***		-41.86**		-40.92**
		(13.18)		(14.42)		(14.16)		(12.80)
d2rincome_l		0.00118		0.00658		0.00121		0.0134*
		(0.00645)		(0.00643)		(0.00690)		(0.00617)
L.r		-0.735***		-0.711***		-0.736***		-0.760***
		(0.0854)		(0.0797)		(0.0917)		(0.0838)
rtobcpi	-14.69*		-13.95		-14.67*		-5.217	
	(7.278)		(8.903)		(7.758)		(9.300)	
D.rincome_l	0.00205		0.00293		0.00213		0.0130	
	(0.0111)		(0.0129)		(0.0121)		(0.0124)	
tlaw2			28.58	180.2				
			(170.6)	(100.4)				
D.malefemale					427.7			
					(13,758)			
D2.malefemale						-12.74		
						(7,541)		
D.educ							30.26	
							(18.09)	
D2.educ								29.26**
								(10.54)
Constant	2,837***	127.2*	2,742**	95.34	2,833**	126.8	1,715	164.8**
	(787.5)	(66.24)	(1,008)	(62.61)	(848.2)	(71.92)	(1,024)	(63.68)
Observations	12	12	12	12	12	12	11	11
R-squared	0.489	0.932	0.491	0.952	0.489	0.932	0.622	0.962

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Price and Income elasticities estimation from Model I, II and III using real tobacco CPI.

	Model I	Model II	Model III/1	Model III/2
Long-run price elasticity	-0.777*	-0.737	-0.776*	-0.276
Long-run bootstrapped price elasticity	NA	NA	NA	NA
Short-run price elasticity	-0.07**	-0.107**	-0.076**	-0.078**
Lagged Residuals	-0.735***	-0.711***	-0.735***	-0.760***
Long-run Income elasticity	0.031	0.045	0.033	0.201
Short-run income elasticity	-0.0005	-0.003	-0.006	-0.0005

*** p<0.01, ** p<0.05, * p<0.1

When using the price of the most popular brand cigarette in the market instead of the conventional tobacco CPI, the estimated results presented in Table 5 show similar result to Table 3. The reported long-run and short-run price elasticities appear to be smaller compared to the results with real tobacco CPI. Whilst the price elasticity appears to be insignificant across all specifications, the estimated coefficients are within the expected range (from -0.23 to -0.55 and from -0.03 to -0.04, for long-run and short-run elasticity respectively). The speed of

adjustment appears to be larger than the case of real tobacco CPI, more precisely from 81% to 84% of the deviations from the long-run equilibrium will be corrected in the next year. It should be noted that similar to the results when using real tobacco CPI, the short run elasticities across specification are larger than the ones in long run, which might reconfirm our hypothesis that while short run equilibrium tend to adjust to long run equilibrium, eventually it moves away very fast.

Table 5. Regression results from Model I and II using the price of most popular brand

	(Model I)	(Model I)	(Model II)	(Model II)	(Model III/1)	(Model III/1)	(Model III/2)	(Model III/2)
VARIABLES	consum1	dconsum1	consum1	dconsum1	consum1	dconsum1	consum1	dconsum1
drslims		-5.338		-7.790		-5.472		-8.044
		(5.257)		(6.762)		(6.031)		(4.927)
d2rincome_l		-0.00516		-0.00326		-0.00496		0.0137
		(0.00821)		(0.00944)		(0.00879)		(0.00838)
L.r		-0.819***		-0.843***		-0.820***		-0.807***
		(0.110)		(0.126)		(0.118)		(0.108)
rslims	-4.779		-4.267		-4.760		-2.066	
	(2.707)		(3.165)		(2.875)		(2.906)	
D.rincome_l	0.00302		0.00478		0.00330		0.0123	
	(0.0117)		(0.0132)		(0.0126)		(0.0116)	
tlaw2			62.71	69.13				
			(169.4)	(158.9)				
D.malefemale					1,539			
					(14,241)			
D2.malefemale						1,359		
						(10,877)		
D.educ							31.17*	
							(15.81)	
D2.educ								45.30**
								(13.81)
Constant	2,472***	29.01	2,309**	17.41	2,460**	30.26	1,671*	105.6
	(695.8)	(79.97)	(853.2)	(99.19)	(746.2)	(90.80)	(757.9)	(80.90)
Observations	12	12	12	12	12	12	11	11
R-squared	0.449	0.876	0.458	0.868	0.449	0.876	0.632	0.932

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Price and Income elasticities estimation from Model I, II and III using the price of most popular brand.

	Model I	Model II	Model III/1	Model III/2
Long-run price elasticity	-0.55	-0.49	-0.55	-0.239
Short-run price elasticity	-0.03	-0.04	-0.03	-0.04
Lagged Residuals	-0.813***	-0.843***	-0.819***	-0.807***
Long-run income elasticity	0.04	0.07	0.05	0.19*
Short-run income elasticity	0.002	0.001	-0.002	-0.006

*** p<0.01, ** p<0.05, * p<0.1

On the other hand, the GDP per capita is not significant, though the coefficient of the income elasticity, both on the short-run and long-run, remain very small across specification. The male to female ratio (see Model III/1 in Table 5) remain insignificant across all specifications. This variable suggests that an increase in this ratio does not have any impact on the consumption of cigarettes, suggesting no gender specifics of the tobacco consumption. Also, the tobacco control dummy variables appear to be insignificant across different specification (see Table 5). Contrary, enrollment in tertiary education (similar to the results when using real tobacco CPI) appear to a significant determinant of tobacco consumption.

A note of caution is in order when comparing the long-run price elasticities. As reported in Table 4 and 6, there is small difference between the price elasticities retrieved from Model I, II, III/1 and Model III/2. A rationale for this difference might be the inclusion of enrollment in tertiary education, which being a significant determinant of tobacco demand, might have influenced in the price elasticity, different from the others model which do not confirm the presence of significant determinants of tobacco demand.

4. Conclusions

The consumption of cigarettes has become an increasingly important issue. To shed more lights in the case of Albania, this study investigated the tobacco demand for Albania using cointegration and Error Correction Model for the period 2006-2017. The empirical analysis conducted on annually aggregate data suggests that tobacco demand is price inelastic to price changes, while also being price inelastic to price changes. More precisely, the estimated results suggested that tobacco demand is price inelastic, with demand being relatively more elastic in the long-run than in the short run. Namely, the price elasticities of tobacco range from -0.27 to -0.77 in long-run and -0.007 to -0.107. With regard to the income elasticity, the estimated results suggested that income is not an important factor influencing cigarette consumption. Also, in terms of other control variables, this paper suggests that all the other factors expect enrolment in tertiary education are insignificant factors.

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