The demand for beer in presence of past consumption and advertising in the Czech Republic

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Abstract: The paper focuses on beer consumption in the Czech Republic, the country with the highest beer consumption per capita in the world. To understand the recent beer-consumption behaviour, we use the monthly data from a three year period, 2006–2008, to estimate both the 2SLS and the SUR model charting the demand for beer extended to the past consumption and advertising expenditure. The demand for beer in the Czech Republic reacts more strongly to the changes in price than it does to the investments in advertising. The results suggest two implications for the policy-makers. Consumption is as sensitive to the price of beer and its alternatives as it is to advertising, so taxes or restrictions on advertising can affect the consumption of beer, considering the long tradition of Czech consumers in drinking beer as the strong role of the past consumption demonstrates.

Key words: beer demand, alcoholic beverages, 2SLS, SUR, Czech Republic

The economic analysis of beer consumption has become crucial for two reasons: for the economic performance that has resulted from the development of the beer industry, and for the negative effects that the consumption of alcoholic beverages has on the society. Studying the determinants of beer consumption can help us to understand how to influence it, and if required, how to reduce it. Furthermore, it is important to study the beer industry both because it is not a fully competitive industry and because it is so well advertised.

The demand for alcohol has now been estimated in more than twenty countries (Gallet 2007). The purpose of this paper is to contribute to these studies, analysing the beer demand in the Czech Republic. There are two good reasons for doing this: first, the Czech Republic has a long tradition in beer consumption that is grounded in the country's traditional propensity to produce and drink beer. In fact, according to Chládková et al. (2009) analysis, the country has for years held the first place in the world for the amount of consumed beer per capita. Hence, the Czech Republic is a good terrain to test whether the previous consumption influences the current demand.

Usually, habitual behaviour adds to future consumption and can be reinforced by advertising. This leads us to the second reason, that is, to take into account the influence of advertising, be it by the beer companies or by the companies producing the alternative goods, since the effects of the informative and persuasive advertising are very important for the consumer choice and habit forming. Due to the enormous advertising expenditures by beer companies and the important position of the beer industry in the economy, the Czech Republic is a good case to study even under this aspect. Advertising continuously contributes to the habit forming of Czech consumers in drinking beer. In fact, the amount spent on beer advertising in the country was more than €37 million in 2008 (TNS Media Intelligence, 2009), more than seven percent of the €521 million (MEMRB, 2009) that the Czech consumers spent on beer in the same year.

Thus, the main purpose of this paper is to evaluate the demand for beer in the Czech Republic, using standard variables, such as prices and income, augmented by two variables that influence the consumption too, such as the past consumption and advertising. A second aim of this paper is to analyse and to delve deeper into the research on the effects of the same variables on the beer and spirits consumption, using the multiple-good demand equations. To evaluate these effects, we have collected the monthly data for a panel of 19 brands of beer and 19 brands of spirits over the period 2006–2008.

The paper is divided as follows: the first section serves as an introduction to the culture and history of the Czech beer industry, the second and third sections summarize the theoretical and empirical literature on the subject and the issue of consumer demand, concentrating on the effects of advertising and the past consumption. The fourth section describes the data, the models used and the empirical approach. In the fifth section, the results are presented; followed by conclusion and policy implications.

BRIEF HISTORY OF THE BEER INDUSTRY IN THE CZECH REPUBLIC

The culture of beer-drinking in the Czech Republic is connected to a long and rich tradition of beer production which has passed from the first local-brewing and cottage industries to the industrial production and to their sophisticated production methods of the present. The first indications of beer production in the Czech territories go back to the year 999, when Bishop Adalbert forbade the monks to produce beer, a drink similar to the beer that was already being produced as far back as the fourth century B.C.

A document from the Visegrad Treaty from 1088, with which Boleslaw II once again allowed the production of beer, proves that the beer production was active, and makes it clear that anyone was allowed to produce beer then. Thereafter, the first franchises were born. The first, established in the 13th century, was 'the mile right' and gave the right to produce beer as far out as one mile from a city. Witnessing the success of production, the aristocracy started to construct beer factories with the backing of the treatise by Wenceslas in 1517, which gave the 'right' to produce beer exclusively to the aristocracy. In the 17th century, the number of factories increased to 3000. After the 30 Years' War, the family-run factories were closed due to a decree in 1781, and larger factories were opened in the cities. At the end of the 18th century, František Ondřej Poupě's rules were established for the beer production process. With the industrial revolution, the factories were endowed with advanced technologies and as a result, they required a greater professionalism from the workers. Qualifications were required by the way of responding to this demand, and the first professional brewers' school was established in 1869, followed by a research institute in 1887. Thereafter, the state intervened invalidating the exclusive right of the aristocracy to produce beer, and the competitive market was opened.

The beer industry expanded in the 19th century when 1087 beer factories opened in the Czech regions with the production volume of nearly 2 million hectolitres. By 1900, the number of factories dropped to 804, even though the production went up by 600 per cent. Further factory closures continued until 1918.

In 1918, the new Republic of Czechoslovakia inherited 60% of the beer factories from the Austrian-Hungarian Empire. The concentration of the industry and the fall in production continued during and after the World War One. In 1945, a decree by the president of the Republic nationalised the beer factories, which became one company under the sole control of the state. In the 1990s, the company was privatised and many different companies came into being, often with the foreign backing on capital. Today, in the Czech Republic there are 72 beer factories with the total annual production of almost 20 million hectolitres, positioning the country as the 16th biggest producer of beer in the world and as the 9th biggest world exporter of beer (Chládková et al. 2009).

According to different sources (see World Drink Trends 2005; Pyšný et al. 2007) the Czech Republic is now the biggest per capita consumer of beer in the world, with the monthly per capita beer consumption between 12–13 litres. This per capita consumption is consistent with our sample data, which comprises the sales of only 19 brands of beer and shows that in average, a Czech consumer drinks between five and eight litres of beer per month. The consumption is highly seasonal, with a peak in the summer months and again at the end of the year. A similar pattern can be seen in the consumption of spirits, with an increase of 0.5 litres per capita in the month of December. On the other hand, if the real average income has a tendency to increase, with a marked seasonal peak in the fourth quarter, the trend in the real prices for beer or spirits demonstrates a tendency to decrease greatly according to season, with an increase in the month of December, followed by a drop in January. According to our sample, the real prices in both categories (beer and spirits) vary between 17.50 and 19.40 CZK per litre of beer, and between 215 and 255 CZK per litre of spirits.

DIFFERENT APPROACHES TO ESTIMATE ALCOHOL DEMAND

Alcohol demand has been analysed by many different economists, often via an econometric model based on a single equation, using standard economic variables to estimate the price and income elasticity. The majority of works that use a functional form based on a single equation utilize a double-log specification. Double-log demand functions are used, first and foremost,

because of their simplicity and for the ease with which the estimated parameters can be interpreted as the correspondent elasticity of demand with respect to the explanatory variables. Among the typical weaknesses of an analysis based on a single equation, there is the use of functional forms that follow the hypotheses that are excessively restrictive in their nature and in terms of consumer preferences.

However, the double-log model can cover the constraint of homogeneity and can be considered to be an approximation of an arbitrary demand function and, as with the AIDS, RDS and TDS models, it satisfies the definition of local flexibility (for a detailed discussion see Alston et al. 2002). This is one of the reasons for which we have decided to use this functional form.

The double-log specification is usually applied to temporal series using the OLS or GLS methods (Gallet 2007). Applying this approach, Adrian and Ferguson (1987), Lee and Tremblay (1992), Clements et al. (1996) and Nelson (2003) estimate the alcohol demand in Canada and the alcohol and beer demand in the US.

It is difficult to get an overview of the results of the aforementioned studies, as the results differ greatly by country and by functional form. Some works (Adrian and Ferguson 1987; Gallet and List 1998; Nelson 1999) suggest that the elasticity of the demand on income varies from -0.26 and 0.83 and that beer is a locally inferior good. In terms of the elasticity of demand on price, the results show a fairly strong sensitivity to the price of beer (from −0.89 to −2.22) and a moderate sensibility to the price of substitute goods. Specifically, the cross−elasticity, when correlated to the price of wine, is often negative and it varies between −0.3 and −0.6 and between −0.2 and −0.3 for spirits.

Some authors have used this approach to analyse the effects of advertising. While McGuinness (1980) and Walsh (1982) results show that advertising has a positive and significant effect on the alcohol demand, Duffy (1982) and Lee and Tremblay (1992) find no empirical evidence of the effect of advertising on the beer demand. The results of these studies vary depending on the influence of other demand variables. Duffy (1982) finds that income is a crucial variable in determining demand, while the price of goods and of their substitutes is less influential. Lee and Tremblay's (1992) results lead to the opposite conclusions.

In addition to the single equation functional forms, there are other analytical specifications of the complete demand system. Clements and Johnson (1983), Selvanathan (1988) and Nelson (1997) examine, with annual data, the consumer demand hypothesis, using the Rotterdam system. Their estimations, based on a version of the conditioned demand system, say that the

income elasticity is around 0.71–0.85 for all estimated alcoholic beverages. While prices elasticities are all negative (from −0.10 to −0.57), cross elasticities are all positive and with less extreme values compared to the previous ones. Chang and Bettington (2001) use the single equation and the almost ideal demand system (AIDS) of Deaton and Muellbauer (1980) in order to estimate wine demand in Australia. Leppänen et al. (2001) use the obtained results for the estimation of this system to internationally compare 14 European countries. Larivière et al. (2000) utilize the Canadian data and apply an AIDS generalized form (LA/AIDS) to estimate the demand for beer, wine and spirits.

THE ROLE OF PAST CONSUMPTION AND ADVERTISING ON BEER DEMAND

There are a few strands of research concerning the neoclassical consumer theory that are relevant to include the past consumption and advertising in the theory. Among these, there are the theories on habitual behaviour (Houthakker and Taylor 1970; Boyer 1983). A consumer fills her/his present consumption bundle according to prices, income, preferences and backed on the accumulated experience in consumption: previous experience, that of his/her family, friends, peer group, or as a result of the experience of advertising, habit, teaching or culture.

According to Becker and Murphy (1988), the mechanism through which the past consumption affects the current utility of the good consumption is a sort of "learning by doing" process, as summarised by the stock of the consumption capital. The good is addictive if the present consumption increases when the habits derived from the past consumption build up, whereas the term 'satiating' good describes when the opposite occurs. Goods that produce harmful habits (influenced by the consumption capital) will become addictive only if the demand for them is sufficiently inelastic (Becker and Stigler 1977). Yet, the consumption capital depends on the exposition of consumption and age, and it can be a measure for the lifelong consumption of the good by the consumer. If the past consumption was high, it is likely that it will also be high at present and in the future, which proves a demand that is both price and income inelastic (Elster and Skog 1999).

There have been relatively few empirical studies applying the past consumption or the addiction approach on alcohol and beer demand, alone or jointly with other addiction goods (Waters and Sloan 1995; Grossman et al. 1998; Bentzen et al. 1999; Bask and Melkersson 2004; Pierani and Tiezzi 2009). Some of

these studies have demonstrated the reinforcing role of the past and future consumption on the alcohol or beer current consumption, while others demonstrated the reinforcing role of the alcohol or beer past consumption on the consumption of the complementary goods, such as tobacco and light drugs.

Another extension of the neoclassical approach applied to the consumer choice is the introduction of the imperfect information, from the biased perception and the cognitive limits of rationality (Kahneman and Tversky 1986), which influence the constant and rational optimization. In presence of imperfect information, the demand function becomes less elastic. Informative advertising eliminates this imperfection because it provides the missing information: it informs consumers of the existence of a good, it can describe the characteristics of the good, and it can even inform the consumers where the good can be purchased and at what price. The result is a more elastic demand curve (Chamberlin 1933). However, advertising can be also aimed at the change of preferences or creating new needs by advising consumers to purchase a brand for the real or imagined benefits. As a consequence, the demand curve turns and becomes less elastic. These two opposite effects make the total effect of advertising difficult to predict. To determine the influence of advertising on demand, it is necessary to work out the elasticity of demand, both for beer and the substitute goods, with regard to advertising (Tremblay and Tremblay 2005). This problem is analysed by Johnson and Myatt (2006) who deal with the turnaround of market demand and find that it depends on the content of the advertisement: if it promotes characteristics that differentiate the product, demand elasticity for all price levels declines; if it highlights its substitutability, then demand elasticity increases. According to Akerlof and Kranton (2000) higher beer consumption levels can also be caused by the effects of advertising that promotes the consumption of beer as a social norm.

Not only the elasticity changes but also the demand shifts may occur in the presence of advertising. Nelson (1999) focuses his analysis on the effect of advertising on the market demand for alcohol and suggests that advertising may alter the market share of the brand, but it has a little to no effect on the total consumption of alcohol or beer. Selvanathan (1989) shows that in the UK, the advertising of beer has a significant influence on the consumption of beer, wine and spirits, and that the advertising of spirits reduces the demand for beer. On the other hand, Duffy (1991) found that neither direct nor indirect advertising had any significant effects in the UK, while Johnson (1985) found that beer advertisements did have a

significant influence on demand, though advertisements for spirits produced no cross-effect.

DATA, MODEL AND EMPIRICAL APPROACH

The econometric analysis is based on the study of monthly data from the three-year period 2006–2008. We used various data sources to estimate our model. Specifically, the advertising expenditure data was obtained from the TNS Media Intelligence, the agency collecting advertising data based on the media monitoring, the prices and purchasing information were provided by the MEMRB, the agency in charge of the retail tracking services, and the income and price index information (base year 2005) were obtained from the Office of National Statistics.

The total sample contains 36 monthly records, including the data on consumption, prices and advertising expenditures on beer and spirits, for the total of 38 brands (19 beers, 19 spirits). As the relevant data were unavailable, we do not consider wine to be a substitute good for the purposes of the assessment, even though Kučerová (2005) asserts that beer or other alcoholic drinks are a distant substitute of wine, since their prices and levels of consumption are non-important for the development of the wine demand.

As mentioned in the second section, the first step of the econometric analysis is based on the estimation of a double-log demand function, that is based on aggregated data, and therefore, on the effects of generic advertising. The second step regards the study of a system of simultaneous equations on a panel of data considering both beer and spirits.

In our first model, we consider the per capita consumption of beer as a function of the current price of beer and its substitute, the current per capita income, per capita advertising for beer and its substitute, and the past beer per capita consumption. The initial model, therefore, assumes the following form:

$$\ln q_{it} = \alpha + \sum \beta_0 \ln p_{it} + \sum \beta_1 \ln p_{jt} + \sum \gamma_0 \ln a_{it} + \sum \gamma_1 \ln a_{jt} +$$

$$+ \sum \eta \ln I_t + \sum \zeta \ln q_{i(t-1)} + \varepsilon_{it} \qquad (1)$$

where: i and j represent beer and spirits, respectively, t indicates months, and q_{it} the quantity of the good i consumed per capita; p_{it} and p_{jt} represent the average prices; a_{it} and a_{jt} represent the aggregate advertising expenditures per capita; I_t is the average consumer income, and $q_{i(t-1)}$ represents the past consumption as an approximation of the consumption capital.

We have included the past consumption in the equation, assuming that it affects the present consumption.

This corresponds to Becker and Murphy's (1988) assumption of the 'myopic addiction', while the rational addiction, according to the above authors, represents the future consumption as well. We could not test the role of the future consumption because of the number of observations in our dataset. However, Becker and Murphy recognize that the myopic behaviour, based on the past consumption, is formally consistent with their definition of rational behaviour.

In order to evaluate the effects of advertising and the past consumption on demand, we choose to compare the results of the proposed model both with and without the relative variables for advertising and the past consumption.

The second step of our analysis regards the estimation of a simultaneous equation model. In particular, a seemingly unrelated regression (SUR) method is used. Classical examples of the SUR estimations are demand functions (Cameron and Trivedi 2009). This model has the particularity that it is based on a set of equations that may be related not because they interact, but because their error terms are related. In fact, for the SUR model, the relationship between the dependent variables is indirect; it comes through the correlation in the errors across different equations. In other words, in this particular system of linear equations, errors are correlated across the equations for the given brand, but they are uncorrelated across brands. The estimation combines observations over both equations and brands. When we use the SUR method, our model takes the following form (equation 2):

$$\begin{cases} \ln q_{it} = \alpha_i + \beta_i \ln p_{it} + \gamma_i \ln a_{it} + \eta_1 \ln I_t + \xi \ln q_{i(t-1)} + \varepsilon_{1t} \\ \ln q_{jt} = \alpha_j + \beta_j \ln p_{jt} + \gamma_j \ln a_{jt} + \eta_2 \ln I_t + \xi \ln q_{j(t-1)} + \varepsilon_{2t} \end{cases}$$

The reason of this choice is that we have two different demand functions for beer and spirits and we study the price, income, advertising expenditure, and the past consumption effects taking into account the simultaneous influence of these variables.

RESULTS AND DISCUSSION

Given that we are using monthly data, our series are highly seasonal. In order to take this problem into account, we use the Holt-Winters seasonal smoothing for all series except for the per capita income. For the latter, we use the Holt-Winters non-seasonal smoothing because the income does not seem to be affected by the same problem as the other variables.

In general, when the time series are used, the first problem is that spurious results can arise if the series are not stationary (Enders 1995). There is a variety of methods proposed for implementing the stationarity tests, and each has been widely used in the literature of applied economics. In this study, the ADF (Augmented Dickey-Fuller) and the ERS (Elliott, Rothenberg and Stock) tests are used to check for the unit roots of the time series variables. Both results are shown in Table 1. In all cases except for the income variable, the null hypothesis of no stationarity can be rejected at a 1% or 5% level of significance. For

Table1. Unit roots tests

Variable	Variables in logarithms				Variables in first differences			
	ADF	critical value	ERS	critical value	ADF	critical value	ERS	critical value
Qu. Beer	−3.558	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−16.677	−17.880 (1%) −12.820 (5%) −10.400 (10%)				
Beer price	−2.731	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−13.696	−17.880 (1%) −12.820 (5%) −10.400 (10%)				
Spirits price	−3.607	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−19.819	−17.880 (1%) −12.820 (5%) −10.400 (10%)				
Beer Adv.	−4.076	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−19.581	−17.880 (1%) −12.820 (5%) −10.400 (10%)				
Spirits Adv.	−3.879	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−19.759	−17.880 (1%) −12.820 (5%) −10.400 (10%)				
Income	−1.851	−3.682 (1%) −2.972 (5%) −2.618 (10%)	−6.637	−17.880 (1%) −12.820 (5%) −10.400 (10%	−5.668	−3.689 (1%) −2.975 (5%) −2.619 (10%)	−28.922	−17.812 (1%) −12.788 (5%) −10.380 (10%)

Table 2. Correlation Matrix

	lnqipcss	lnpiss	lnpjss	lnaiss	lnajss	D1.lnIss	L.lnqiss
Qu. Beer	1						
Beer price	−0.192	1					
Spirits Price	0.413	0.441	1				
Beer Adv.	**0.634**	0.108	0.430	1			
Spirits Adv.	0.236	0.321	0.228	**0.720**	1		
Income	−0.057	−0.002	0.031	0.318	**0.528**	1	
Past Consumption	0.486	**−0.531**	−0.155	−0.056	0.245	−0.017	1

the ERS test, the results are not different from the ADF test. According to these results, the income is stationary at first differences.

The correlation matrix for all variables used in the models shows that the estimations can suffer from a multicollinearity problem (Table 2). For this reason, we have estimated four different versions of our model (Table 3).

In all four OLS estimated versions of our first model, the price of beer is negatively correlated with demand. On the other side, according to our results, spirits seem to serve as a substitute for beer. In fact,

Table 3. Demand for beer: OLS estimation

	(i)	(ii)	(iii)	(iv)
Beer price	−3.305 (1.147)**	−0.796 (0.766)	−1.837 (1.096)*	−0.848 (0.854)
Spirits price	3.221 (0.839)**	1.406 (0.532)*	2.766 (0.682)**	1.433 (0.570)*
Income	−0.315 (0.594)	−1.077 (0.357)**		−1.107 (0.418)*
Beer Adv.		0.357 (0.054)**		0.348 (0.080)**
Spirits Adv.			0.029 (0.011)*	0.002 (0.014)
Past Consumption		0.493 (0.095)**	0.496 (0.135)**	0.495 (0.097)**
Constant	−6.031 (4.301)	−10.786 (2.655)**	−9.233 (3.842)*	−10.661 (2.829)**
Breusch–Pagan	2.38 (0.50)	3.41 (0.64)	1.28 (0.86)	4.00 (0.68)
White's test	9.94 (0.36)	15.34 (0.76)	15.04 (0.38)	23.44 (0.66)
Test-F	5.55	23.97	10.94	19.31
Reset test	0.45 (0.72)	0.56 (0.64)	0.27 (0.85)	0.51 (0.68)
Observations	35	35	35	35
R-squared	0.35	0.81	0.59	0.81

Standard errors in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%

the cross-price elasticity is positive and statistically significant in all the four estimations. Beer demand is also moderately and positively advertising elastic (0.35), in both the second and fourth estimations. The results on the spirits advertising expenditures have a similar impact as an increase in the advertising expenditure for spirits increases the demand for beer. However, the latter is not as strong as the former, given that the variable is not always significant. This could be due to the strong correlation between this variable and the others (see Table 2). Income elasticity is always negative and statistically significant. These results confirm that beer is a mature good and can be seen as a locally inferior good for certain income levels. Finally, the demand for beer is past consumption elastic (approx 0.5), meaning that the past consumption has a positive impact on the current consumption, demonstrating that beer is an addictive good.

At the end of Table 3, the test for the model specification (RESET test) tells us that there are no omitted variables in the model. The mean VIF in Table 4 shows that the collinearity is not an issue in our estimations.

Both prices and advertising expenditures are potentially endogenous variables because they are objects of choice from each firm. Prices are potentially determined simultaneously and partially determined by the demand. Moreover, given that the advertising budget is usually determined as a percentage of sales, it is necessary to test whether the advertising variables are independent on the error terms.

The Hausman test is carried out in two different ways in order to determine endogeneity. In the first one, the endogeneity for each 'endogenous variable' was tested, assuming that the other variables were exogenous. In the second one, the endogeneity of all variables together (price of beer, price of spirits, advertising for beer and spirits) was tested (Table 5). The result of the test, computed for each endogenous variable assuming that the other three variables are

Table 4. Analysis of collinearity

Variables	(i)		(ii)		(iii)		(iv)	
	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF
Beer price	1.24	0.805	1.73	0.58	1.76	0.60	2.08	0.48
Spirits price	1.24	0.805	1.56	0.64	1.27	0.79	1.73	0.58
Income	1.00	0.999	1.13	0.88			1.50	0.67
Beer Adv.			1.4	0.71			3.03	0.33
Spirits Adv.					1.14	0.88	3.57	0.28
Past Consumption			1.41	0.71	1.42	0.7	1.43	0.70
Mean VIF	1.16		1.45		1.4		2.22	

exogenous, asserts that the beer price and the advertising variables are endogenous with a 5% level of significance. Conversely, price and advertising for spirits are exogenous. The result of the test computing when all the variables together are considered endogenous asserts that endogeneity is an issue in our sample and that we can assume that both prices and advertising expenditures are endogenous, in keeping with the economic theory.

In order to take into account the endogeneity problem, we use the 2SLS estimation methodology. In this case, the natural candidates as instruments are the lagged variables of the same series. The relevance of instruments is tested at the first step of regression and with the Hansen test (not shown in the table). It may be observed that the partial R-squared is always

high, in particular in the last regression it varies from 0.64 to 0.79. Moreover, the F statistics is significant in all estimations (Table 6).

The 2SLS estimated results (Table 7) show that all variables are significant and of the expected sign. The only problem is that of the advertising expenditure for spirits, which is only significant at 10% in the (iii) estimation. The own price elasticity is very high and always significant and negative. The contrary occurs with the cross-elasticity of beer demand to the price of spirits. This result could be interpreted as spirits standing as a substitute good for beer. The estimated income elasticity is always negative. Hence, beer is confirmed to be a locally inferior good. Both advertising expenditures (beer and spirits) have a positive impact on beer consumption. Finally, the past consumption has a positive effect on beer demand, demonstrating a strong degree of complementarity between the past and present consumption, so that beer can be considered as an addictive good.

Table 5. Hausman test

	Test	Prob.	Results
Beer price	3.60	0.0678	endogenous
Spirits price	1.90	0.1785	exogenous
Beer Adv.	4.01	0.0547	endogenous
Spirits Adv.	0.40	0.5304	exogenous
All variables	5.95	0.0015	endogenous

Multiple-good demand estimations

The purpose of the second model of this paper is to study more carefully the relationship between

Table 6. Demand for beer: first stage regression

Variable	(ii)		(iii)		(iv)	
	partial R^2	F (5.29)	partial R^2	F (4.30)	partial R^2	F (6.28)
Beer price	0.43	4.31 0.005	0.54	9.03 0.000	0.64	8.22 0.000
Spirits price	0.58	7.85 0.000	0.53	8.32 0.000	0.72	7.55 0.000
Beer Adv.	0.74	16.79 0.000	0.66	14.99 0.000	0.65	13.74 0.000
Spirits Adv.					0.79	10.280 0.000

Table 7. Demand for beer: 2SLS regression

	(ii)	(iii)	(iv)
Beer price	−2.394 (1.452)*	−3.779 (1.856)*	−2.393 (1.397)*
Spirits price	1.843 (0.624)**	2.05 (0.941)*	1.847 (0.806)*
Income	−1.063 (0.356)**		−1.066 (0.530)*
Beer Adv.	0.343 (0.061)**		0.341 (0.133)*
Spirits Adv.		0.033 (0.015)*	0.000 (0.027)
Past consumption	0.388 (0.135)**	0.344 (0.169)*	0.389 (0.106)**
Constant	−8.059 (5.149	0.522 (6.116)	−8.075 (4.002)*
Wald chi^2	104.44 0.000	26.81 0.000	106.70 0.000
Observations	35	35	35

Standard errors in parentheses

*significant at 10%; **significant at 5%; ***significant at 1%

beer and spirits consumption. Up to now, we have found that the cross-price and advertising in spirits influence positively beer demand. Hence, the quantity demanded of beer and spirits could be seen as a system of simultaneous demand equations.

The seemingly unrelated regression method involves two dependent variables that, in our case, are the logarithms of the quantity demanded respectively for beer and spirits. In this specific estimation, we use the data for 19 brands of beer and spirits for three years (2006–2008) for a panel of 57 observations. The estimation results are shown in Table 8. In particular, the first two columns summarize the results for the SUR model when both the prices and advertising expenditures are included as independent variables. Third and fourth columns show the results for the SUR estimation, when also income and the past consumption of beer and spirits are included. Finally, the last two columns show the results when prices and advertising expenditures are considered as endogenous variables. Also in this case, the instrument variables are the lagged value of the same variables.

The first estimation (first two columns in Table 8) presents a quite low R-squared, while all regressors are jointly significant at 1% level. These results improve considerably when we consider the second and the third estimations.

The regressors are jointly significant in each equation and in each estimation. Moreover, the correlation

Table 8. Demand for beer and spirits: SUR with IV

	SUR		SUR		SUR-IV	
	qipc	qjpc	qipc	qjpc	qipc	qjpc
Beer price	−1.178 (0.400)***		−0.199 (0.075)***		−0.2 (0.076)***	
Beer Adv.	0.072 (0.018)***		0.006 (0.003)*		0.005 (0.003)*	
Spirits price		−0.351 (0.236)		0.033 (0.051)		0.018 (0.052)
Spirits Adv.		0.031 (0.012)***		0.005 (0.002)**		0.007 (0.003)**
Income			−5.613 (2.063)***	−2.811 (1.936)	−5.621 (2.063)***	−2.815 (1.956)
Beer past consumption			0.949 (0.019)***		0.95 (0.019)***	
Spirits past consumption				0.964 (0.022)***		0.959 (0.023)***
Constant	3.249 (1.069)***	−0.883 (1.244)	56.183 (20.458)***	27.548 (19.19)	56.276 (20.461)***	27.631 (19.393)
R-squared	0.060	0.072	0.984	0.980	0.984	0.980
Chi^2	18.93	7.56	2 521.66	2 031.33	2 494.60	1 972.82
P-value	0.000	0.023	0.000	0.000	0.000	0.000
Observations	57	57	38	38	38	38

Standard errors in parentheses

*significant at 10%; **significant at 5%; ***significant at 1%

matrix of the residuals and the Breush-Pagan test of independence (not shown in the table) indicate a statistically significant correlation between the errors in the two equations, as should be expected.

As far as the parameters are concerned, we can see that the results are slightly improving when we go from the SUR with all variables (third and fourth columns) to the SUR estimation with the instrumental variables (fifth and sixth columns). In particular, the price of the beer is negatively correlated with the quantity, while the advertising expenditures are able to increase beer demand, given that both variables are statistically significant. Also in this case, the results tell us that beer can be considered as a locally inferior good and as an addictive good, since income elasticity is significantly negative and the past consumption elasticity is high, positive and significant, demonstrating the strong degree (almost equals to one) of complementarity between the past and current beer consumption. Concerning spirits, the explanatory variables have not the same impact. For example, price and income have no significant influence on spirits demand. On the contrary, the past consumption shows a strong effect on demand, while advertising expenditures have a low impact that is also only significant at the 10% level. This proves that spirits consumption is an addictive good because it is not influenced by price and income, while it is strongly influenced by the past consumption, demonstrating also in this case the strict complementarity between the past and current spirits consumption.

CONCLUSION

The consumption of alcohol attracts attention from both the economic and social perspective because of the importance of the alcohol industries and of health risks, social problems and traffic accidents it can create. On the other hand, taxes on alcohol contribute to the state's exchequer. Moreover, information on the nature of the demand for alcohol is key to establishing the individual and socially optimal level of alcohol consumption.

The main goal of this paper was to evaluate the principal determinants of the demand for beer in the Czech Republic, beer being the most popular alcoholic beverage in the country, also because it is the cheapest alcoholic drink (Pyšný et al. 2007; Chládková et al. 2009). We aimed also to determine the effect of advertising and the past consumption on beer demand. To this end, we have modelled the beer demand as represented by a double-log function, which has proven itself to be well suited. Finally, we have utilised the SUR approach to

take into account the interrelationship between beer and spirits, as its substitute demand.

Our econometric analysis indicates that the most important determinants of beer demand are price, income and past consumption. While beer advertising does have an immediate effect on beer demand, the spirits advertising does not have a strong effect in determining beer demand.

Although price elasticity in the US (Alley et al. 1992; Nelson 2003) and the UK (Selvanathan 1989; Duffy 1990) did not drop below –0.4, with the exception of Nelson (1997), which estimated that beer demand in the US reacts to high prices, beer demand in the Czech Republic is much more price-sensitive, with an elasticity from –2.4 to –3.8. However, when we take into account the interaction between the demand for beer and for its substitute using the SUR approach, our price elasticities (with an approximate value of –0.2) are smaller and similar to those of the previous studies.

Income elasticity in the UK and the US (Nelson 1997, 2003) falls between 0.5–0.7 and 0.12–0.25, respectively, according to the studies. In the case of the Czech Republic, however, an increase in income has, in all our estimations, a negative influence on beer demand in favour of spirits, confirming that beer is a locally inferior good.

We can consider the effect of informative advertising on beer demand in the Czech Republic to be negligible, given that the beer industry is mature and the relevant information widespread among consumers. Therefore, we can definitively call the examined advertising effect to be persuasive. As with McGuinness (1980), Walsh (1982) and Johnson (1985) in the case of the UK, our results also demonstrate that the elasticity in advertising is significantly greater than zero. Advertising cross-elasticity only produces a modest positive effect on beer consumption. In general, from the results obtained from this study, we see that advertising, both direct and indirect, increases the product demand. In our estimations, advertising has a stronger effect on demand than it does in other country studies. This means that a specific alcohol advertising campaign induces a positive effect on any alcohol consumption.

We have also found that the past consumption significantly increases the current consumption, demonstrating that the beer and spirits consumption is an addictive behaviour that strongly depends on the previous consumption. In this sense, our results are in line with the empirical estimates of Grossman et al. (1998) on alcoholic addiction in the United States, and with the findings of Benzten et al. (1999) on the demand of four alcoholic beverages (including

beer) in the Nordic Countries. In the latter work, the magnitude of the past consumption parameters assumes the same value of our estimates for both beer and spirits (approx 0.95).

Considering the problems connected with alcohol consumption accompanied with high expenditures, the negative effect of price on beer demand provides the policy-makers with an alternative route towards the reduction in beer consumption. One possibility might be to increase the taxes and thus the final prices to the consumer. The issue of the optimum tax, however, cannot be resolved without a detailed study of the physical costs related to beer consumption, since market prices are not sufficient to cover the medical costs incurred disproportionately by drinkers compared to non-drinkers. This is, however, a study beyond the scope of the present work.

As brought to the fore in other studies, our work also confirms that advertising has a positive effect on beer consumption. If policy-makers want to reduce the negative effects of beer consumption, the introduction of a ban on alcohol advertising could be considered as a tool, also considering the habit forming deriving from the long tradition of Czech consumers in drinking. In fact, we have demonstrated that the past consumption plays a strong role in beer demand in the Czech Republic, confirming Becker and Murphy (1988) theoretical finding that a strong addiction to a good requires a big effect of the past consumption of the good on the current consumption. Our findings are also empirically confirmed by Pyšný et al. (2007) who found that the average consumption of alcohol in the Czech Republic 'is at a higher level than the upper limit for healthy alcohol consumption'. Hence, given the strong role of the consumption capital, as approximated by past consumption in our estimations, in determining beer and spirits demand in the country, both a permanent increase in prices and a ban on alcohol advertising could reduce the degree of complementarity between the past, current and future alcohol consumption, lowering the habit forming of drinking, and the negative externalities it produces. A potential focus for further research could be developing the connection to the demand for substitutes other than spirits and the introduction of the future consumption as an additional determinant of the current consumer demand.

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