Wine consumption in the Czech Republic and the prices of alcohol

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Abstract: Consumption of wine in the Czech Republic has a growing tendency, representing 15.4 litres per capita in 1995 and 20.0 litres per capita in 2012. The goal of this paper is an analysis of the development of consumer demand for wine in the Czech Republic based on the estimation of elasticity coefficients derived from the constructed dynamic model. The overall development in the period 1948–2012 is demonstrated through the linear trend: $QCW_T = -340.77 + 0.1788 \times T + u_T$. The growing consumption of wine was examined in relation to the development of the prices of wine, beer, and rum in the period 1991–2012. The achieved negative values of the own price elasticity coefficients (ranging from –0.2957 to –0.1624) suggest, that there worked normal price reactions. Cross price elasticity coefficients of the gross demand for wine showed complementarity between the consumption of wine and beer or wine and rum. The cross price elasticity of the gross demand for wine related to the price of 10° beer was –0.2757 in average, and –0.2074 in the case of rum.

Key words: consumption trends, dynamic model of demand, own price elasticity of demand, cross elasticity of demand

According to the report of the OIV (Organisation Internationale de la Vigne et du Vin), the wine consumption in the world noted a slight increase in 2012, but stagnated in Europe. In France, though, the consumption in 2012 has increased to 30 million hl, i.e. it has grown annually by 0.9 mil. hl, whereas from the long-term viewpoint, it linearly decreased from 1995 by 0.4 mil. hl per year. Wine consumption has increased also in Germany, annually by 300 thous. hl. A stable consumption was noted in Greece and Portugal. In Spain, there was noted a decrease by 600 thous. hl (6%) against 2011, in Italy, a decrease by 400 thous. hl. Therefore, it can be concluded, that the wine consumption in Europe is relatively stable. Wine consumption in China has grown by 9%, in the U.S.A. by 2%. A growth of consumption was noted in Argentina, RSA, and Australia. On the contrary, e.g. in Chile there was noted a decrease of wine consumption in 2012. Changes in alcoholic drinks consumption are dealt with by a number of authors, e.g. Bentzen (2011) according to whom: "The old, traditional wine producing countries have experienced a heavy decline in the domestic wine consumption and additionally, there has in some cases been a shift towards an increased beer consumption, e.g. the beer consumption now exceeds the wine consumption in Spain."

Wine consumption in the Czech Republic (CZ) annually grows. In 2011, it represented 19.4 l per capita per year. In 2012, there was expected a further growth to 20 l per capita. Reasons for the higher consumption of wine in CR are seen in a change of the lifestyle, which is connected with the prevailing decline from spirits with higher alcohol contents. The CR experiences a gradual growth of the popularity of wine and its drinking becomes an important social phenomenon. People also regard wine as a healthy drink. Some questions of the domestic wine consumption were investigated by Czech authors Pyšný et al. (2007) and Chládková et al. (2009).

In spite of the continuous world leadership of the CR in beer consumption, it has been slightly decreasing, recently. In 2011 it represented 142.5 l per capita per year according to the data of the Czech Statistical Office (CZSO), which was the lowest consumption since 1978. The highest beer consumption was noted in 2005, when it represented 163.5 l per capita per year (the 2011 figure thus represents a 12.8% decrease). Czech brewing industry is analysed in detail e.g.

by Žufan (2007), and Žufan and Stávková (2011). A decreasing trend is also noted in the overall spirits consumption (40%). In 2011, the spirits consumption represented 6.9 l per capita per year (2.8 l in the net alcohol value), when the highest consumption of spirits was noted in 2003, when it represented 8.4 l per capita per year and 3.4 l in the net alcohol value (decrease by 17.1%, in the net alcohol value even by 17.6%). There have also increased prices of all types of alcoholic beverages during these years in CZ. In the period of 1991–2012, the price of a litre of quality white wines ranged between CZK 36.06 in 1991 and 66.10 CZK in 2001. In 2011, the price was CZK 62.88. The price per ½ litre of the bottled beer gradually increased from CZK 4.04 in 1991 to 10.10 CZK in 2011. The price of rum increased from CZK 104.78 in 1991 to 237.08 CZK in 2011.

The question of the influence of price on the purchase behaviour is dealt with by e.g. Damien Wilson (MSc Wine Business, Groupe ESC Dijon Bourgogne) and Anthony Spawton (University of South Australia) (2010). These authors introduced the cues and motivations of the consumers with regard to the response to prices, as well as the variations to this behaviour that have been observed in the empirical data. The wine production industry in Italy and the price competition was dealt with e.g. by Stasi et al. (2010). Their paper explores the Italian wine sector and provides information on the industry structure and its conduct in terms of the market power and price competition.

This article aims to quantitatively assess the impact of the price of alcoholic beverages to the level of wine consumption in the Czech Republic. The development of the annual wine consumption per capita is studied in relation to the consumer price of wine, beer and rum – the price representatives in the area of consumption, see the records of the CZSO. The analysis is performed on the basis of time series of the wine consumption and the prices of the representatives of alcoholic beverages. The time series were taken from the CZSO, for the years 1991 to 2012. For the analysis of cost-consumption relations, there were constructed linear demand models with the dynamic construction, which allow evaluating the own and cross price elasticity of the wine consumption, and thus quantifying the intensity of the examined relationships. Parameter values for the constructed dynamic models of demand for wine were obtained by the least squares method, and the constructed regression models were subjected to the statistical and economic verification. Before analysing the cost-consumption relations, an attention was paid to the evaluation of the longer-term trends in wine consumption in the CR. For this purpose, there was studied the time series of the wine consumption data from 1948 to 2012, which was also taken from the CZSO.

MATERIAL AND METHODS

The analysis of the price-consumption relations in the wine market was done based on the data of the CZSO (the Consumption of alcohol and cigarettes per capita per year, and the Survey of average prices of the selected products – food products).

First of all, there was taken over the time series of the annual wine consumption per capita, from the CZSO database: QCW_T, which is monitored in litres. Within this time series, there were first studied its long-term development tendencies – the Czech wine consumption in 1948–2012. In connection with the analysis of the price-consumption relations within the CR, the time series QVW_T was examined for the period 1991–2012. Shortening of the time series QCW_T was motivated by assuring the comparability of the consumer prices of wine, beer and spirits, which were necessary for the evaluation of the development of wine consumption in the CR. This shortening eliminated the "fixed" prices in the centrally planning (directive) economy of the CR (or Czechoslovakia, at that time).

Further on, there were taken the time series of consumption prices of beer from the CZSO: PB_T (CZK per 0.5 l), and rum: PR_T (CZK per 1 litre), as the price representatives of other alcoholic drinks. Coherently with the analysis of the wine consumption, the time series was also shortened for the period 1991–2012. The time series of the consumer price of wine: PW_T (CZK per 1 litre) was adjusted as an arithmetic average of the price of white wine: PwW_T (CZK per 1 litre) and the price of red wine: PrW_T (CZK per 1 litre), i.e. $PW_T = (PwW_T + PrW_T)/2$. The time series for white wine (PwW_T) was also taken from the CZSO. The time series for red wine (PrW_T) was taken from the market information system of the State Agricultural Intervention Fund (SZIF) and the Situation and Trend Report Wine and Grapes, published by the Czech Ministry of Agriculture.

Thanks to the differentiation of the CZSO evidence (data divided for Czech Republic, Slovakia, and the whole Czechoslovakia), it is possible to perform the evaluation of the price-consumption relationships in 1991–2012 separately for the CR, in spite of its beginning of existence only from the 1st January 1993.

Basic development tendencies in the wine consumption in the CR in 1948–2012, or in the defined partial periods, were indicated through linear trends: $QCW_t = g + h \times T + u_T$.

Due to the aim of this part of analysis being just to indicate the basic development trends in the wine consumption, the constructed models of the linear trend were not statistically tested, and there was only calculated the determination coefficient (r^2). The declaration of the time variable in this and the follow-up analyses was done based on the number of the monitored periods (n), when the starting value was 1: $T = 1, 2, \ldots, n$.

The price-consumption dependences were examined through linear dynamic models of the consumer demand for wine:

$$QCW_T = a_W + b_{WW} \times PW_T + c_W \times T + u_T \quad (1)$$

$$QCW_T = a_B + b_{BW} \times PB_T + c_B \times T + u_T \quad (2)$$

$$QCW_T = a_R + b_{RW} \times PR_T + c_R \times T + u_T \quad (3)$$

Parameters of models (1), (2), (3) were estimated through the OLS method. When verifying the statistical validity of the constructed dynamic models of demand, there was emphasized the determination coefficient: r_1^2, r_2^2, r_3^2. Its statistical validity can be seen in the results of the F-test: $F_1 = F(r_1^2) \wedge \alpha(F_1)$, $F_2 = F(r_2^2) \wedge \alpha(F_2), F_3 = F(r_3^2) \wedge \alpha(F_3)$. Further on, the results of t-tests of the particular parameters were evaluated in the models (1), (2), (3) a (4): $t_{a_W} \wedge \alpha(t_{a_W})$, $t_{b_{WW}} \wedge \alpha(t_{b_{WW}})$, $t_{c_W} \wedge \alpha(t_{c_W})$; $t_{a_B} \wedge \alpha(t_{a_B})$, $t_{b_{BW}} \wedge \alpha(t_{b_{BW}})$, $t_{c_B} \wedge \alpha(t_{c_B})$; $t_{a_R} \wedge \alpha(t_{a_R})$, $t_{b_{RW}} \wedge \alpha(t_{b_{RW}})$, $t_{c_R} \wedge \alpha(t_{c_R})$. Together with the determination coefficient, there were also monitored the values of the autocorrelation coefficients: ρ_1, ρ_2, ρ_3, and the values of the Durbin-Watson statistics: DW_1, DW_2, DW_3 within the statistical verification of the models (1), (2) and (3). The fundamental statistical verification of the constructed models was performed in accordance with Hušek (1999).

In accordance with Nicholson (1992), the own price elasticity of demand was evaluated through the value of the b_{ww} parameter. The coefficient of own price elasticity of the demand for wine was derived in the following way:

$$\varepsilon_{WWT} = b_{WW} \times \frac{PW_T}{QCW_T} \quad (e\text{-}1)$$

Coefficients of the cross price elasticity of the demand for wine related to the price of beer were derived with reference to the same literature in the following way:

$$\varepsilon_{WBT} = b_{BW} \times \frac{PB_T}{QCW_T} \quad (e\text{-}2)$$

The elasticity coefficient (e-2) was calculated based on the b_{BW} parameter. The cross elasticity of the demand for wine related to the price of rum was evaluated through the relation:

$$\varepsilon_{RWT} = b_{RW} \times \frac{PR_T}{QCW_T} \quad (e\text{-}3)$$

for determination of which it was necessary to estimate the b_{RW} parameter.

The gained values of the price elasticity coefficients were also used for the evaluation of the economic acceptability of the constructed dynamic models of demand in the field of wine – see the theory of consumer behaviour, e.g. Maurice and Phillips (1992), Nicholson (1992).

RESULTS I: ANALYSIS OF WINE CONSUMPTION

Wine consumption in the CR in the period of 1948–2012 shows an overall growing trend. The growing trend is clearly demonstrated by the linear trend model:

$QCW_T = -340.77 + 0.1788 \times T + u_T$, which is shown in Figure 1. This figure shows the annual wine consumption per inhabitant. The highlighted linear trend is relatively strong in the terms of the value of the determination coefficient value: $r_2 \times 100 = 80\%$. In accordance with the gradient of the linear trend, the annual increment of wine consumption per capita in the CR represents about 0.18 litres.

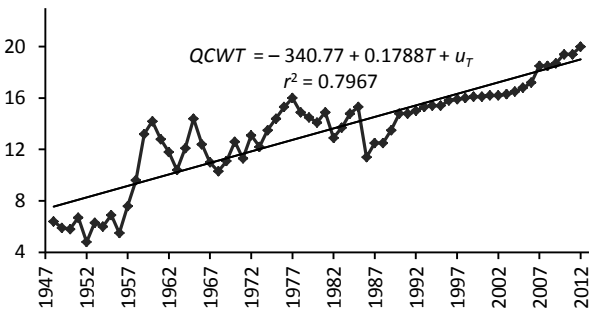

Figure 1. Wine consumption in the Czech Republic in 1948–2012 (litres per capita per year)

Source: (calculations of authors based on the CZSO data)

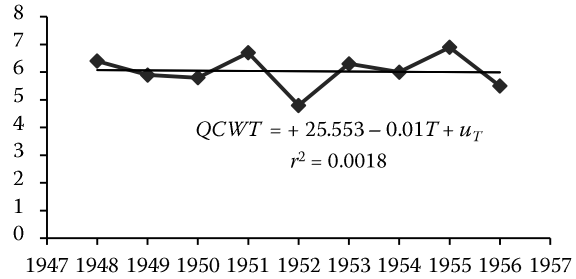

Figure 2. Wine consumption in the Czech Republic in 1948–1956 (litres per capita per year)

Source: calculations of authors based on the CZSO data

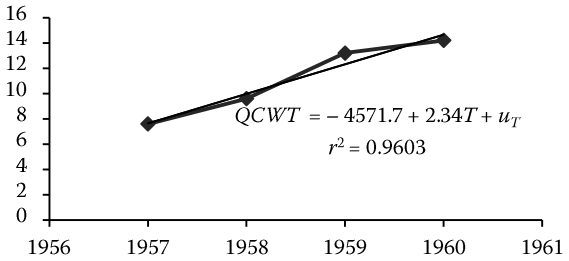

Figure 3. Wine consumption in the Czech Republic in 1957–1960 (litres per capita per year)

Source: calculations of authors based on the CZSO data

Figure 1 also shows that the lowest consumption in the monitored period was noted in 1952, when it represented only 4.8 litres per capita. The highest consumption is noted (based on the estimation of the Czech Ministry of Agriculture) in 2012, when it represented about 20 litres of wine per 1 inhabitant per year. Based on the above mentioned values, it can be concluded, that the current average wine consumption in the CR has grown more than 4 times in comparison with the after-war period. Figure 1, though, also shows that the wine consumption did not always have a growing character. Except for the growth periods, we can also note the periods of stagnation or even decline. In this regard, the whole 1948–2012 period can be divided into several partial periods.

In **1948–1956,** the annual wine consumption was oscillating (except for the 1952) between 5 and 7 litres. After calculating the linear trend $QCW_T = 25.553 - 0.01 \times T + u_T$, we can see that the consumption in this period does not show either growth or a declining trend. The average annual increment is almost zero. Exactly speaking, there is a minimal annual decline – see Figure 2. The determined – almost horizontal – trend line has the determination coefficient of 0.0018, i.e.: $r^2 \times 100 = 0.18\%$

In the following sub-period, i.e. in **1957–1960**, the consumption has gone through a significant growth. The average wine consumption per capita has reached 14.2 litres in 1960, which was 6.6 litres more than in 1957. The annual wine consumption per capita in 1957–1960 is shown in Figure 3, which also shows the linear trend of its development: $QCW_T = -4571.7 + 2.34 \times T + u_T$. The linear growth is relatively very strong based on the calculated determination coefficient: $r^2 \times 100 = 96\%$.

After 1960, i.e. in the period of **1961–1973**, the wine consumption also oscillated, and the consumption develops in waves of various length and sizes. There are no significant growth or decline trends in this period. This partial period can also be characterized by an almost horizontal trend line: $QCW_T = 19.527 - 0.0038 \times T + u_T$ with the determination coefficient value close to zero: $r^2 \times 100 = 0.02\%$, see Figure 4.

In the period of **1974–1977,** there happened another upsurge of the wine consumption. The annual wine consumption per capita has grown from 13.5 litres in 1974 to 16 litres in 1977, which represents a 2.5 litres increase. The wine consumption in this period shows a clear growth trend, which was calculated as: $QCW_T = -1644.6 + 0.84 \times T + u_T$ with the determination coefficient of: $r^2 \times 100 = 99.66\%$, see Figure 5.

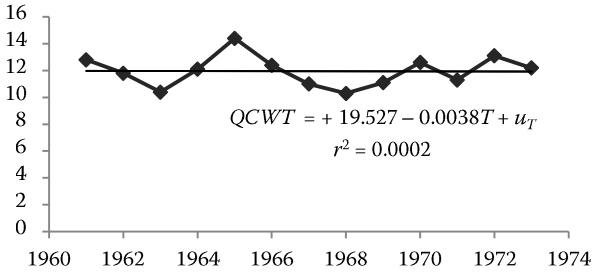

Figure 4. Wine consumption in the Czech Republic in 1961–1973 (litres per capita per year)

Source: calculations of authors based on the CZSO data

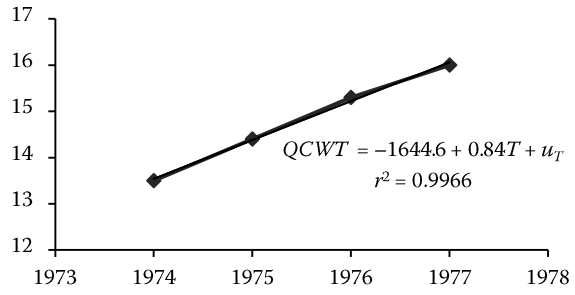

Figure 5. Wine consumption in the Czech Republic in 1974–1977 (litres per capita per year)

Source: calculations of authors based on the CZSO data

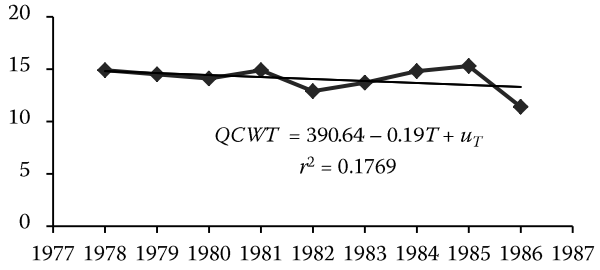

Figure 6. Wine consumption in the Czech Republic in 1978–1986 (litres per capita per year)

Source: calculations of authors based on the CZSO data

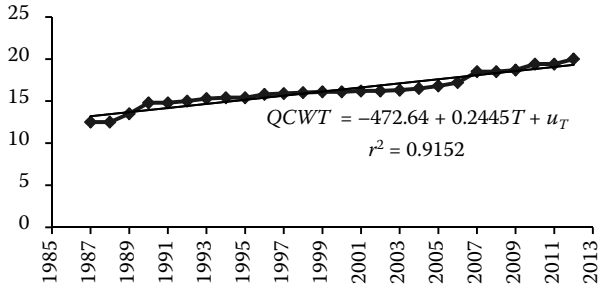

Figure 7. Wine consumption in the Czech Republic in 1987–2012 (litres per capita per year)

Source: calculations of authors based on the CZSO data

In the next period of **1978–1986,** there started to prevail decline tendencies in the wine consumption. In 1986, the annual consumption almost returned back to the level of 1971 (11.3 litres). The highest consumption in this period did not reach 16 litres, i.e. it stayed below the consumption maximum of the previous partial period (1974–1977). The annual wine consumption per capita development is shown in Figure 6, which also shows its declining trend: $QCW_T = 390.64 - 0.19 \times T + u_T$. Determination coefficient of the linear trend model reached the value of: $r^2 \times 100 = 17.69\%$.

The period of **1987–2012** represents a period of another upsurge of wine consumption. This development prevails till the last monitored year. Annual wine consumption per capita has grown from 12.5 litres in 1987 to 20 litres in 2012, i.e. by 7.5 litres. The wine consumption has been growing throughout the whole period. This development including the annual wine consumptions per capita is shown in Figure 7. The determination coefficient of the linear growth trend: $QCW_T = -472.64 + 0.2445 \times T + u_T$ reached the value of: $r^2 \times 100 = 91.52\%$.

RESULTS II: ANALYSIS OF PRICE-CONSUMPTION DEPENDENCES

The growth trend of the wine consumption in the period 1986–2012 (Figure 7) was further examined in connection with the development of consumer prices of alcoholic drinks. This analysis enables to examine the projections of gross demand for wine (Varian 1996). The CZSO data enable to analyse the gross demand in the given consumption area within the CR for the period 1991–2012. In this period, it is possible to evaluate the amount of the consumed litres of wine per 1 inhabitant (QCW_T) depending on the average price per 1 litre of wine (PW_T), or on the price of half a litre of 10° beer (PB_T) and the price of 1 litre of rum (PR_T). For these purposes, there were constructed three regression models of the dynamic gross demand (1), (2), and (3). The construction of these models enabled to quantitatively evaluate the dependence of the wine consumption on its price, or on the price of beer and rum – see the values of the parameters b_{WW}, b_{BW}, b_{RW}. Estimations of the parameters of the constructed dynamic models of

Table 1. Model 1, OLS using monitoring in 1991–2012 (n = 22)

$QCW_T = a_W + b_{WW} \times PW_T + c_W \times T + u_T$			
Parameter	norm. error	*t-criterion*	$\alpha(t)$
$a_W = 17.0791$	0.5947	$t_{a_W} = 28.7195$	$4.08.10^{-17}$
$b_{WW} = -0.0689693$	0.01367	$t_{b_{WW}} = -5.0438$	$7.21{\cdot}10^{-5}$
$c_W = 0.320608$	0.02208	$t_{c_W} = 14.5219$	$9.72{\cdot}10^{-12}$
Mean value of dependent variable	16.7955	norm. error of dependent variable	1.561586
Sum of square residues	2.3973	norm. error of regression	0.3552
Determination coefficient	$r_1^2 = 0.9532$	adjusted determination coefficient	0.9483
F-criterion	F_1 (2.19) = 193.43	probability level	$\alpha(F_1) = 2.34{\cdot}10^{-13}$
1st order autocorrelation	$\rho_1 = 0.5741$	Durbin-Watson statistics	$DW_1 = 0.8632$

Table 2. Model 2, OLS using monitoring in 1991–2012 (n = 22)

$QCW_T = a_B + b_{BW} \times PB_T + c_B \times T + u_T$			
Parameter	norm. error	t-criterion	$\alpha(t)$
a_B = 16.3115	1.3550	$t_{a_B} = 12.0384$	< 0.00001
b_{BW} =–0.438751	0.2758	$t_{b_{BW}} = -1.5911$	0.12810
c_B = 0.336372	0.07089	$t_{c_B} = 4.7451$	0.00014
Mean value of dependent variable	16.7955	norm. error of dependent variable	1.5616
Sum of square residues	4.9479	norm. error of regression	0.5103
Determination coefficient	r_2^2 = 0.9034	adjusted determination coefficient	0.8932
F-criterion	$F_2(2.19)$ = 88.822	probability level	$\alpha(F_2) = 2.28 \cdot 10^{-10}$
1st order autocorrelation	ρ_2 = 0.8322	Durbin-Watson statistics	DW_2 = 0.4442

the gross demand for wine including the results of their elementary statistical verification are included in Tables 1–3.

In case of the model (2), see Table 2, there was found an inconclusive b_{BW} parameter, which – owing to the objective of this paper – represents a substantial issue. The analysis of the cross price-consumption dependences in the wine consumption was therefore lead through the regression model (4), which replaced the models (2) and (3). This model enabled an alternative estimation of cross price parameters of the gross demand for wine: b_{BW} and b_{RW}:

$$QCW_T = a + b_{BW} \times PB_T + b_{RW} \cdot PR_T + c \times T + u_T \quad (4)$$

Parameters and the elementary statistical verification of the model (4) are shown in Table 4.

Within the elementary statistical verification, we can consider the model of the wine consumption dependence on its price, the model (1), and the model of the wine consumption dependence on the price of 10° beer and the price of rum, the model (4), to be acceptable – see the performed F-tests and t-tests. On the other hand, we cannot neglect the fact that in the model (1), we can see a relatively strong 1st order autocorrelation, shown by the value of ρ_{WW} (0.5741) and DW_{WW} (0.8632). The model (4) shows better values of ρ_W (0.3602) and DW_W (1.2038), but neither this are without objections. The presence of a statistically significant time delay within the examined price-consumption dependences opens the need of a further examination of the behaviour in wine consumption in the CR. From the first sight, there is offered a relatively easy explanation – the purchases for "archivation", i.e. the postponed consumption, but this is definitely not a massive trend. The postponed consumption of wine in the case of Czech consumers has rather a quarterly or half-annual delay connected with the purchases of wine in campaigns. These delays, though, cannot be analysed based on the data used

Table 3. Model 3, OLS using monitoring in 1991–2012 (n = 22)

$QCW_T = a_R + b_{RW} \times PR_T + c_R \times T + u_T$			
Parameter	norm. error	t-criterion	$\alpha(t)$
a_R =15.8507	0.5877	$t_{a_R} = 26.9703$	< 0.00001
b_{RW} =–0.0157055	0.005222	$t_{b_{RW}} = -3.0077$	0.00724
c_R = 0.345425	0.04216	$t_{c_R} = 8.1923$	< 0.00001
Mean value of dependent variable	16.7955	norm. error of dependent variable	1.5616
Sum of square residues	3.7986	norm. error of regression	0.4471
Determination coefficient	r_3^2 = 0.9258	adjusted determination coefficient	0.9180
F-criterion	$F_3(2.19)$ = 118.5706	probability level	$\alpha(F_3) = 1.85 \cdot 10^{-11}$
1st order autocorrelation	ρ_3 = 0.6502	Durbin-Watson statistics	DW_3 = 0.6895

Table 4. Model 4, OLS using monitoring in 1991–2012 (n = 22)

$QCW_T = a + b_{BW} \times PB_T + b_{RW} \times PR_T + c \times T + u_T$			
Parameter	norm. error	*t-criterion*	α(*t*)
a = 19.0612	1.2149	t_a = 15.6901	$6.06 \cdot 10^{-12}$
b_{BW} = –0.605991	0.2091	$t_{b_{BW}} = -2.8980$	0.00959
b_{RW} = –0.018293	0.004519	$t_{b_{RW}} = -4.0479$	0.00075
c = 0.5161	0.06891	t_c = 7.4899	$6.18 \cdot 10^{-7}$
Mean value of dependent variable	16.7955	norm. error of dependent variable	1.5616
Sum of square residues	2.5901	norm. error of regression	0.3793
Determination coefficient	$r_4^2 = 0.9494$	adjusted determination coefficient	0.9410
F-criterion	$F_4(3.18)$ = 112.6268	probability level	$\alpha(F_4) = 7.46 \cdot 10^{-12}$
1st order autocorrelation	ρ_4 = 0.3602	Durbin-Watson statistics	DW_4 = 1.2038

(the situation and trend reports document the price levels of industrial producers together with the sold amounts on an annual basis).

The construction of models or the composition of included variables was subordinated to the possibility to analyse the influence of the prices of alcohol on the wine consumption. The influence of the prices of wine on its consumption in 1991–2012 was examined through the model (1): $QCW_T = 17.0791 - 0.06897 \times PW_T + 0.3206 \times T + u_T$. In accordance with the calculated negative value of the parameter in the price of wine (b_{WW} = –0.0689), it can be concluded that the consumer price of wine negatively influences its consumption, which is in accordance with the law of declining demand, see Nicholson (1992). More precisely, when the average annual consumer price of wine grows by CZK 1 per litre, there can be expected an annual decline of the wine consumption per capita by 0.07 litres in CZ. Cross price correlations in gross demand for wine in 1991–2012 were evaluated through the model (4): $QCW_T = 19.0612 - 0.6060 \times PB_T - 0.01829 \times PR_T + 0.5161 \times T + u$. This additionally constructed model replaced the originally considered models (2) and (3), because the model (2) showed a statistically insignificant b_{BW} parameter of –0.438751 according to the *t*-test. The level of statistical significance of the given parameter was lower than 88%. In accordance with the estimations of price parameters in the model (4), it can be concluded that the wine consumption is negatively influenced by the prices of other categories of alcohol, i.e. from the position of the consumer behaviour theory, there exist complementary relations in the given direction. If the price of 10° beer increases by CZK 1 per bottle (half litre), the annual consumption of wine per capita decreases by more than 0.6 litres. In case of an increase of the price of 1 litre of rum by CZK 1, there can be expected a decrease of the annual wine consumption by less than 0.02 litre per capita.

The price-consumption relations in the wine consumption were evaluated above all through the coefficients of the own and cross price elasticity of the gross demand. The formula for the quantification of the own price elasticity coefficient (e-1) was constructed in accordance with the calculated parameters in the dynamic demand model (1) in the following way (5):

The construction of calculation of the cross price elasticity coefficient of the demand for wine related to the price of 10° beer (e-2) based on the parameters of the model (4) resulted in the formula (6).

$$\varepsilon_{WWT} = -0.0689693 \times \frac{PW_T}{17.0791 - 0.0689693 \times PW_T + 0.320608 \times T} \quad (5)$$

$$\varepsilon_{WBT} = -0.605991 \times \frac{PB_T}{19.0612 - 0.605991 \times PB_T - 0.018293 \times RB_T + 0.5161 \times T} \quad (6)$$

$$\varepsilon_{RWT} = -0.018293 \times \frac{PR_T}{19.0612 - 0.605991 \times PB_T - 0.018293 \times RB_T + 0.5161 \times T} \quad (7)$$

The evaluation of the price elasticity of the demand for wine related to the price of rum, see the coefficient (e-3), was done based on the formula (7) which was supplied with the values of parameters from the demand model (4). The calculated coefficients of demand elasticity in the wine consumption in the CR for the particular years of the monitored period (1991–2012) are shown in Table 5.

The calculated values of coefficients of the own price elasticity (5) show that in 1991–2012, there operated the common price reactions within the gross demand for wine in the CR: $\varepsilon_{WWT} < 0$. Intensity of these price reactions was in the interval of $\langle -0.2957; -0.1624 \rangle$. The average intensity of the price elasticity of wine consumption in the monitored period was –0.2357. In this regard, it can be concluded that in 1991–2012 Czech consumers reacted to a one-per cent growth of the price of 1 litre of wine by decreasing its consumption by 0.24% in average. Based on the values of the ε_{WWT} coefficient, we can see that the price-consumption reactions can be characterized as inelastic.

Table 5. Price elasticity of the gross demand for wine

Year	ε_{WWT}	ε_{WBT}	ε_{RWT}
1991	–0.1712	–0.1609	–0.1260
1992	–0.1624	–0.1951	–0.1496
1993	–0.1892	–0.2390	–0.1626
1994	–0.1919	–0.2395	–0.1663
1995	–0.2088	–0.2443	–0.1651
1996	–0.2255	–0.2527	–0.1646
1997	–0.2476	–0.2617	–0.1614
1998	–0.2527	–0.2747	–0.1853
1999	–0.2496	–0.2839	–0.1793
2000	–0.2593	–0.2776	–0.1825
2001	–0.2957	–0.2913	–0.2370
2002	–0.2865	–0.3095	–0.2481
2003	–0.2761	–0.3145	–0.2426
2004	–0.2721	–0.3048	–0.2416
2005	–0.2595	–0.2945	–0.2431
2006	–0.2328	–0.2895	–0.2640
2007	–0.2265	–0.2891	–0.2732
2008	–0.2286	–0.3007	–0.2657
2009	–0.2292	–0.2960	–0.2400
2010	–0.2367	–0.3086	–0.2213
2011	–0.2479	–0.3148	–0.2231
2012	–0.2346	–0.3237	–0.2207

Source: calculated by the authors

The coefficients of the cross price elasticity of the gross demand for wine (6) and (7) implied a certain complementarity between the consumption of wine and beer: $\varepsilon_{WBT} < 0$, or wine and rum: $\varepsilon_{WRT} < 0$. The cross price elasticity of the gross demand for wine related to the price of 10° beer oscillated in 1991–2012 between –0.3237 and –0.1609. Its average value within this period was –0.2757. In accordance with this value, it can be concluded that Czech consumers reacted to one-per cent increase of the price of 10° beer by decreasing the consumption of wine by 0.27% in average. The cross price elasticity of the gross demand for wine in relation to the prices of rum oscillated in 1991–2012 between –0.2732 to –0.1260. The average intensity of these price-consumption reactions reached the value –0.2074. Thus, the consumption of wine recalculated per 1 Czech inhabitant in 1991–2012 in reaction to one-per cent increase of the price of rum decreased in average by 0.21%. When interpreting and specifically when comparing the achieved results, it is necessary to notice that the income of consumers was not taken into account when analysing the gross demand for wine (Deaton 1986).

CONCLUSIONS

Wine consumption in the Czech Republic shows a growing trend. This positive development in the period of 1948–2012 can be demonstrated through the linear trend: $QCW_T = -340.77 + 0.1788 \times T + u_T$. In accordance with the value of the gradient of this linear trend model, the annual increment of the wine consumption per capita represents approximately 0.18 litres. Within the period of monitoring, the lowest consumption was recorded in 1952, when one inhabitant consumed only 4.8 litres of wine per year. The highest consumption was noted in the last monitored year (2012), when according to the estimation of the Czech Ministry of Agriculture, it represented 20 litres per year. The current level of wine consumption in the CR reaches about the quadruple of the after-war level. The development of wine consumption within the period of monitoring, though, cannot be described as continuously growing. Besides the periods of the consumption growth, there were also periods, when the consump-

tion stagnated or even declined. A stagnating trend (horizontal linear trend) was found in the period of 1948–1956, and similarly (even though on a double level) in the period of 1961–1973. A decline of wine consumption was noted in 1978–1986. The growth of consumption prevailed in the periods 1957–1960, 1974–1977, and 1987–2012.

The growing consumption of wine was examined in relation to the development of the prices of alcohol, specifically the prices of wine (the average price of white and red wine without the varietal differentiation), the prices of 10° beer, and rum. When evaluating the prices of the above-mentioned alcohol and their influence on the wine consumption, or evaluating the price-consumption relations in the gross form, there were used especially the elasticity coefficients. The intensity of the consumer reaction in wine consumption related to the changes of its price was evaluated through the coefficient of the own price elasticity of the gross demand for wine, ε_{WWT}. The influence of price changes of 10° beer and rum on wine consumption was analysed through the coefficient of the cross price elasticity of the gross demand for wine, i.e. ε_{WBT}, ε_{WRT}. The achieved negative values of the own price elasticity coefficients suggest that in 1991–2012, there worked normal price reactions within the gross demand for wine in the CR. The intensity of these price reactions oscillated between –0.2957 to –0.1624. The price-consumption reactions thus had an inelastic character. The average intensity of the price elasticity of the wine consumption in the monitored period was –0.2357. Thus, in 1991–2012 the Czech consumers reacted to one-per cent increase of the wine prices by an average decrease of consumption by 0.24%. Thus, the reaction of consumers on price increases does not cause any dramatic decline in the wine consumption.

The cross price elasticity coefficients of the gross demand for wine showed a certain complementarity between the consumption of wine and beer, or wine and rum. The cross price elasticity of the gross demand for wine related to the price of 10° beer ranged between –0.3237 and –0.1609, in 1991–2012. Its average level was –0.2757 in the monitored period. In accordance with the reported value, it is possible to conclude that Czech consumers reacted to one-per cent increase of price of 10° beer by decreasing the wine consumption by 0.27% in average. The cross price elasticity of the gross demand for wine in relation to the changes of the prices of rum ranged between –0.2732 to –0.1260. The average intensity of these price-consumption reactions reached the level of –0.2074. Thus, in 1991–2012 the wine consumption per capita declined as a result of one-per cent increase of the price of rum by 0.21% in average. Both categories of the examined cross price-consumption reactions can thus be also considered inelastic. The finding that the cross elasticities are negative can be interpreted as a recommendation for the retailers that an increase of the price of the cheaper type of drink does not lead to a decline of the sales of the more expensive one.

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