ANALYSIS OF FLOWERS PRODUCTION AND CONSUMPTION DETERMINANTS IN CZECH REPUBLIC

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Abstract

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The paper deals with an analysis of economic factors which affect production and consumption of flower branch products. It answers scientic questions set on base of the fact that this branch started to get in a centers of attention and experiences growth again. The paper uses both the linear and the nonlinear regression models results of which are instrumental to recognition of practical problems in the monitored area. The most important surveyed factor influencing the production appears an amount of covered areas used for growing. The use of this production factor was decreasing till 2004; only in the following period growing areas have been enlarged. Despite the fact the decrease in covered space leads to an increase in production thanks to growing intensification of the production. Subsidies to farmers provided by the European Union in a form of direct payments SAPS affect the production positively, however, with a lower sensitivity than the intensively used growing area. Basic determinants of the flower consumption monitored in expenditures for the flowers are among others the price and the income. Because a significant part of the price is the value added tax the VAT rate was used as a representative explanatory variable. Its change will influence the consumption with a lower sensitivity than the variable of the income. In the last part of the paper, a behaviour of consumers divided in groups according to amount of income was analyzed. A saturation level was determined in the commodity flowers in consumers in a salaried employment in 2010.

Keywords: direct payments SAPS, covered areas, value added tax, income elasticity, econometric modeling, saturation level

INTRODUCTION

In the world, same as in the Czech Republic, the flower production and consumption has its essential and traditional place.

The floriculture is a full-fledged part of Czech agriculture; flower production was at the forefront on European markets above all in the period between the world wars. After a decay coming in the 1950's, this branch successfully developed most of all thanks to freer conditions in trading. After 1989, foreign export firms make use of difficulties brought by a transformation of centrally controlled economy, and only from 1997 an increasing trend can be seen both in the flower production and in the consumption.

The Common Agricultural Policy of the European Union, whose integral part is also the Czech Republic since 2004, aims to create a multifunctional sustainable and competitive agriculture. The branch dealing with decorative flower growing, whether it is woody ornamentals or flowers, belongs undoubtedly in these long-term development trends of the common agricultural policy.

Flowers in all their forms are not only a beautiful present or a decoration, but recently above all thanks to still wider assortment in each season they are also an essential and very pleasant part of common life.

It is necessary to be aware of what is hidden behind the beauty of above all imported flowers. Structural

changes in flower industry bring together problems arisen by excessive use of agri-chemical means like pesticides, fungicides and artificial fertilizers whose impact on the environment has fatal consequences (Denen-Schmutz *et al.*, 2009; Harrison, 2003). Other problems seems to be unethical treating with cheap labour and unsuitable work conditions in the Third World countries where owing to globalization this agricultural branch shifts (Maloba, 2008; Cross *et al.*, 2009).

Reasons and consequence of flower purchase are analysed in many social-environmental studies. Already in 1995, in a book The Game of the Rose Maharaj and Dorren (1995) draw attention to a necessary change in consumers' behaviour. According to the Association of Flower Producers and Florists, the Czech consumer still increases its consumption and is willing with growing standard of living to invest in flower purchase still bigger amount of money. However, flower consumption does not mean only a luxury present or handsome consideration.

Problems of consumer behaviour on European market are dealt with a number of authors who use methods of statistical analysis for an empirical investigation. For example Schmidt (1996) who classified consumers according to preferences in 3 groups on German flower market. The first group of consumers decides according to a price and most often buy in large shopping centre or in chain stores. The second range of consumers, which further increases, are people who prefer visually interesting cut and pot flowers of better quality. These purchase above all in specialized shops. The third and still decreasing place is taken by the final customer demanding high-quality products and to them appertaining floristic service.

Other approach to research of customer behaviour was dealt by Oppenheim (1996) who used mean-end analysis to find out an influence of various characteristics of cut flower product on customer behaviour. On base of empirical data je states that a significant influence is shown just by non-market factors; specially of psychological character.

Batt and Pool (2004) were engaged in consumer preferences in West Australia; they investigated a frequency of flowers purchase, occasions for which flowers are bought, and a price which consumers are willing to pay. He attaches importance also to a place where the purchase is realized. Their results can be summarized in a message that most respondents buys flowers less than four times a year and only one of five buyers is willing to pay more than 20 $ for special occasions.

A wide investigation was carried out by Huang and Yeh (2009) who classify consumers according to frequency of purchase and preferences into three groups: heavy, medium and light consumers. Heavy consumers prefer psychological factors to social ones. The most important reason for purchase is emotional matters, satisfaction at purchase, liking for heterogeneous and new varieties of flower

products. This group solves a flower price on the last place.

Other questionnaire survey which analysed flower market in Greece was undertaken by Tzavaras, Tzimitra-Kalogiani and Bourlakis (2010). This team researches above all socio-economic factors obtained from personal meetings. Beside social factors, which represent reasons for purchases of type: flower as a present, or on occasion of function or religious event, they state that a significant influence was shown by demographical indicators as a sex and an education.

Italian flower market was described thanks to an author team Schimmenti, Galati, Borselino and Tinervia (2012) who classified basic factors influencing consumption of cut and pot flowers into five groups, i.e. buyers according to: a price, a motivation to buy, a frequency of purchase, a place of purchase, and characteristics of product with references to authors who dealt with that in more details. A result of their research was that most of inquired respondents is willing to spend more than 10 € and above all for pot flowers with a frequency of purchase 1–6 times a year. In their study they state that buyers attach a big influence on decision making on purchase to an appearance of flowers and possible inadequacies, and then a price follows. Certificates and origin of the product is appreciated only by a fractional part of inquired respondents; an influence of this factor has not been confirmed.

The aim of paper is to identify, quantify, and evaluate an influence of economic factors which share in changes in production and consumption of Czech flower growing.

From a viewpoint of production it is dealt with evaluation of significance of area of which flower growing enterprise dispose, and whether direct subsidies in the form of SAPS support development of this marginal part of agricultural basic industry.

In a part which investigates consumer behaviour, an influence of determinants disposable income and VAT rate is considered. Structural parameters of these explanatory variables are introduced both in absolute, and relative units in the form of elasticity coefficients.

A partial aim in this part is an evaluation of behaviour of a consumer who is represented by household of employees and findings what sum for flowers they would be willing to spend in comparison with a sum which they spend now.

In connection to the set aims, the following methodological procedure is applied leading to their fulfilment.

An analysis of behaviour of a consumer and a producer is carried out in several ways. One of them is a statistical evaluation of primary data on base of empirical investigation which uses questionnaires obtained from personal meetings, telephone interview, or governed interview end so on. In such way obtained primary data can be processed by the help of quantitative and qualitative statistical methods.

Other approach which enables evaluation of above all economic factors affecting the chosen endogenous variable is an economic or econometric analysis which can use both the primary and the secondary data. This way to observe the given problems has not been sufficiently used yet.

MATERIAL AND METHODS

In relation of factors affecting the flower production it can be generally stated that these are the same as in any other business area. So, for the analysis needs the author consider labour forces, a capital, land, in agriculture also climatic conditions, and last but not least also scientific and technical development or a dispositive factor.

For the consumption area it is possible to determine groups of factors which we call:
● market,
  ○ economic,
  ○ other,
● non-market,
  ○ psychological,
  ○ social,
  ○ demographical,
  ○ cultural.

In the market factors it would be possible to rank economic factors which are represented above all by a product price, a consumer's income, demand and supply. In certain cases, the key factor can be a development of economic cycle with all consequences. Other factors can include a quality, an origin, a life of the product, and fashionable trend.

The non-market factors can be divided in groups of factors evaluated as psychological which includes emotional behaviour of individuals when they buy standard, but also atypical or new flower products for their own pleasure and sensorial enjoyment. Other reason can be an expression of emotion of feeling (profession of love, the joy of meeting, an apology, a request or thanks etc.).

Social factors result from a referential group which affects the consumer, but also from a social role and status. They buy flowers as a present on various social and religious occasions like for example weddings, funerals, anniversaries etc. Thanks to these factors it is necessary in flower consumption to count on seasonal swings which show both in product prices and the purchased amount.

From the mentioned view only economic factors were selected which are suitable for chosen approach of econometric modelling and whose values were available from official secondary data sources. Quantification of non-market factors would demand wider and time and finance consuming empirical investigations.

To find out and to quantify market influences, respective economic factors, an econometric analysis was used whose tool is an economic and subsequently an econometric model.

Econometric models need to be declared in the following way:

$$PROD = f(AREA, SAPS)$$

$$SPOT = f(DEFPRIJ, SAZBADPH)$$

where
PROD ....a flower production in CR in mil. CZK,
SPOT ....a flower consumption in CR in CZK/person/year,
AREA...............covered areas in ha,
SAPS ....direct payments to farmers in 100 CZK/ha,
DEFPRIJ ....a deflated income in thous. CZK,
SAZBADPH ...a value added tax rate in %.

Background data represent secondary data found out from available official sources, e.g. from the Czech Statistical Office and the Ministry of Agriculture. Year time series are used for the period 1994–2010.

The explanatory variable VAT rate can be considered a less suitable variable from a viewpoint of its variability. Regarding the fact that in the last 7 years it changed almost every year it is possible to count on it in a standard way. Other factor which speaks in favour of this decision is the fact that statistics monitor prices only in four the most sold kinds of flowers (rose, carnation, gerbera and Saintpaulia); re-counted weighted price would be a distorted variant apart from the fact that a seasonal fluctuation happens in prices.

For an analysis of economic factors which influence the production and consumption of flowers pieces of knowledge of the classical linear regression model (LRM) in a basic form were used:

$$Y_t = \beta_1 X_{1t} + \beta_2 X_{2t} + \ldots \beta_k X_{kt} + u_t, \qquad (1.1)$$

u_t................a random component,
β_k ....j-th regression coefficient or a structural parameter ($j = 1, 2, \ldots, k$),
X_{it}..............an explanatory (exogenous) variable, regressor ($i = 1, 2, \ldots, k$),
Y_t...............an explained (endogenous) variable, regressand.

The above mentioned model serves to expression of an absolute influence of exogenous variable when a unit change of these variables causes a change in an endogenous variable expressed by a regression coefficient in the given units.

For a relative expression of the influence of particular variables in % these variables enter in the model in a logarithmic transformation.

The calculated models have to be tested whether they meet basic assumptions of qualities of the random component so that to provide impartial and consistent estimations of model parameters with use of the ordinary least squares method (OLSQ) (Hušek, 2007). This method provides the best estimated parameters just when following assumptions are met:

- E(u) = 0,

  the mean value of residual component is zero for all t.

- E(u.u') = σ²Iₙ,

  a dispersion of residual component is constant and final for all t.

- E(uₜuₛ) = cov(uₜuₛ) = 0,

  residual components are mutually uncorrelated.

- a nonrandom matrix X containing regressors has lineary independent columns.

The principle of OLSQ method is to find parameters which minimize a sum of squares of deviations of theoretical values of explained variable from their real values.

For s statistical verification of calculated linear models an investigation of following examinations is made:

- a conformity of the estimated model with real data,
- a value of dependence tightness in a form R^2 – a coefficient of multiple determination,
- a significance testing of parameters by the help of t-test.

For an econometrical verification of particular equations it is used:

- a testing of multicolinearity by a method VIF,
- Durbin-Watson test of autocorrelation of residues,
- Breuch-Pagan test of heteroscedasticity,
- Jarque-Bera test of a normal distribution of random component,
- Reset test for determination of suitable function form.

In the part flower consumption the knowledge of nonlinear demand functions is used which should meet these assumptions:

- an expression of such an amount of income under which a demand for a certain products does not occur at all,
- it has to follow a tendency aiming at saturation with achievement of a certain amount of income,
- in a random income amount it must not express negative spending for consumption.

Most of these assumptions are met by so called Törnquist functions:

1. $y_i = a_1 \dfrac{x_p}{a_2 + x_p},$ (1.2)

2. $y_i = a_1 \dfrac{x_p - a_3}{a_2 + x_p},$ (1.3)

3. $y_i = a_1 x_p \dfrac{x_p - a_3}{a_2 + x_p}.$ (1.4)

Parameters a_1 and a_2 of these functions are estimated by a nonlinear method of least squares which starts from initial estimation of parameters which are iteratively innovated. The iterations continue so long until set convergence criterion is achieved.

For a relative expression of relation between the consumption (y_i) and income (x_p) a coefficient of elasticity was used for which the following figure has been derived:

$$E_{ii} = \frac{x_p(a_2 + a_3)}{(a_2 + x_p)(x_p - a_3)}.$$ (1.5)

RESULTS AND DISCUSSION

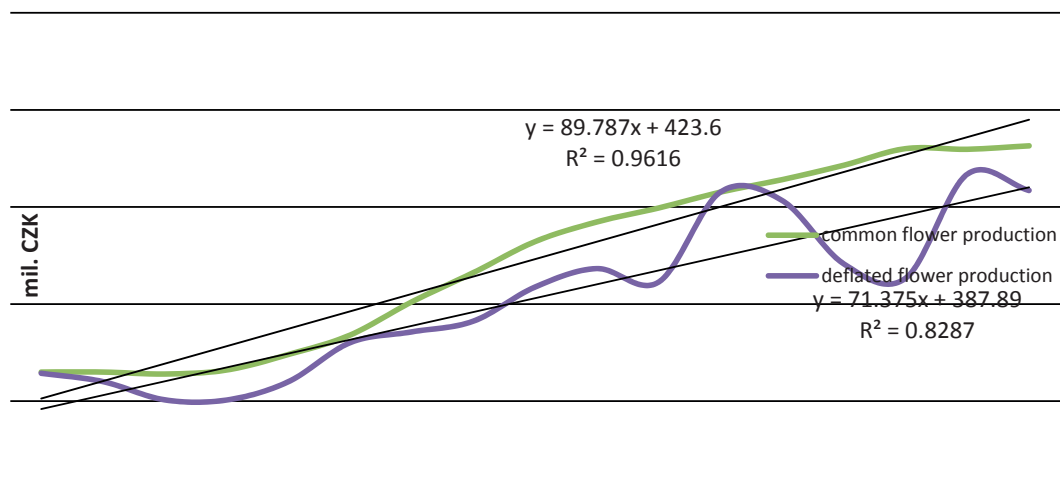### Analysis of Flower Production in the Czech Republic in 1994–2010

Growing of flowers and woody ornamentals in the Czech Republic has its unsubstitutable place in the agricultural basic industry, not only for its long-term tradition, but also for a share in the gross plant production. According to data of the Czech Statistical Office monitored in constant prices the share of growing of woody ornamentals, flowers and their seeds increased in the total production from the original 2.4% in 1991 to 6.6% in 2008. After this year, probably as a consequence of the world economic crisis, a decrease has happened to the present value of 5% share. This data is comparable with the commodities potatoes, maize for grain, or sugar beet. A commodity fruit takes only half of the share in plant production than the monitored production of woody ornamentals and flowers.

According to the Fig. 1 it is possible to state that an increase in flower production happens annually, approximately by 90 mil. CZK counted in current prices. Taking into account year-on-year changes in production input prices with use of an agricultural producer price index then the flower production grows on average by almost 72 mil. CZK.

Production factors influencing the production can be generally described as work, so as a number of people working in the given area or businesses dealing with flower growing; further, a paid-in capital measured by a value of fixed assets or its change and an amount of cultivated area in the form of covered and outdoor areas.

Accessible supportive data provide information only about a structure and a development of growing areas, see the Fig. 2. To determine other production factors it would be necessary to make more thorough investigation because a situation and prospective report of the Ministry of Agriculture monitored number of employees in 1999 for the last time and only in the form of estimation.

From 1994 to 2004 the development of growing areas shows a gradual decrease on average by 1 ha per year; however, in the following period from 2004 the situation has changed and an annual increase by 0.8 ha has happened. The year 2004 is for this agricultural area a year of changes in the form of introduction of direct subsidies – single payments

$y = 89.787x + 423.6$
$R^2 = 0.9616$

mil. CZK

common flower production

deflated flower production
$y = 71.375x + 387.89$
$R^2 = 0.8287$

1: *Trend of flower production in the Czech Republic*
Source: Flower Growers and Florists Association of the ČR and own calculations

covered areas in ha
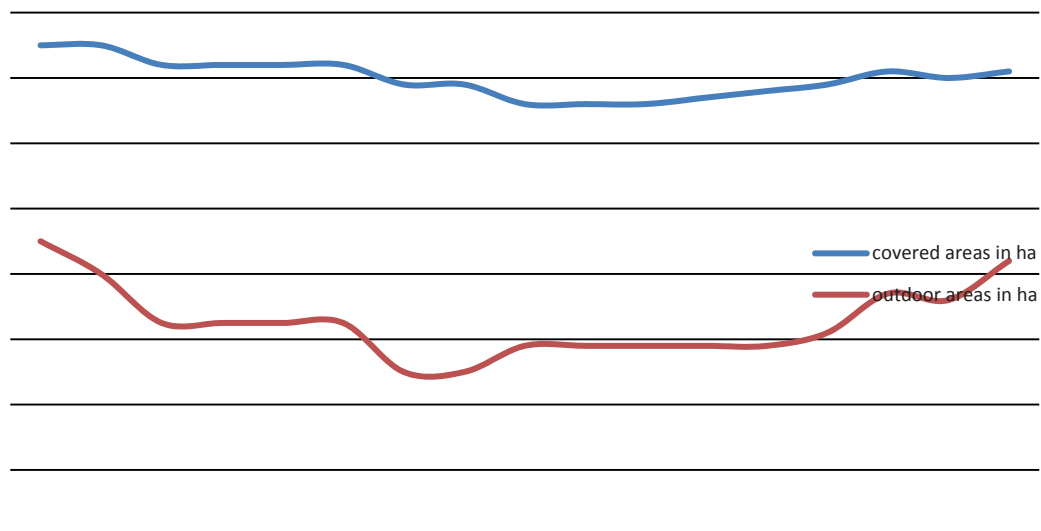
outdoor areas in ha

2: *Development of covered and outdoor areas for flower growing*
Source: Flower Growers and Florists Association of the ČR and own calculations

mil. CZK/ha of covered area

$y = 0.5622x + 2.9054$
$R^2 = 0.8215$

flower production intensity
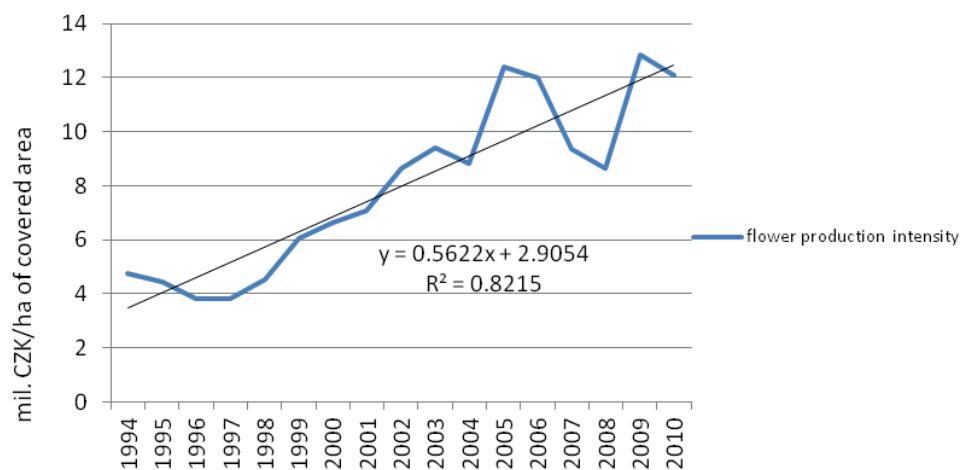
3: *Development of flower production intensity in the ČR*
Source: Flower Growers and Florists Association of the ČR and own calculations

I: *Comparison of indicators of flower production intensity*

Country	Intensity in mil. €/ha of covered area
Czech republic	0.84
Netherlands	0.86
Germany	0.73
Poland	0.071

Source: Own calculations

per area of agricultural land. This magnitude was included in a further research of structural analysis of flower production.

From the above mentioned knowledge it is obvious that this area of agricultural production has significantly increased the growing intensity. The proof is a resulting indicator of intensity calculated as a share of flower production per hectare of covered area which took the value 12.1 mil. CZK in 2010. According to calculations showed in the Fig. 3 it is possible to say that the production from 1 ha of covered area grows in every next period by 562.2 thous. CZK.

To compare this indicator with selected countries in the framework of the European Union it is necessary to transfer the value production indicator from Crowns to Euros. According to data processed by the Flower Growers and Florists Association the Czech Republic did not do too badly in 2010. The proof is the Tab. I.

Modelling of Flowers Production in the ČR

To quantify relations between the production and covered areas together with a direct support of farmers in a form of payments SAPS a simple linear regression model was used results of which are shown in the Tab. II.

The production function was estimated both in the linear and the power form. From a viewpoint of economic verification of the model it can be stated

that the production will increase by 57.69 mil. CZK providing decrease in covered areas by 1 ha. This finding confirms a significant intensification in the given branch. Contrary to covered areas the increase in direct payments by 100 CZK/ha would support production by 17.3 mil. CZK.

The advantage of power function is the fact that from estimated parameters it is possible to determine unambiguously a sensitivity of a reaction of an endogenous variable to 1% change of an explanatory or exogenous variable.

From the results of regression model it is possible to presume that the intensification of production has a bigger influence; it will bring more than 16% increase in the production, if the area decreases by 1%. In spite of that the increase of direct payments SAPS by 1% will invoke almost the same reaction in flower producers. This branch of agriculture will support increased subsidies, but with not too high response. So, it is up to the agrarian policy of the state whether it wants to struggle for development of this enterprise area in a form of also other kinds of supports or financial tools, as national complementary payments TOP-UP or spending from the European Agricultural Fund for Rural Development.

The statistical model of production was dynamized by inserting delayed endogenous variable and its results confirm that subsidies in this branch have only a marginal role. This is understandable because areas on which the realization is carried out are of a smaller extent maximally in tens of hectares. According to the above mentioned, the variable SAPS is not statistically verified and its influence on the production is not confirmed. In contrast to the delayed production which shows itself with positive impact and means that if the production grows in the foregoing year, in all likelihood it will grow also in the following year.

II: *Estimation of parameters of flower production model*

Exogenous variable	Parameter	Stand. error	t-stat	p-value	R^2	DW statistics	LMF	Number of observations
Endogenous variable of flower production in mil. CZK (PROD)								
constant	8334.61	1394.00	5.979	3.38e-05***				
AREA	−57.6923	10.6505	−5.417	9.08e-05***				
SAPS	0.173075	0.022094	7.834	1.75e-06***	0.89	2.53		17
Endogenous variable of flower production in mil. CZK (logPROD)								
constant	78.8950	45.5173	1.733	0.1581				
l_AREA	−16.2871	10.0720	−1.617	0.1812				
l_SAPS	0.939944	0.473791	1.984	0.1183	0.51	2.23		17
Endogenous variable of flower production in mil. CZK (PROD)								
constant	2353.77	913.49	2.5767	0.02425**				
PROD(t−1)	0.928936	0.100581	9.2357	0.00001***				
AREA	−16.892	6.40241	−2.6384	0.02164**				
SAPS	−0.000453	0.0237041	−0.0191	0.98507	0.995	1.17		16

Source: Own calculations

To be able to use and apply results of linear regression models it is necessary to meet requirements of a statistical and econometrical verification as mentioned in the paper methodology. In this case specification assumptions were not broken and estimations of model parameters can be considered as the best, impartial and consistent.

Analysis of Flower Consumption in the Czech Republic in 1994–2010

According to data of the Association of Flower Producers and Florists of the CR, the structure of flower consumption was monitored in more details till 1999 when the consumption of cut flowers created almost 50% of the total consumption; pot flowers only less than 29%, and bed flowers 8%. During the next years the structure started to change gradually; in 2005 cut flowers took only 36% share, vice versa, pot flowers reached a share almost the same as cut flowers – 33%, and bed flowers recorded a significant growth with the share in the total consumption 21%. In the following year till the last monitored year 2010 this structure is relatively steady only with small changes in per cent in a sense of growth of consumption of bed flowers including also balcony plants. It is very likely that the above mentioned changes in the structure were cause by changes in consumer prices of this biological product invoked just by changes in rates of added value tax or a change in consumer's preferences.
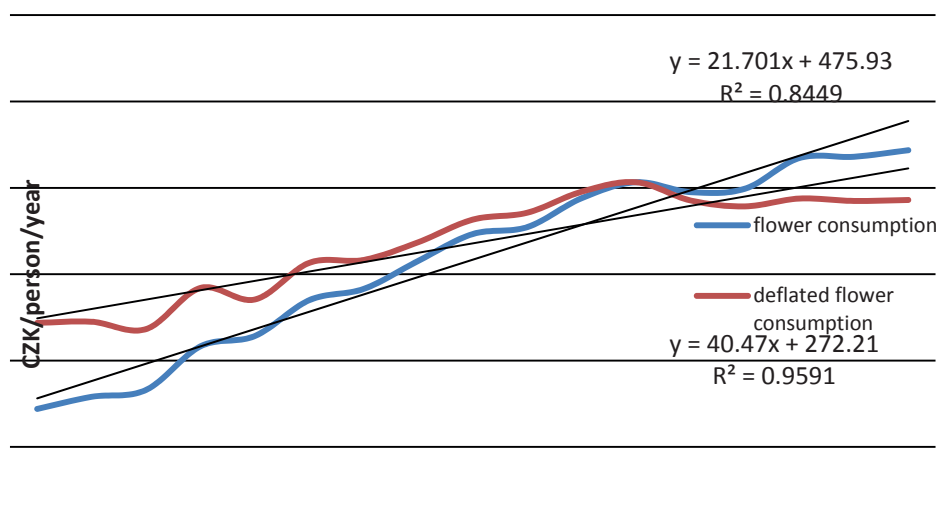
The flower consumption in the Czech Republic shows still growing tendency, see the Fig. 4. In 2010, it amounted approximately to 900 CZK per inhabitant per year. If we compare this number with economically advanced countries like the Netherlands, where the consumption in a conversion to CZK moves about 2500 CZK/person/year, or Switzerland with the consumption 1600 CZK/person/year, it is obvious that we have relatively big reserves in this respect.

In the paper, both the consumption in real prices, and in deflated prices or prices net of inflation by the help of the consumer price index – CPI was monitored. As it results from the graph, spending for flowers grow at average by almost 22 CZK/person/year measured in deflated prices. In the real prices, the consumption growth would amount to annual increase by 40 CZK/person/year.

According to a cardinalistic consumer theory, among basic determinants affecting generally the consumption of given estate a taking or an income is considered with which the given entity can dispose. A basic economic assumption is, if a disposable income increases, that the consumption of considered estate will increase and vice versa. However, this statement is true only up to a specific income limit. To obtain such an income limit, when the consumption grows no longer further, we speak about a level of saturation with the given estate. The consumer is not willing to spend his/her income for purchase of such an estate and orientates to other goods.

Other important factor which will influence decision making of the consumer is a price of the monitored product. Generally it is true that if the flower price grows, the consumption would decrease. A relatively significant part of consumer price of flowers is created by the added value tax – VAT. Then it can be supposed that increase in VAT rate will show itself immediately in the consumer flower price. In the area of consumer prices of cut flowers and pot flowers several changes in VAT rates happen. In 1994, flowers are liable to the basic rate 23%. This decreases immediately in the next year by one per cent to a rate 22%. Fundamental changes occur on the 1. 8. 2001 when cut flowers, bed flowers and green plants – leaves, leafage, branches etc. are

$$y = 21.701x + 475.93$$
$$R^2 = 0.8449$$

$$y = 40.47x + 272.21$$
$$R^2 = 0.9591$$

flower consumption

deflated flower consumption

CZK/person/year

4: *Development of flower consumption in the Czech Republic*
Source: Flower Growers and Florists Association of the ČR and own calculations

shifted in a group with a reduced rate of value added tax at a level 5%. Cut flowers remain in a group with the basic rate. The reduced rate of VAT grows then from 5% to 9% in 2009; to 10% in 2010, and the present rate amounts 14% since 2012.

In case of the structural analysis of flower consumption following scientific question arise:

1. How the change in income will influence the flower consumption in the CR?
2. How the change in VAT rate will influence the flower consumption respectively the spending for the consumption in the CR?
3. Which variable influences the flower consumption more – the income or the price on behalf of the VAT rate?

The above mentioned questions are answered by a linear regression model conceived as a multiple regression from 17-year time series when explanatory variables are the income and the VAT rate.

Tab. III shows results of estimated structural parameters, both the linear, and the power functions which can be evaluated from a viewpoint of economic verification in this way.

The explained or endogenous variable in the model is the flower consumption expressed in CZK per person and year net of inflation by the help of the consumer price index (DEFSPOT). This is explained at first by a variable income net of inflation (DEFPRIJ) and then by a variable VAT rate (SAZBADPH). Multicolinearity has not been proved between the both explained variables, so the influence of the variables can be interpreted separately. If the net income increased by 1000 CZK under a condition ceteris paribus, it would mean an increase in consumption by 4 CZK per person/year; expressed relatively then 1% increase in income would invoke 0.77% increase in the consumption. From this finding it is apparent that the reaction in flower consumption reacts almost sensitively to an income change. The situation in VAT rate is different; if the rate increases by 1%, then the consumption will decrease by contrast by 8.23 CZK. If the advised increase in VAT rate to 17.5% happened, the flower consumption per person/year would decrease by as many as 29 CZK which would mean in the lowest

income groups a perceivable change. Similarly also results of power function can be interpreted where 1% change in VAT rate will invoke 0.13% change in spending for flowers. The consumer's sensitivity to the price change in a short term expressed by the help of the VAT rate can be defined as very low.

From the above mentioned interpretations it is obvious that consumer's decision making more than the flower price is influenced by their disposable income. It is comprehensible, if he/she does not available enough of free finances, he/she will not buy flowers even for more advantageous price. The flower producer may be recommended to focus on the quality and longer life of his/her products which is fully in accordance with knowledge that sale of pot, bed and balcony flowers in the last year significantly exceeds the sale of cut flowers.

Both conclusions resulting from the linear regression model (LRM) correspond to economic theories; they also meet requirements for the statistical verification; all parameters are significant, and the determination index confirms a high conformity of the model with real data. From the view of econometrical verification, specification assumptions both the random components and the whole LRM are met.

As it was mentioned above, the flower consumption is influenced above all by the income amount. For modeling of relation between these variables as a more suitable seems to be the nonlinear function which results of power function showed in the Tab. III prove. In the next part of the paper, a non-linear model will be quantified conceived from cross-section data of the statistics of family account of the Czech Statistic Office in 2010 over a group of employees which will answer other scientific questions:

4. At what level the saturation level is in the flower consumption; how much consumers would be willing to spend for purchase of flowers, if their incomes corresponded with it?
5. What is the distance between the saturation level and the real spending for flowers in particular income groups monitored in 2010?

To find answers to these scientific questions 4 and 5 knowledge of Törnquist functions was used; they

III: *Estimation of parameters of flower consumption model*

Endogenous variable flower consumption in CZK/person/year (DEFSPOT)								
Exogenous variable	Parameter	Stand. error	t-stat	p-value	R^2	DW statistics	LMF	Number of observations
constant	356.101	106.3895	3.347	0.0048***				
DEFPRIJ	0.00402606	0.0009057	4.445	0.0006 ***				
SAZBADPH	–8.23107	1.65405	–4.976	0.0002 ***	0.891	1.825		17
Endogenous variable flower consumption in CZK/person/year (logDEFSPOT)								
constant	–2.03824	1.62365	–1.255	0.2299				
l_DEFPRIJ	0.76689	0.13775	5.567	6.94e-05***				
l_SAZBADPH	–0.137736	0.02833	–4.860	0.0003 ***	0.895	1.969		17

Source: Own calculations

IV: *Estimations of Törnquist function parameters*

Exogenous variable	Estimation	Stand. error	t-stat	p-value	R²	Number of observations
a_1	151.661	31.8920	4.755	0.0021***		
a_2	26 235.5	12159.8	2.158	0.0679*		
a_3	3719.97	884.431	4.206	0.0040***		
					0.9832	10

Source: Own calculations

meet requirements for a construction of this type of consumption function. All types of these functions work with cross-section basic data divided into deciles – ten groups of consumers according to their income amount.

In the work, parameters of all three Törnquist functions were estimated. The 1st Törnquist function was excluded from the analysis, in spite of that the economical verification is all right, the model does not meet conditions of the statistical verification for the reason of insignificance of parameters. The 2nd Törnquist function used just for relatively essential products, among which flowers undoubtedly belong, seems as the most suitable. The Tab. IV shows results of the estimations which can be interpreted in a way which will answer the above mentioned questions.

The consumer was willing to spend maximally as many as 152 CZK/person/month or 1824 CZK/person/year for purchase of various kinds of flowers which represents the saturation level and the consumer would not by flowers further even with bigger amount of income.

Counting in monthly spending, it means that the first group with the lowest incomes is distant from this saturation level by approximately 138 CZK, so almost 11 times. Expressed relatively, they consume flowers only from 9% of the saturation level.

An average household of employees which has a net financial income about 16 000 CZK per person/month is much better off. Their spending for flowers are distant from the saturation level by 110 CZK, so already only almost 4 times, and expressed relatively, they consume at the level of 27% of the saturation level.

Employees with the highest incomes spend for purchase of flowers as many as 70 CZK per month which means a distance from the saturation level 82 CZK. From the mentioned it results that they are almost at 50% of the saturation level.

The 3rd Törnquist function could not be estimated by the least squares method which from the economic point of view strengthens the assumption that it is not dealt with luxury estate, but only non-essential.

For other analysis of consumer behaviour a derivation and calculation of coefficient of income elasticity for the 2nd Törnquist function was used. The Tab. V shows how this coefficient expressing the sensitivity of consumer behaviour in % developed on assumption of 1% change in income. According to the results, the first to the sixth income groups

react the most sensitively which with 1% increase in income increase spending for flowers by 1–2%. The 7th–9th groups would reacts relatively sensitively which approximate to the border 1%.

V: *Estimations of income elasticity coefficients*

Income group	Average income	Coefficient of elasticity
1.	6 700	2.038626
2.	8 600	1.520034
3.	9 800	1.341546
4.	11 000	1.211499
5.	12 400	1.110964
6.	14 000	1.012433
7.	15 700	0.934881
8.	17 900	0.855947
9.	21 000	0.770178
10.	30 300	0.603541
average		1.139965

Source: Own calculations

Also, it is worth mentioning surely the last group which though it reaches the saturation level only by half, it is not willing to buy more nor in a case of income increase. The behaviour of the richest group of consumers can be marked as inelastic with semi-sensitive reaction to an income change.

This interpretation brings a question why also the richest spend only a half sum for purchase of this estate when it was proved that they are by far not saturated by this product? Are they unsatisfied with the quality or a suitable support to sale is missing? How their behaviour could be influenced and their preferences changed in goods selection?

The answer is a possible education of the society from the earliest age to perceive a live flower as an integral part of the environment in which it moves. This consciousness is formed above all by the family environment, however, we must forget nor educational institutions, same as cultural environment, whether it is a restaurant, a theatre, or a social hall. Maybe it would be enough when we replace an artificial flower by a live but ethically stainless one, which is supposed in Czech flowers; we make minimally further step nearer to the nature.

Regarding the fact that original scientific works investigates only the flower price of the economic

factors and state that the influence on a purchase volume was proved significant, results of the econometric analysis can be hardly confronted with other studies. So, they can be understood as a completion of wide empirical investigations with impact on the marketing and sale strategy both the retail chain stores and small businessmen.

CONCLUSION

A share of growing of wood ornamentals, flowers and their seeds in the total plant production has increased from the original 2.4% in 1991 to 6.6% in 2008. After this year, probably owing to the world economic crisis it decreases to the current value of 5% share. This data is comparable with a commodity potato, maize for grain, or sugar beet.

It is possible to state that flower production grows every year, approximately by 90 mil. CZK calculated in current prices. Taking into account year-on-year changes in production input prices with use of price index of agricultural producers for plant production, then the flower production grows at average by less than 72 mil. CZK.

This area of agricultural production significantly increased growing intensity. A proof is the resulting indicator of intensity calculated as a share of flower production in a hectare of covered area which accounted to value 12.1 mil. CZK/ha in 2010. If we compare these calculations, then the Czech Republic stands on the second place immediately after the Netherlands and exceeds Germany and Poland. The foregoing data are completed also with findings that a production from 1 ha of covered area grows by 562,2 thous. CZK in the every following year.

A production function was estimated both in the linear, and the power form. From a viewpoint of economic verification of the model, it can be stated that the production will increase by 57,69 mil. CZK on assumption of decrease of covered areas by 1 ha. This finding confirms a significant intensification in the given branch. Contrary to covered areas, the increase of direct payments by 100 CZK/ha would support production by 17.3 mil. CZK.

From results of the regression model it can be judged that intensification of production has bigger influence; it brings more than 16% increase in production, if the area decreases by 1%. Despite the fact the increase of direct payments SAPS by 1% will invoke almost the same reaction in flower producers. If we bear in mind results of the dynamic model, then it is possible to state that the support of growers in the form of direct payments SAPS is insignificant for them, in contrast to intensive use of covered areas and production of the foregoing year. This branch of agriculture will certainly support increased subsidies. It is on the state agrarian policy whether it wants in form of also other kinds of supports of financial tools, like e.g. national subsidiary payments TOP-UP or spending from the European Agricultural Fund for Rural Development, to struggle for development of this business area.

According to data of the Association of Flower Producers and Florists of the CR, the structure of flower consumption has been monitored in details since 1999 when a consumption of cut flowers represents almost 50% of the total consumption, pot flowers only fewer than 29%, and bad flowers 8%. During next years the structure slowly changed. In 2005, cut flowers take only 26% share; vice versa pot flowers reach the also same share as cut flowers – 33%. Bad flowers record a significant increase with a share in the total consumption 21%. This structure is relatively steady in the following years to the for the last time monitored year 2010, only with some small changes of several percents, in a sense of growth of the consumption of bad and in them included balcony plants.

In 2010, it was at a level of approximately 900 CZK per inhabitant. In comparison of this sum with economically advanced countries, like the Netherlands, where the consumption in conversion to CZK move around 2500 CZK/person/year, or Switzerland with the consumption 1600 CZK/person/year, it is obvious that we have relatively big reserves in this respect.

In a part of work focused on the consumption, at first an influence of income and VAT rate, which was proposed as an alternative variable for a consumer price, was examined. If the net income increases by 1000 CZK on condition ceteris paribus, it would mean an increase of consumption by 4 CZK per person/year, expressed relatively then 1% increase in income would invoke 0.77% increase in the consumption. From this finding it is evident that the reaction in flower consumption reacts almost sensitively to an income change. A different situation is in VAT rate; if the rate is increased by 1 per cent point, then the consumption is vice versa 8.23 CZK. If the advised increase of VAT rate to 17.5 happens, the flower consumption per person/year would decrease by as many as 29 CZK which would mean a perceivable change in the lowest income groups. Similarly also results of power function can be interpreted where 1% change in VAT rate will invoke 0.13% change in spending for flowers. Sensitivity of consumers to a price change in a short period expressed by the help of VAT rate can be defined as very low.

Other partial questions were monitoring of saturation level in the flower consumption, how much crowns consumers would be willing to expend for purchase of flowers, if their incomes correspond to that, and what is a distance between the saturation level and the real expenses for flowers in particular

income groups monitored in 2010. A consumer would be willing maximally to spend as much as 152 CZK per person/month or 1824 CZK /year for purchase of various kinds of flowers which represents the saturation level and the consumer would no longer buy flowers even with higher income. Counting in month expenses it means that the first group with the lowest incomes is distant from this saturation level by approximately 138 CZK, so almost 11 times. Expressed relatively, they consume flowers only from 9% of saturation level. An average household of employees with the net income around 16 000 CZK/person/month is better off. Their spending for flowers are distant from the saturation level by 110 CZK, so almost only 4 times; expressed relatively, they consume at a level of 27% saturation level. Employees with the highest incomes spend for flower purchase as much as 70 CZK per person/month which means a distance from the saturation 82 CZK. From the above mentioned it results that they are almost at 50% of the saturation level. This interpretation raise questions why also the richest spend only a half sum for purchase of this good when it was proved that they are far from saturation with this product? Are they unsatisfied with quality or is a suitable support of sale missing? How it would be possible to influence their behaviour and change preferences in choice of goods?

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