# The Evaluation of Meat Consumption Based on Different Models of the Matrix of Growth

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**Abstract.** The dynamics and the structure of agricultural activities can be examined on the base of the matrix of growth. In this paper, the consumption of different kinds of meat in Central Serbia, during the period from 2000. to 2011, is analyzed using the matrix of growth and curvilinear trend. First, the growth of consumption of the *i*-th kind of meat was being observed as linear function, using average indirect rates of growth. Subsequently, the evaluation of meat consumption was performed using econometric linear model and non-linear system of Cobb-Douglas type. The curvilinear trend is applied for the same goal. The results obtained by these methods were compared with the data of the realized average consumption of the observed types of meat for year 2012. It was concluded that the matrix of growth gives equally good results for forecasting the average consumption of meat like trend method.

**Keywords**: the matrix of growth, linear and non-linear econometric system, curvilinear trend, meat consumption.

## 1 Introduction

The meat production in the world has great economic and especially nutritional significance. In human nutrition the meat is used in fresh and processed state. With human population growth, respectively with the increase in consumer purchasing power, the world meat production becomes increasingly important economic factor. The meat, in human diet, satisfies most of the needs for proteins of animal origin, whose biological value and structural quality are considerably higher compared to plant proteins and are necessary for the construction and reconstruction of tissue. Meat contains carbohydrates and fats, which are important for generation of heat and energy of the human body. The meat is a source of essential minerals such as iron, zinc and phosphorus which are significant for human organism being because they participate in bone structure, as well as teeth, blood and other. Also meat contains vitamins, especially B group (thiamin, riboflavin, niacin, pantothenic acid, vitamin $B_6$ and vitamin $B_{12}$ which promote the growth and preservation of health. The effects of meat on physical health and mental well-being are well known, and new knowledge about human consciousness, considering healthy nutrition, yield to the individual human need for control of meat consumption. In the study by Vinnari and


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Tapio (2009), five coherent images of different views of meat consumption in future are constructed. The fact that meat represents agro-industrial materials for production of numerous high-value and expensive meat products which are highly appreciated in the market, confirms the importance of meat. Producers in markets all over the world are making great efforts to satisfy the consumer expectations in terms of quality and well-organized supply chains, and numerous studies are carried out in this direction (Henchion et al., 2014).

Mutual relations in the field of the consumption of the material goods, especially those intended for human diet as one of the most important consumption groups, can be analyzed by setting the matrix of growth and the corresponding model where direct and indirect relations are explicitly expressed. Analysis and evaluation of consumption of certain types of meat can help to adequately adjust the structure of production with demand structure in the next period. By predicting the consumption of meat the necessary import can be ensured on time. The goal of this paper is to present the prediction of meat consumption obtained using the matrix of growth and compare it with the results obtained by widely used trend methods.

Forecasted values of different productions (Krivokapić and Anokić, 2012) can be obtained using matrix of growth and also the movement of GDP by regions can be analyzed (Anokić et al, 2013) using this method. More examples from literature of using matrix of growth is for setting up a multimodal transport model in Croatia (Nikolić, 2003) or for demographic analysis (Kovačić, 1976).

## 2 Method

The matrix of growth is a square scheme formed of direct and indirect rates of growth. Direct rate of growth expresses the growth of one single activity independently from the growth of other observed activities. The indirect rate of growth denotes relative growth of the *i*-th activity in relation to the value of the *j*-th activity in the previous (*t-1*) or the currently observed *t* time period. By simultaneous covering of both direct and indirect rates of growth, the matrix of growth enables, in addition to the intensity of growth, the identification of structural changes between observed activities.

Activities at the beginning and the end of the observed period can be connected with the average matrix of growth. Using the matrix of growth it is possible to establish the dynamic system for projecting future structural relations. Different types of meat can substitute one another in nutrition, which means that the levels of their consumption are mutually dependent, that is, the increment of consumption of the *i*-th kind is the function of the level of consumption of all other kinds of meat. Depending on the relationship between the increments of consumption of the *i*-th kind of meat and the level of consumption of all kinds of meat, different models of growth can be defined. A model based on indirect rates of growth and econometric linear and non-linear system of Cobb-Douglas type is used in this paper. Subsequently, the method of curvilinear trend was applied. Selection of a line that is best adapted to the actual data was estimated based on the index of correlation. The equations of cubic and power trend, based on that indicator, are used in this paper.

### 2.1 Models of Consumption Growth

The increment of the consumption of *i*-th kind of meat in period (*t-1*,*t*) is:

$$\Delta Y_{it} = Y_{it} - Y_{i,t-1} \qquad i = 1,2,...,n \qquad \textbf{(1)}$$

There is a mutual dependence between consumptions of different kinds of meat, the increment of consumption of the *i*-th kind of meat, $\Delta Y_{it}$, is a function of levels of consumption of all other kinds of meat

$$\Delta Y_{it} = f_i\left(Y_{1t},...,Y_{i-1,t},Y_{i+1,t},...,Y_{nt}\right),\ i = 1,2,...,n \qquad \textbf{(2)}$$

Therefore, it is possible to establish a following system of equations:

$$Y_{it} - f_i\left(Y_{1t},...,Y_{i-1,t},Y_{i+1,t},...,Y_{nt}\right) = Y_{i,t-1},\ i = 1,2,...,n \qquad \textbf{(3)}$$

Depending on the kind of a relationship existing between the increment of the consumption of the *i*-th kind of meat and the level of the consumption, different models of growth are obtained.

**A Model Based on Indirect Rates of Growth.** Using indirect rates of growth in order to express linear dependency of consumption increment of the *i*-th kind and the level of consumption (Lakić and Krivokapić, 2008) there is a connection based on the relation between the consumption in two successive periods, in the matrix form:

$$\left(I - \frac{1}{n-1}R\right)Y_t = Y_{t-1}, \qquad \textbf{(4)}$$

where I and R represent a unit matrix and a matrix of growth, respectively, and $Y_{t-1}$ and $Y_t$ represent vectors of the consumption in period *t-1* and *t*, respectively. Assumed constancy of the matrix of growth means that changes between the consumption of different kinds of meat are allowed in absolute values, but only with condition that the relative relations remain unchanged.

In addition to its good sides, the observed system has weak points. Neglecting the fact that indirect rates of growth are changing from period to period and that they can be considered as constants only in the case when all direct rates of growth are equal, can be overcome by introducing average (constant) matrix of growth for longer period (*0*,*T*). Then it is possible to establish, for every moment of the interval (*0*,*T*), *t=1,2,3,…T*, a following connection between the consumption vectors $Y_t$ and $Y_{t-1}$, based on the average matrix of the consumption growth:

$$\left(I - \frac{1}{n-1}\overline{R}\right)Y_t = Y_{t-1} \qquad \text{or} \qquad Y_t = \left(I - \frac{1}{n-1}\overline{R}\right)^{-1} Y_{t-1} \qquad \textbf{(5)}$$

On the basis of the last equation based on a known vector of consumption in period (*t-1*) and average matrix of growth $\overline{R}$, the vector of consumption in period *t* can be evaluated.

**An Econometric Model.** An econometric model based on the matrix of growth denotes structural changes of the consumption by connecting its trend into the complete dynamic system. By this system, the structure of growth which is used to connect two states of consumption is revealed.

An econometric model can be formed on the basis of linear and nonlinear dependence of coefficients of growth.

*a) A linear econometric model*

In the case of the linear dependence of coefficients of growth, the consumption of observed kinds of products in period *t* and *t-1* is expressed via the following system of equations:

$$Y_{it} - \sum_{j \neq i=1}^{n} r_{ij} Y_{jt} = Y_{i,t-1} \quad \textbf{(6)}$$

or in matrix form:

$$(I - R)Y_{t-1} = Y_t \ , \quad \textbf{(7)}$$

where $I$ and $R$ represent a unit matrix and a matrix of coefficients of growth, respectively, and $Y_{t-1}$ and $Y_t$ represent vectors of the consumption in period *t-1* and *t*, respectively.

In the case of the linear dependence upon parameters, the increment of consumption in period *t* is equal to the following expression:

$$\Delta Y_t = a_1 Y_{1t} + a_2 Y_{2t} + \ldots + a_n Y_{nt} + \varepsilon_t , \quad \textbf{(8)}$$

where $\varepsilon_t = (\varepsilon_1, \ldots, \varepsilon_t)$ is an error or a deviation from the linear dependence. Considering that the sum of squared deviations is

$$\sum_{t=1}^{T} \varepsilon_t^2 = (\varepsilon', \varepsilon) = (\Delta Y - Ya)'(\Delta Y - Ya) \quad \textbf{(9)}$$

the first derivative of $a$ is

$$\frac{\partial(\varepsilon', \varepsilon)}{\partial a'} = -2Y'(\Delta Y) + 2Y'Ya' \quad \textbf{(10)}$$

Equalizing this derivative with zero, the following is obtained:

$$a' = (Y'Y)^{-1} Y'(\Delta Y) \quad \textbf{(11)}$$

If the label on the $\hat{R}' = (a_1, a_2, \ldots, a_n) = a'$, the transposed matrix of evaluated coefficients of growth is obtained:

$$\hat{R}' = (Y'Y)^{-1} Y'(\Delta Y) \quad \textbf{(12)}$$

The evaluation of the consumption in period *t*, when the consumption in period *t-1* is known, is being performed using the following relation:

$$Y_t = \left(I - \hat{R}\right)^{-1} Y_{t-1} , \quad \textbf{(13)}$$

in which matrix $\hat{R}$ is the transposed matrix of evaluated coefficients of growth.

*b) An econometric model based on non-linear dependence of Cobb-Douglas type*

The change of phenomenon in period (*t-1*, *t*) can be followed also using coefficients of dynamics of the consumption which expresses the relation between the levels of the consumption of the *i*-th kind of meat in currently (*t*) and previously observed (*t-1*) period, i.e.:

$$d_{it} = \frac{Y_{it}}{Y_{i,t-1}} \qquad i = 1,2,...,n \; ; \; t = 1,2,...,T \tag{14}$$

The coefficient of the consumption can also be expressed as a function of the consumption of Cob-Douglas type:

$$d_{it} = Y_{1t}^{e_{i1}} \quad . \quad . \quad . \quad Y_{nt}^{e_{in}} \qquad \text{or} \qquad \log d_{it} = \sum_{j=1}^{n} e_{ij} \log X_{jt} \tag{15}$$

In this process, the coefficients of elasticity of growth are marked as $e_{ij}$ ($i,j = 1,...,n$).

Connections between different kinds of meat can be expressed using following system of equations:

$$\log Y_{it} - \sum_{j=1}^{n} e_{ij} \log Y_{jt} = \log Y_{i,t-1} \qquad i = 1,2,...,n \tag{16}$$

or in matrix form:

$$(I - E)\log Y_t = \log Y_{t-1} \tag{17}$$

The solution of this system gives the connection between vectors of the consumption in period *t* and *t-1* respectively:

$$Y_t = e^{(I-E)^{-1}} \log Y_{t-1} \, . \tag{18}$$

Repeating the previous procedure the transposed matrix of the coefficients of elasticity is determined by:

$$\hat{E}' = \left[(\log Y)'(\log Y)\right]^{-1}(\log Y)'(\Delta \log Y) \tag{19}$$

More theory about these issues can be found in Stojanović (1976 and 1990).

**A Curvilinear Trend.** With respect to the maximum value of the index of correlations, the parabola of the third degree and the equation of a power trend are used for extrapolation in this paper, respectively:

$$\hat{Y}_i = a + b_1 t_i + b_2 t_i^2 + b_3 t_i^3 \qquad \text{and} \qquad \hat{Y}_i = a * t_i^b \, , \qquad i = 1,2,...,n \tag{20}$$

The software package IBM SPSS Statistics Version 20 was used for extrapolation of the consumption in 2012 in this study.

## 3 Results and Discussion

The time series for the period from 2000 to 2011 for consumption of different kind of meat: beef, baby beef, veal, pork, pork of suckling pig, mutton, goat meat,

poultry meat, offal, fish and prepared fish in Central Serbia are used for the purpose of analyzing the dynamics of structural changes of consumption of different types of meat using methodology based on a matrix of growth (table 1).

**Table 1**: The average consumption of meat, fish and fish products in Central Serbia

| Year | **Consumption of meat** (kg/per household) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **beef and baby beef** | **veal** | **pork** | **pork of suckling pig** | **mutton and goat meat** | **poultry meat** | **offal** | **fish and prepared fish** |
| 2000 | 12.0 | 2.3 | 26.3 | 11.8 | 2.7 | 29.2 | 1.9 | 7.6 |
| 2001 | 13.1 | 2.2 | 25.6 | 10.5 | 3.1 | 30.6 | 1.9 | 11.2 |
| 2002 | 15.0 | 2.3 | 32.5 | 10.6 | 3.0 | 39.5 | 2.0 | 10.4 |
| 2003 | 15.5 | 2.6 | 33.8 | 10.7 | 2.3 | 39.2 | 2.5 | 14.5 |
| 2004 | 15.5 | 2.6 | 36.9 | 10.7 | 2.1 | 41.7 | 2.4 | 12.0 |
| 2005 | 14.3 | 2.5 | 35.6 | 9.2 | 2.0 | 42.3 | 2.4 | 15.5 |
| 2006 | 12.2 | 1.6 | 43.7 | 8.5 | 3.9 | 44.1 | 5.1 | 19.2 |
| 2007 | 12.7 | 0.5 | 50.7 | 8.9 | 4.2 | 45.3 | 7.6 | 18.6 |
| 2008 | 14.1 | 1.2 | 41.8 | 6.3 | 3.6 | 43.6 | 5.3 | 17.3 |
| 2009 | 11.7 | 0.4 | 41.8 | 6.3 | 4.2 | 52.1 | 3.9 | 17.2 |
| 2010 | 10.1 | 0.4 | 44.1 | 5.4 | 3.4 | 52.0 | 4.4 | 16.2 |
| 2011 | 11.8 | 0.8 | 43.8 | 5.5 | 2.7 | 49.6 | 4.0 | 19.5 |

*Source: Bulletin, questionnaire of meat consumption, material-Office of Statistics of Republic of Serbia*

Assuming that the consumption of meat in 2012 shows the same tendency as in the previous period, solution of the system defined on the basis of indirect rates of growth is used for the estimation of the consumption levels in 2012.

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = \begin{bmatrix} 1.0002 & 0.0017 & 0.0001 & 0.0003 & 0.0008 & 0.0001 & 0.0007 & 0.0002 \\ 0.0015 & 1.0125 & 0.0005 & 0.0023 & 0.0062 & 0.0004 & 0.0052 & 0.0012 \\ -0.0171 & -0.1462 & 0.9942 & -0.0270 & -0.0725 & -0.0052 & -0.0602 & -0.0146 \\ 0.0062 & 0.0526 & 0.0021 & 1.0097 & 0.0261 & 0.0019 & 0.0217 & 0.0052 \\ 0.0004 & 0.0033 & 0.0001 & 0.0006 & 1.0017 & 0.0001 & 0.0014 & 0.0003 \\ -0.0030 & -0.0259 & -0.0010 & -0.0048 & -0.0128 & 0.9991 & -0.0107 & -0.0026 \\ -0.0010 & -0.0083 & -0.0003 & -0.0015 & -0.0041 & -0.0003 & 0.9966 & -0.0008 \\ -0.0072 & -0.0618 & -0.0025 & -0.01142 & -0.0306 & -0.0022 & -0.0255 & 0.9938 \end{bmatrix}^{-1} \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix} = \begin{bmatrix} 11.8 \\ 0.7 \\ 45.5 \\ 4.9 \\ 2.7 \\ 49.9 \\ 4.1 \\ 20.2 \end{bmatrix}$$

The consumption of beef and baby beef as well as the consumption of mutton and goat meat will remain at the same level in 2012, the consumption of veal and pork of suckling pig will decrease, and consumption of pork, poultry, offal and fish will increase compared to the previous year.

Further, using the matrix of estimated coefficients of growth, the following solution of the system of equations of the econometric model based on linear dependence is obtained:

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = \begin{bmatrix} 0.0766 & 2.4752 & 0.0374 & 0.0725 & -0.0526 & 0.0661 & 0.1617 & 0.1809 \\ -0.2927 & 0.9255 & 0.1701 & 0.2602 & 0.1290 & -0.1003 & -0.3973 & 0.0466 \\ 2.2120 & 1.9462 & -2.2406 & -1.7806 & -3.5574 & 1.7960 & 9.4835 & 0.3162 \\ 0.1472 & 2.2920 & -0.3712 & 0.3716 & 0.4685 & 0.1788 & 1.3734 & 0.0210 \\ 0.4657 & -1.1171 & -0.4052 & 0.0858 & -0.2123 & 0.2481 & 1.2068 & -0.0625 \\ -0.0424 & 0.5229 & -2.1093 & 0.5049 & -3.9993 & 2.1955 & 6.6115 & 0.7779 \\ 0.8539 & 0.1738 & -0.3717 & -0.8271 & -0.1432 & 0.2134 & 1.9375 & -0.1808 \\ 1.3521 & -3.0085 & 1.6075 & -1.3805 & 1.4544 & -0.8909 & -4.1750 & 0.0165 \end{bmatrix}^{-1} \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix} = \begin{bmatrix} 10.9 \\ 0.5 \\ 43.7 \\ 5.0 \\ 3.3 \\ 47.8 \\ 4.7 \\ 21.5 \end{bmatrix}$$

Results of the system equations indicate that consumption of beef and baby beef, veal, pork, pork of suckling pig and poultry meat will decrease in the forecasted 2012 year. The consumption of other kinds of meat increased compared to the previous year. We noted, also that there is a tendency to replace one type of meat with another which is characteristic for the countries affected by the economic crisis. For example, poultry meat is a substitute for beef (Chamorro et al, 2012).

Econometric model based on the nonlinear dependence is based on the matrix of estimated coefficients of elasticity of growth. After a sequence of operations using natural logarithmic function and applying the procedure from the previous model, transposed matrix of elasticity coefficients is obtained and used for consumption evaluation in 2012.The system of equations gives the following results for 2012:

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = e^{\begin{bmatrix} 0.1287 & 0.1402 & -1.0942 & 0.4337 & -0.1821 & 1.1937 & 0.3783 & 0.1935 \\ -2.3631 & 0.1307 & 16.4711 & 0.1669 & 0.8664 & -14.3768 & -5.5330 & 2.1467 \\ 0.9111 & -0.0186 & -2.7616 & 0.0549 & -0.4040 & 2.7065 & 1.1890 & 0.0081 \\ 0.7780 & 0.1184 & 0.8679 & 0.2152 & 0.3383 & -1.0737 & -0.3401 & 0.2166 \\ 2.4238 & -0.4697 & -1.8712 & -0.3780 & 0.1408 & 0.7539 & 0.5999 & -0.4299 \\ -0.0135 & 0.0563 & -5.2009 & 0.8363 & -0.6360 & 5.2302 & 1.8504 & -0.1044 \\ 2.8606 & -0.3047 & 0.1344 & -1.5643 & -0.1442 & -0.6934 & 0.7356 & -0.5556 \\ 0.4781 & -0.0512 & 1.7717 & -0.6212 & -0.0720 & -0.7778 & -0.0376 & -0.2493 \end{bmatrix}^{-1} \log \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix}} = \begin{bmatrix} 11.8 \\ 0.7 \\ 45.5 \\ 5.3 \\ 2.2 \\ 57.6 \\ 3.0 \\ 17.3 \end{bmatrix}$$

Obtained values show that consumption of following types of meat will decrease in forecasted 2012 year compared to the previous year: veal meat by 0.7 kg per household, suckling piglet meat by 5.3 kg, mutton and goat meat by 2.2 kg, offal by 3.0 kg and fish by 17.3 kg,. Consumption of pork meat will increase in 2012 compared to 2011 year by 45.5 kg and of poultry meat by 57.6 kg. It is forecasted that the consumption of beef and baby beef meat will have the same value of 11.8 kg per household. The prediction of the values of the average consumption of the observed types of meat per household in 2012 are obtained using the adequate equation of cubic and a power trend lines.

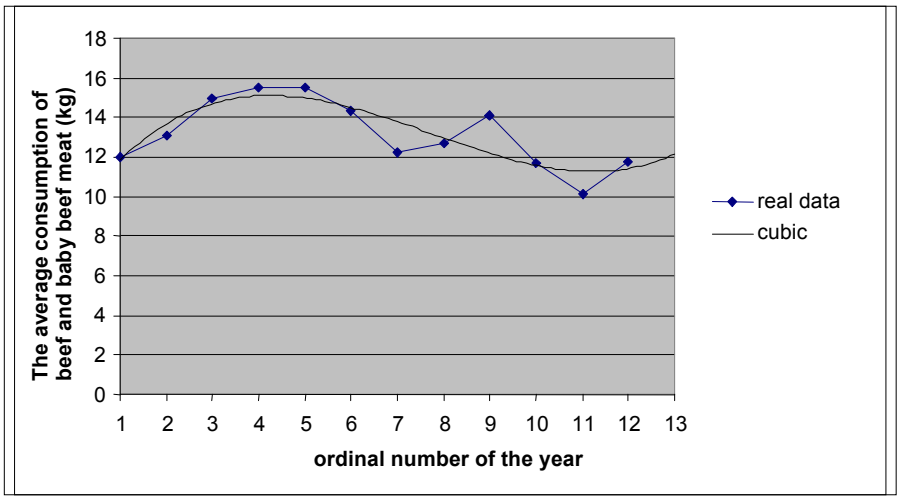


**Fig. 1.** Movement of the consumption of beef and baby beef per household in 2000 to 2011, and the adequate trend line

When it comes to the average consumption of beef and baby beef, the largest index of correlation in the amount of $I^2 = 0.731$ corresponds to the mathematical function $\hat{Y}_i = 9.145455 + 3.221895t_i - 0.524026t_i^2 + 0.022621t_i^3$. The projected average consumption of beef per household in 2012, using rated function is 12.2 kg (graph 1). For the average consumption of veal per household, the best adapted function with $I^2 = 0.862$ is obtained with forecasted consumption of 1.2 kg of veal

per household in 2012. Using the cubic function that best corresponds to the average consumption of pork with $I^2$ = 0.845, the consumption of 39.3 kg of pork per household in 2012 is forecasted. Cubic line with $I^2$ = 0.940 gives the best description for the average consumption of suckling pig meat per household and the forecasted consumption per household in 2012 is 4.7 kg. The largest index of correlation $I^2$ = 0.552 corresponds to the cubic line which projected the value of average consumption of sheep and goat meat per household for 2012 in amount of 1.5 kg. Levels of average consumption of poultry meat per household can be best modeled using a mathematical function of a power form $\hat{Y}_i = 28.369443 * x^{0.232894}$ with correlation index $I^2$ =0.921. The obtained forecasted value for 2012 amounts to 51.6 kg of poultry meat on average per household (graph2). When it comes to offal, the best adapted line is cubic with the correlation index $I^2$ =0.671 and the average consumption is 1.3 kg in 2012. For the assessment of the average consumption of fish and prepared fish a power function with correlation index $I^2$ =0.856 is used and the obtained forecasted value for 2012 is 19.9 kg.

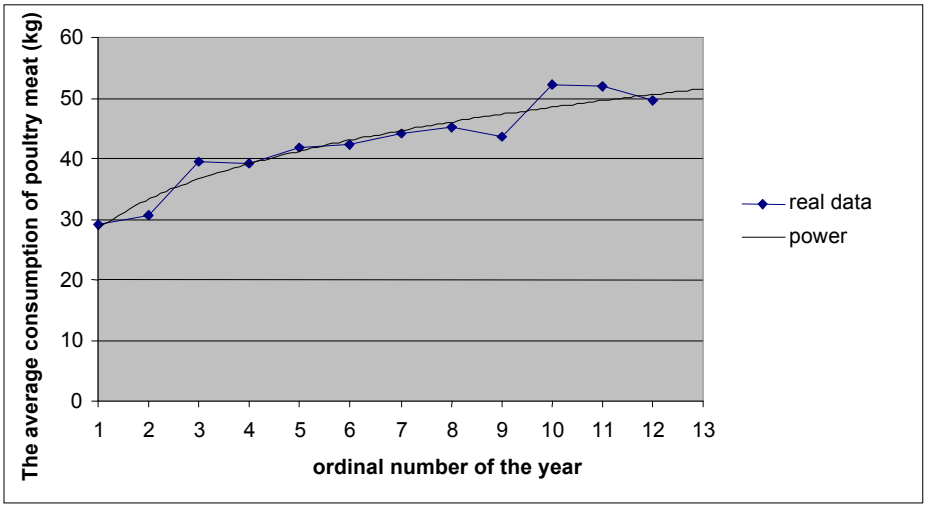


**Fig. 2.** Movement of the consumption of poultry meat per household in 2000 to 2011, and the adequate trend line

The forecasted values of average consumption of the observed kinds of meat per household in 2012, obtained by the model based on the matrix of growth, model based on the indirect rate of growth, linear and non-linear econometric model, and applying the curvilinear trend were compared with the actual average consumption data for the year 2012. The real average consumptions per household of beef and baby beef, pork, suckling pig meat in 2012 were 12.2 kg, 39.1 kg and 4.5 kg, respectively, and the closest results to them are those predicted by cubic trend. The best predicted values for average consumption of sheep and goat meat, offal and fish, which had the real values of 2.3, 3.6 and 17.1 kg, respectively, were obtained by non-

linear econometric model. The linear econometric model gave the best prediction for the average consumption of veal of 0.5 kg per household, which is equal to the real consumption of this kind of meat. The closest result to the real average consumption of poultry meat per household in 2012 equal of 49.1 kg was obtained by the method based on indirect rates of growth.

## 4 Conclusion

Structural changes of meat consumption are established through direct and indirect rates of growth, using the matrix of growth for period from 2000 to 2011. Using appropriate models, prediction of consumption for the next year is performed. The three models that had been used gave different estimates of meat consumption by kinds of meat, as a result of their different approaches to the problem.

This paper confirmed the thesis that matrix of growth can be applied in the analysis of meat consumption and forecasting for the next period of time. In addition to many modern methods, of which the trend is commonly in use, the results obtained by the presented computation using the matrix of growth, have shown the way to determine the consumption trend and an appropriate assessment of meat consumption in the future. Considering that the method of indirect rate of growth and the linear econometric methods provided the value for one type of meat that was closest to the real value, projecting the consumption for the next year, while the econometric method based on nonlinear dependence and curvilinear trend values obtained closest values to the real data for three kinds of meat, it can be concluded that the matrix of growth gives equally good results in forecasting the average consumption of meat as the widely used trend method. As meat production should follow the same consumption, in order to maintain a balance in the market, the importance of this study is in the fact that the forecasted consumption can be the basis for planning the production volume of appropriate kinds of meat, which would prevent any shortages and sudden price changes.

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