



## Econometric Estimation of Food Services Supply Factors

**Sazida Shakirova, Ekaterina Kadochnikova and Anna Lyzhova**  
Associate Professor, Institute of Management, Kazan Federal University Russia.

(Corresponding author: Sazida Shakirova)  
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**ABSTRACT:** The authors emphasize the key role of internal factors that determine the food services supply, and performed their econometric assessment to justify management decisions aimed at the service sector sustainable development. In order to identify the observed factors that determine the turnover of enterprises in the production of food services, the work performed a regression analysis of the 46 enterprises performance in 2017. The empirical estimates of linear models parameters of multiple regression presented in the article confirmed the hypothesis of different influence of factors determining the efficiency of food services for different social categories of enterprises. The elasticity of all studied factors is higher for restaurants and cafes, as opposed to canteens, which have more risks of sustainable development. The most significant impact on the volume of food sales has a change in the number of employees. The impact of changes in the value of fixed assets on the food sales in all the studied enterprises is in significant, there is a different impact of changes in the number of seats on the total turnover and the turnover of products of its own production. The quality of the results was tested using the Fisher test, Student test, regression equation specification error test (RESET). The results of empirical evaluations have confirmed the feasibility of the practical use of this approach to evaluate internal factors that determine the range of food services with the goal of sustainable development.

**Keyword:** Food services, sustainable development, turnover, value of fixed assets, number of employees, number of seats.

### I. INTRODUCTION

One of the main conditions for sustainable growth and development of the food service sector is the optimal combination of its participants' interests. A number of scientific theories and concepts are used to determine this combination [1, 2]. Most researchers agree that sustainable development is impossible without a comprehensive long-term improvement of economic, social and environmental parameters, the qualitative change of which is possible only through innovative changes in the structure and functions of economic systems and their participants [3, 4]. At the heart of any concept of sustainable development of sectoral economic systems, there is an innovative component that ensures the intensity of this development. Sustainable development of the foodservice sector as a sectoral economic system that connects the majority of consumers and producers of products (services) is based on the principles of rational resource exchange, social orientation to different groups of consumers and their preferences, innovative development [5,6]. The most significant place in the production of food services is occupied by restaurants, cafes and canteens. According to GOST 31985 the restaurant stands for "the enterprise (object) of the food providing to the consumer services in the organization of food and leisure or without leisure, with the wide range of dishes of difficult production, including specialties and products, alcoholic, soft, hot and other types of drinks, confectionery and bakery products, purchased goods". Cafe stands for "the enterprise (object) of the food representing to the consumer services in the organization of food and leisure with the representation of limited, in comparison with the restaurant), the product range and services realizing specialties,

confectionery, and bakery products, alcoholic and non-alcoholic drinks, purchased goods". According to the above definitions, restaurants and cafes do not have significant differences in the characteristic conditions of service. Most often, in practice, a limited number of dishes can be in some restaurants and a fairly wide range of dishes of complex manufacture can be offered in the cafe. Canteen stands for "the enterprise (object) public power engaged in preparation and implementation with on-site consumption of various food and food products in accordance with menus, different days of the week". This definition of dining is not complete enough, because in practice they sell not only their products, but also purchased products. On request, customers can provide additional services (leisure).

The principles of innovative development determine the conditions and possibilities of adapting the food service sector to external and internal market factors through innovation, development of new products and the use of advanced technologies [7]. The principle of rational resource exchange characterizes the parameters of effective trade turnover between participants in the sphere of food services. Administrative, economic, social and adaptive methods should be used to improve the sustainability of nutrition services and to implement the principles outlined above. Therefore, the purpose of this study is to quantify the internal market factors of the supply of food services, which is necessary for the empirical substantiation of management decisions aimed at improving the effectiveness of these methods of sustainable development of food services. The hypothesis of the study suggests that in the conditions of increasing demand and expanding the range of food services, as well as increasing competition, the increase in the supply of food services contribute to the increase

in the material resources available at the enterprise and the number of employees.

## II. METHODS

A review of research on the development of nutrition services [8-11] has allowed us to identify factors that may have an impact on the consumption of nutrition services. These factors have been grouped by us on the following grounds:

### A. Factors determining the demand for food services:

(a) External socio-economic factors: average monthly accrued salary, average per capita income, the ratio between the average wage and the subsistence minimum, the proportion of the population with incomes below the subsistence minimum, the share of household food expenses in the total amount of expenses, the size of the scholarship, the size of the pension.

(b) External demographic factors: population, the share of the urban population in the total, the share of the working-age population in the total, the share of employment in industry, the share of employment in the services sector, the number of students, the number of pensioners, the pension burden of the population, population density, the number of men, the number of women.

(c) Internal marketing factors: the presence of thematic concepts, the presence of sites of restaurants, affordability, fashion.

### B. Factors determining the supply of food.

(a) Internal factor: the amount of investment in catering, the total amount of investment in the economy of the region, the number of seats in catering enterprises, the number of catering enterprises, the number of employees of catering enterprises, the value of fixed assets in catering.

(b) External factors: Gross Regional Product (GRP), the share of manufacturing industries in GRP, the share of service industries in GRP, the number of individual entrepreneurs, the value of fixed assets in the economy, the number of enterprises and organizations in the region, the number of small businesses in the region, the number of public buses per 100,000 population, the rate of inflation, the number of employees of small enterprises, turnover of retail trade per capita, wholesale trade turnover, the volume of paid services to the population in the region.

Note that the social categories of enterprises engaged in the production of food services, have differences in the range of dishes and in the organization of service (self-service). Based on the above, restaurants and cafes can be combined into a social category "A", canteens – in the social category "B".

The main indicator of the activity of the enterprises rendering services of food is trade turnover in general and trade turnover of own products included. The total turnover consists of sales of own products and purchased goods. In category "A" the share of purchased goods is greater than in category "B".

To make management decisions on which factor to increase trade turnover with, it is necessary to study the degree of influence of these factors, the closeness of their connection with the help of regression and correlation analysis techniques. Following the results of work [12], as regressors of trade turnover of food services we have chosen the number of seats, equipment and fixed assets and the number of

employees. Evaluation of the linear model of multiple regression [13-16], reflecting the influence of factors on the productive characteristic and measurement of the closeness of the relationship between them was performed using the Gretl software environment according to the formula:

$$Y_1 = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{13} + \varepsilon_1 \quad (1)$$

where,  $Y_1$  – the total turnover (or turnover of own products), RUB thousand,  $X_{11}$  – number of employees, people,  $X_{12}$  – the value of fixed assets, thousand RUB,  $X_{13}$  – the number of seats, units,  $\beta_0$ ,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$  – regression parameters, estimated with the ordinary least squares method,  $\varepsilon$  – random deviation (error).

To identify the dependence of the volume of trade turnover and production of own production on the available material resources of the enterprise (the cost of fixed assets and the number of seats) and the number of employees, a regression analysis was performed and obtained: the correlation coefficient for a linear relationship; the coefficient of determination; the adjusted coefficient of determination; estimation of free regression coefficient; estimation of the regression coefficient for each factor, their standard errors, the observed values are t-test statistics and their P-values; table of variance analysis and observed value of Fisher statistics and its P-value; standard error of the model; a number of information criteria and other characteristics.

## III. RESULTS AND DISCUSSION

The results of the evaluation allow a comprehensive study of the relationship between the volume of food sales and the analyzed factors: the number of employees, the cost of fixed assets and the number of seats. The calculation of the linear correlation coefficient showed that the factors that have a strong and medium close connection with the effective feature – the turnover of food services, are the number of seats and the number of employees. Determination of factors with maximum indicators of close correlation with the indicator of trade turnover of food services per capita makes it possible to characterize the dependence of the variation of the effective feature of the variation of the feature-factor. Knowing the indicators of close correlation, we can solve the following groups of issues: 1) to answer the question about the need to study this relationship between the features and the feasibility of its practical application; 2) comparing the indicators of the closeness of the relationship for different situations, we can judge the degree of difference in its manifestation for a specific condition; 3) and finally, comparing the indicators of the closeness of the effective feature with various factors, it is possible to identify those factors that in these specific conditions are decisive and mainly affect the formation of the value of the effective feature.

According to the absolute value of the regression coefficients, it is impossible to draw a conclusion about the degree of influence of a factor on the effective sign – trade turnover, because of the different scale (different average values and mean square deviations) of the factors. For correct interpretation, the average coefficient of elasticity is calculated, which shows how many percent the value of the effective sign – turnover changes, with an increase in the value of the factor-argument by one percent. The average coefficient of elasticity is calculated by the following formula:

$$\varepsilon_j = \beta_j \frac{x_j}{\bar{y}} \quad (2)$$

where,  $\beta_j$  – regression coefficient at the j-th factor;  $\bar{X}$  – average value of the j-th factor;  $\bar{Y}$  – average value of turnover.

Based on the performance indicators for 2017 for a sample of 46 enterprises of the food service sector of group A (21 objects) and B (25 objects), the data on the regression and elasticity coefficients presented in table

1 are obtained. The elasticity coefficients presented in Table 1 indicate the varying degree of influence of the analyzed factors on the total turnover, including the turnover of products of own production. Differences in the influence of the signs-arguments are also observed in the context of the social categories of enterprises in the sphere of food services.

**Table 1: Results of regression analysis of factors of trade turnover.**

Effective and factor features	By category A enterprises		By category B enterprises		In General, the analyzed enterprises	
	$\beta_j$	$\Theta_j$	$\beta_j$	$\Theta_j$	$\beta_j$	$\Theta_j$
Total turnover (Y1)						
Number of employees (X1)	7,73 <sup>*</sup>	0.95	6,38 <sup>**</sup>	0.760	7,78 <sup>**</sup>	0.918
cost of fixed assets (X2)	2,36 <sup>*</sup>	0.285	4,83 <sup>*</sup>	0.176	3,09 <sup>**</sup>	0.267
Number of seats (X3)	1,29 <sup>*</sup>	0.347	0,58 <sup>**</sup>	0.340	0,49 <sup>**</sup>	0.197
Test: P-value F	0.32 E-5		0.45 E-6		0.54 E-4	
RESET test: P-value F	0.1468		0.2439		0.2943	
Turnover of own catering products (Y2)						
Number of employees (X1)	4,09 <sup>**</sup>	0.924	5,95 <sup>**</sup>	0.872	3,67 <sup>***</sup>	0.679
cost of fixed assets (X2)	1,39 <sup>*</sup>	0.324	2,78 <sup>*</sup>	0.125	1,12 <sup>*</sup>	0.152
Number of seats (X3)	1,15 <sup>*</sup>	0.612	0,56 <sup>*</sup>	0.404	0,67 <sup>**</sup>	0.442
Test: P-value F	0.54 E-4		0.12 E-7		0.65 E-8	
RESET test: P-value F	0.1634		0.1967		0.3645	

**Note:** \*\*\*, \*\*, \* – significance at the level of 1, 5, and 10% respectively.

The most significant impact on the volume of food sales has a change in the number of employees. The increase in the number of employees at the enterprise by 1% leads to an increase in the total turnover of restaurants and cafes (group A) by 0.950%, canteens (group B) – by 0.760%, and in General for the studied enterprises – 0, 918%. The contribution of this factor to the increase in the turnover of products of own production is different: a higher percentage of the increase in sales of own products is observed for group A enterprises (0.924%), and a lower percentage – for the analyzed objects as a whole (0.679%).

The impact of changes in the value of fixed assets on the sale of food in all the studied enterprises is insignificant. The highest percentage of elasticity in restaurants and cafes on sales of products of own production (0,324%) and the lowest – at the canteens on the same productive basis (0,125%).

The change in the number of seats affects the total turnover and the turnover of products of own production in different ways. Thus, for group A enterprises, the increase in seats by 1% contributes to the growth of the total turnover by 0.347%, and the turnover of their own products by 0.612%. At the enterprises of group B, the strength of the influence of this factor on the total turnover and turnover of products of its own production is practically the same: 0.340 % and 0.404% respectively. In General, the influence of the number of seats on the value of the total turnover is lower than in the previous two analyzed groups for the studied objects of catering enterprises. The coefficient of elasticity is 0.197%. The coefficient of elasticity of this factor for the turnover of own products is doubled.

#### IV. SUMMARY

The simulation results can be summarized in several conclusions.

The calculation of the linear correlation coefficient showed that the factors that have a strong and medium close connection with the effective feature - the turnover of food services, are the number of seats and the number of employees.

Using linear multiple regression and partial elasticity coefficients, the different influence of the studied factors on the turnover for different social groups of catering enterprises is empirically confirmed. The elasticity of all studied factors is higher for social category “A” enterprises (restaurants, cafes) and lower for social category “B” enterprises (canteens), which indicates the risks of sustainable development of category “B”.

On the basis of the study, it is possible to rank the factors by the strength of their influence on the change in turnover:

- the increase in the number of employees has the maximum impact on the increase in total turnover and production of own production;
- increase of seats in order to improve the efficiency of public catering enterprises gives positive results in all study groups;
- the increase in the value of fixed assets has minimal impact on the growth of trade.

Thus, these results confirmed the hypothesis that the increase in the supply of food services contribute to the increase in the material resources available at the enterprise and the number of employees. Using the data of the study will allow making the right management decision in the development of business plans for the development of catering.

#### V. CONCLUSIONS

The problems of the overall food services sphere economic development sustainability and its structural adjustment, as well as the specific problems of enterprises social categories, indicate the need to improve the methodological component of sustainable development of the food services sphere. The use of quantitative methods of management decisions substantiation ensures the sustainability of the food services sphere production, contribute to the comprehensive improvement of enterprises through the effective use of material resources, the development of new products, the integration of resources, the creation of breakthrough technologies and the modernization of business processes. The predominant use of econometric models allows to provide a comprehensive

assessment of the factors of development of the sphere of food services, to take into account the economic, social and environmental interests of all stakeholders. The perspective direction of the development of this research can be obtaining forecast estimates of trade turnover of food services on the basis of regression modeling and trend forecasts of regressors. This is why polynomial trends described by discrete polynomials of low orders are popular. Effective application in the construction of polynomial trends can find algorithms for their evaluation based on discrete transformations [17]. Also of practical interest is forecasting using fuzzy time series models [18].

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