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Factor Analysis of the Development of the Hotel Industry

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Annotation: In the article, based on economic and mathematical methods, an econometric analysis of factors affecting the development of hotels and accommodation facilities in the Samarkand region was carried out. The level of factors affecting the activity of hotels and similar dynamics of accommodation in 2010-2020 was studied. Forecast values for 2022-2027 are given.

Keywords: hotel business, Samarkand, factorial analysis, dynamics, forecast.

In our Republic, hotels and accommodation facilities are important indicators of the development of the hotel industry. The econometric analysis of factors influencing the development of hotels and accommodation facilities, carried out using economic and mathematical methods, makes it possible to explore the relationship of social and economic processes, to study their patterns and the possibility of observation based on scientific experiments.

In this study, we studied the scientific works of such scientists as Y. Abdullaev, M. Ivanova, Y. R. Magnus, Andrew F. Siegel [1], who are devoted to determining the share of the tourism industry in gross domestic product and developing a forecasting model. Based on the correlation-regression analysis, the ways of improving the forecasting methods are investigated.

Table 1. Factors affecting the operation of hotels and similar accommodation facilities in the Samarkand region[2]

Resulting actor: Profit from the sale of hotel services (million soums) – **Y**	
Factors	**Meaning**
Rooms: Rooms (rooms), units	x1 _
Rooms: m eats, units	x2 _
Visitors served, total people	x3 _
Number of overnight stays, total - units (days)	x4 _
Visitors served (guests from far abroad)	x5 _
Hotels and similar accommodation facilities (in units)	x6 _
Costs for hotel services (million soums)	X7 _

The main factors of the multi-factor econometric model discussed below are the resulting factors: Profit from the sale of hotel services (million soums); and as a factor, the number of rooms (units), the number of guests in the hotel (units), the number of customers who visited and served the hotel (one person per person), the number of hotels and similar accommodation facilities (units), the number of rooms in the hotel Expenses (in in the amount of one thousand soums), services for 8

[1] Abdullaev Y. Statistics of umumi nazariyasi. - T . : " Fan " , 1993. - 240 b. ; Ivanova M. A . Economic statistics. Textbook. - M., "INFRA ", 2000. - 210 With. ; Magnus Ya.R., Katyshev P.K., Peresetsky A.A. Econometrics. Textbook. - M., 2005. - 499 p . ; Andrew F., Siegel. Practical business statistics. 4th edition, - M .: Williams Publishing House , 2002. - 450 p.

[2] Developed by the author

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thousand. The resulting factor and the factors influencing it were determined in the order indicated in table - 1.

Correlation analysis of selected influencing factors is important in creating a multifactorial econometric model of economic problems.

As a result of correlation analysis, the problem of input or output of the model is solved by identifying factors that have a high correlation between the influencing factors.

Using the Pearson correlation coefficient, which is considered the most common indicator, xi and y $_i$, the line between samples (i = 1, ..., n)

$$r_{xy} = \frac{Cov(x,y)}{s_x s_y}, \qquad (1)$$

The relationship is studied and calculated as follows:

where: *Cov* (*x*,*y*) is the coefficient of covariance, which is calculated as follows,

$$Cov(x,y) = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}), \qquad (2)$$

S_x, S_y - standard deviation, which is calculated as follows:

$$S_x = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}, \; S_y = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})}, \qquad (3)$$

Table 2. Outcome and Influencing Factors Selected for Correlation-Regression Statistical Analysis[3]

years	Profit	Number of rooms	Number of seats	Total visitors served	Number of starts	Guests from far abroad	Number of hotels	Hospitality costs
	Y(*t*)	X $_1$	x2 _	x3 _	x4 _	x5 _	x6 _	X7 _
2010	7409.5	1576	2991	110868	299100	12496	68	2503.3
2011	10844.2	1748	3487	129271	300294	15314	83	3408.1
2012	15977.8	1576	3583	136583	304165	19053	80	3854.5
2013	25648.6	1748	3920	130507	314581	14172	77	3972.3
2014	29414.7	1576	5070	136591	309290	25663	91	4162.8
2015	32861.9	1748	4899	140420	290596	28682	101	4273.8
2016	37482.6	1576	4852	154475	345880	40727	107	4397.1
2017	41483.2	1748	4245	176375	384586	48037	104	4409.8
2018	45816.7	1576	4374	231200	468970	82374	111	4611.3
2019	58789.4	1748	5800	268367	544066	84799	139	4985.4
2020	18256.9	1576	6442	65054	160317	11748	143	1721.6

Based on the data in Table 2, we construct a matrix of correlation coefficients by calculating the Pearson correlation coefficients using the formula (1)

[3]Developed by the author

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Profit from sales of hotel services (million soums) - (Y) weak relationship with the room (number of rooms) (X1), number of foreigners visited and served in the hotel (persons) (X5) strong relationship, hotel service number of visitors (persons) (X3), the number of nights the client stays at the hotel (per day) (X4), the number of hotels and similar accommodation facilities (in units) (X6), the cost of hotel services (thousand soums) (X7), and the average of the factors can be say there is a connection.

Table 3. Matrix of correlation coefficients of resulting and influencing factors[4]

	Y	*x1*	*x2*	*x3*	*x4*	*x5*	*x6*	*X7*
Y	1	0.270551	0.503405	0.856651	0.801048	0.904765	0.607228	0.78305
x1	0.270551	1	-0.04055	0.278956	0.271111	0.120682	0.017231	0.361559
x2	0.503405	-0.04055	1	0.11299	0.003065	0.307598	0.906412	0.005089
x3	0.856651	0.278956	0.11299	1	0.986036	0.947283	0.325769	0.825887
x4	0.801048	0.271111	0.003065	0.986036	1	0.908137	0.22104	0.802999
x5	0.904765	0.120682	0.307598	0.947283	0.908137	1	0.53684	0.709072
x6	0.607228	0.017231	0.906412	0.325769	0.22104	0.53684	1	0.053566
X7	0.78305	0.361559	0.005089	0.825887	0.802999	0.709072	0.053566	1

Profit from sales of hotel services (million soums), which is considered the resulting factor - factors Y2, X2, X3, X4, X5, X6, X7 have a strong correlation, so we considered it necessary to include these factors as factors influencing the model. The entered coefficient of determination (R2) is used. The coefficient of determination is calculated by the following formula:

$$R^2 = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}, \qquad (4)$$

where: where yi are the observed values of the resulting factor; ȳ - arithmetic mean of the resulting multiplier; ŷ - certain, smoothed values of the resulting factor; n is the number of observations.

The determinant coefficient is a proportion of the variance of the influence of influencing factors on the outcome factor in the econometric model.

An analysis of the significance of the identified model based on the "null hypothesis" is done by testing. " Hypothesis equals zero ".

No: b1 '= b2' = ... = bk '= 0, which represents the overall significance of the regression coefficient. If the results of the analysis do not refute the "zero hypothesis", then the conclusion is made: "The influence of the factors X1, X2, ..., XK on the resulting indicator "u" is insignificant, the overall quality of the regression equation is low." The "null hypothesis" is tested using analysis of variance and the "null hypothesis" is expressed as N1: Dfact = alternative hypothesis Dcold N1: Dfakt > Dkold. Fisher's test 1 is used to test these hypotheses.

The actual value of the Fisher criterion is calculated using the following formula [5]:

[4] Source: Calculated based on data from the State *Committee of the Republic of Uzbekistan* for *Tourism Development.*

[5]Alimova M.T. Khududii tourism bozorining rivozhlanish hususiyatlari va tendendenlari. Monograph. T.: Iktisodiyot", 2015, 2826., B. 126

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$$F = \frac{R^2}{1-R^2} * \frac{(n-k-1)}{k}, \qquad (5)$$

buerda n - kuzatuvlar sony; k - kўp omilli regression tenglamasidagi omillar (parametlar) sony. where n is the number of observations; k is the number of factors (parameters) in the multivariate regression equation.

It compares the actual value of the Fisher criterion with the critical value of the criterion (F fact(a; k; nk-1)). If $Ff_{act} > F_{table}$, then the model being determined is significant [6].

Calculations by the least squares method were carried out in the data processing program R. Table 4 presents the results of calculations.

Table- 4. Results of determining the parameters of a multifactorial econometric model[7]

	Not standardized coefficients		Standardized odds	t-statistics	Probability
	Coefficient	standard error	Beta		
a0	82845.7	16.42		73.591	0.000002
$a_3(X_2)$	5.86	3.74	0.446	1.56	0.32211
$a_4(X_3)$	0.548	0.27	0.176	2.38	0.7746537
$a_5(X_4)$	0.191	0.23	-0.23	2.05	0.6688525
$a_7(X_5)$	0.641	0.093	0.213	2.57	0.1846321
$a_8(X_6)$	4.37	0.0248	-1.724	0.019	0.0097303
$a_9(X_7)$	9.46	0.03198	0.012	2.95	0.9678235

Here: Outcome factor (dependency variable): Method Y: Smallest squares selection: 2010-2020. Number of observations: 10 Influencing factors: 7.

Influencing factors are examined, whether they are significant or insignificant, based on statistical criteria when viewed econometric model.

Table – 5. Criteria for checking the quality and relevance of the econometric model[8]

Multivariate correlation coefficient R	multifactorial coefficient of determination $R2^-$	Corrected $R2^-$	Standard error of estimation	F - real	Durbin's stats Watson
0.967	**0.93557**	**0.993**	**0.125**	**226.76**	**2.1**

In this study, we proposed to use a linear model based on multivariate regression analysis for forecasting. In general, this model looks like this [9]:

$$y \u003d a_0 + a_1 x_1 + a_2 x_2 + .. + a_n x_n, \qquad (6)$$

where *y* is the resulting factor (involuntary variable); x1, x2,… .., xn - influencing factors (free variables); a0-free cad; a1, a2, ..., an - parameters of the multifactorial model.

The following system of equations is formed to determine the values of the parameters a1, a2, ..., an in the model (6)[10]

[6] Econometrics: Textbook. / Ed. I.I. Eliseeva. -M.: Finance and statistics, 2003. - 346 p.
[7]Compiled based on the research of the author.
[8]Compiled based on the research of the author.
[9]Econometrics: Textbook. / Ed. I.I. Eliseeva. -M.: Finance and statistics, 2003. - 344 p.

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$$\begin{cases} na_0 + a_1\sum x_1 + a_2\sum x_2 + ... + a_n\sum x_n = \sum y \\ a_0\sum x_1 + a_1\sum x_1^2 + a_2\sum x_1x_2 + ... + a_n\sum x_nx_1 = \sum yx_1 \\ ..... \\ a_0\sum x_n + a_1\sum x_1x_n + a_2\sum x_2x_n + ... + a_n\sum x_n^2 = \sum yx_n \end{cases}, \quad (7)$$

When solving the system of equations (7), on the basis of relative analytical methods a0, a1, ..., an, the values of the parameters a0, a1, ..., an are determined.

Profit from the sale of hotel services (million soums); we perform a least-squares review and analysis of the model based on the factors chosen as factors influencing it.

In determining the density of the relationship between the resulting factor and the selected factors influencing the econometric regression model (6), based on the general model and the coefficients given in Table 3.4, we summarize the appearance of the multivariate econometric model as follows:

$$Y = 82845{,}7 + 5{,}86 * x_2 + 0{,}191 * x_4 + 0{,}641 * x_5 + 4{,}37 * x_6 + 9{,}46 * x_7, \quad (8)$$

The coefficient of determination R2, given in the table - 5, is equal to

0.967, indicating that the relationship between the resulting factor and the selected influencing factors is quite close, i.e., the profit margin (Y) from the sale of hotel services is 99% of the selected effect for the multivariate econometric model, and the remaining 1 percent depends on the unaccounted factors.

The adjusted coefficient of determination is usually used to be able to compare models with different numbers of factors and to ensure that factors in those numbers do not affect the R2 statistic, i.e. [11].

In our results in Table-5, the adjusted coefficient of determination is 0.993, and the approximation of the coefficient of determination R2 is approximately equal to the change in the number of factors included in the econometric model.

Based on Fisher's F-test, we use a multivariate econometric model to ensure that it is statistically human and adequate for the process being studied. The actual value of the F-criterion is shown in Table-5.

F fact = 228.76. To determine the theoretically calculated value of the Fisher F-criterion, we calculate the theoretically calculated value of the F-criterion based on the values of the degrees of freedom $k_1 = {}_t$ va $k_2 = nm\text{-}1$ and the degree value a. The theoretically calculated value of the F-criterion is Ftable = 8.16 at a significance level a = 0.05 and degrees of freedom $k_1 = 6$ VA k_2 =7-6 = 1.

From the fulfillment of the condition F actual > F table (228.76> 8.16) with a value determined at the significance level a = 0.05, it follows that the econometric model is significant and adequate to the process under study. Profit from the sale of hotel services for this model (million soums); and the level of factors influencing it can be used to predict future periods.

[10] Econometrics: Textbook. / Ed. I.I. Eliseeva. -M.: Finance and statistics, 2003. - 344 p.
[11] Dimitrios Asteriou and Stephen G. Hall. Applied Econometrics. Modern approach using Eviews and Microfit. Revised edition. Palgrave Macmillan, New York, 2007. - p. 397

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In the econometric model (8), we use the Durbin-Watson (DW) test to test for autocorrelation of the residuals of the resulting factor [12].

If there is no autocorrelation between the residuals of the resulting factor, DW = 2, in the case of positive autocorrelation, DW tends to zero, and in the case of negative autocorrelation, it tends to 4.

If there is no autocorrelation in the residuals of the resulting factor, then the value of the calculated DW criterion will be about 2. The fact that the value of the calculated DW criterion in our model is 2.1 indicates that there is no autocorrelation of the residuals of the resulting factor in the model.

Based on model (8), non-stationary trend regression models of the influencing factors included in the forecast of the level of profit from sales of hotel services in future periods are considered. Trend Regression Model for Number of Hotel Rooms:

$$X_2 = \frac{1}{0{,}021 * 0{,}95}, \qquad (9)$$

Trend regression model on the number of hotel rooms (in units):

X_3 \u003d 198.8- $e^{0078 * t}$, (10)

Trend regression model of the trend in terms of the number of guests served by the hotel:

$X4=78.24-e^{0.052*t}$, (11)

Regression model of the trend of the number of nights that customers spend in a hotel:

$X5 = 47.96 - e^{0.106*t}$, (12)

Trend regression model in terms of the number of hotels and similar accommodations:

X6 \u003d 7217.02 - $e^{0.225 * t}$, (13)

The trend regression model for the cost of hotel services:

X_7 \ u003d 22906.95 -$e^{0.031 * t}$, (14)

Predicting each influencing factor on the aforementioned trend regression models, we determine their forecasts for future periods by placing their values (8) in the model arguments (Table 6).

Table-6. The level of factors influencing the activity of hotels and similar accommodation dynamics in 2010-2020 And forecast values for 2022-2027.[13]

	Y	x1 _	x2 _	x3 _	x4 _	X7 _
2010	8107.2	1599	3018	111236	299523	12554
2011	11809.9	1771	3514	129639	300717	15372
2012	17107.5	1599	3610	136951	304588	19111
2013	27705.9	1771	3956	130875	315004	14230
2014	30509.1	1599	5097	136959	309713	25721
2015	34528.7	1771	4926	140788	291019	28740
2016	39597.1	1599	4879	154843	346309	40785
2017	43772.9	1771	4272	176743	385009	48095
2018	47797.1	1599	4401	231568	469393	82432

[12]Dimitrios Asteriou and Stephen G. Hall. Applied Econometrics. Modern approach using Eviews and Microfit. Revised edition. Palgrave Macmillan, New York, 2007. - p. 397
[13] Predicted by the author

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2019	60539.4	1771	5827	268735	544489	84857
2020	20541.8	1599	3018	270396	470369	83692
2021	23698.9	1689	6122.7	242436	479368	82614
2022	28935.2	1469	6164	242444	485388	82729
2023	24963.2	1490	6208.5	247452	487412	82949
2024	19632.2	1483	6256.6	249460	499438	83174
2025	22536.9	1569	6308.4	253367	518563	84404
2026	29369.5	1608	6364.4	262177	526393	84640
2027	28752.3	1678	6424.7	268587	529527	84880

In accordance with the forecast indicators affecting the amount of profit from the sale of hotel services in the Samarkand region for 2022-2027 , in 2027 , an increase in the number of rooms in hotels is expected: rooms (rooms) (X1) - by 14.2 %, room fund: places (X2) - by 4.2%, an increase in the number of visitors served (X3) - by 10.8%, the number of overnight stays (X4) - by 9.1%, the amount of expenses for hotel services (X7) - by 2.6% (Table 6, Fig. 1).

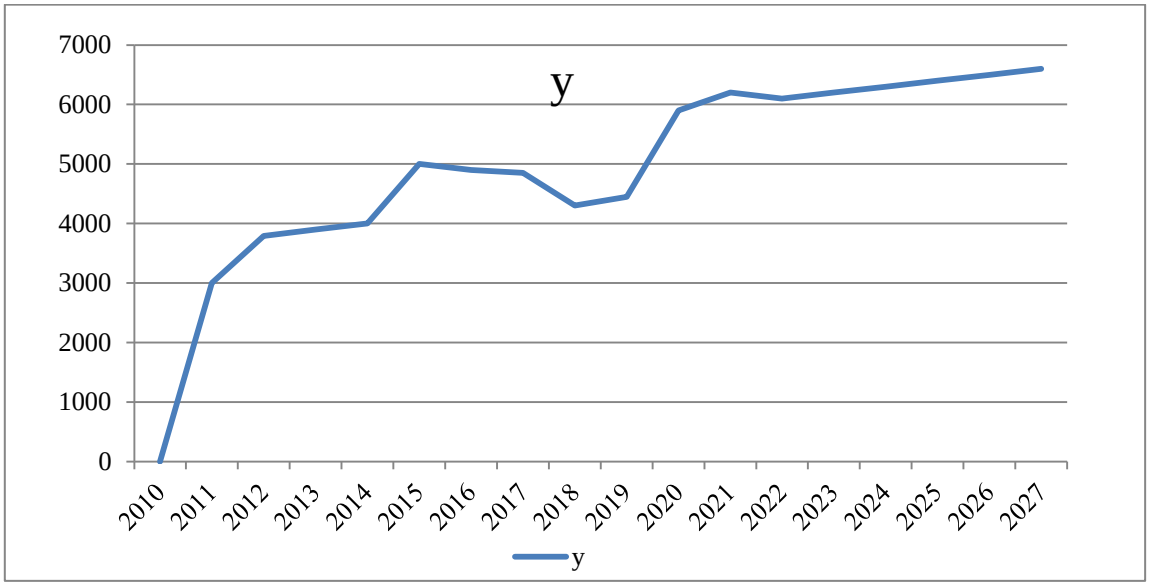

Fig. 1. Profit from the sale of hotel services (million sums); Dynamics in 2010-2020 And the forecast values for 2021-2027. [14].

So, it can be summed up that the econometric model is significant for the model tested by mathematical statistical analysis, the validity of the parameters and the absence of autocorrelation. Using this econometric model, the level of profit from the sale of hotel services can be proposed for use in forecasting future periods.

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