



ASSESSMENT OF INVESTMENT ATTRACTIVENESS INDICATORS ON THE BASIS OF FACTOR ANALYSIS

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Article history:	Abstract:
Received: 21 st March 2023	The paper presents the results of a factor analysis of the main socio-economic indicators of the region. A correlation data matrix has been built. Two factors have been identified that have a significant impact on the development of the region. In conclusion, the author gives recommendations for improving the investment attractiveness of the region.
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INTRODUCTION.

The success of the economic development of the regions and the country as a whole is largely determined by the stimulation of investment activity. In recent years, it has become obvious that the successful development of the country and its regions is impossible without large-scale investments that meet the growing demands of citizens for the quality of life and ensure the competitiveness of the economy in international markets. Investments play an important role in ensuring high and sustainable economic growth rates for both a particular region and the entire country. They determine the future of the country as a whole, of a single economic entity, and are a necessary condition for the development of the economy [1].

In modern conditions, when regional authorities carry out significant programs of socio-economic development, the investment attractiveness of the region plays a special role. The increasing of investment attractiveness and investment activity are a necessary condition for the stable development of the region.

So, in order to stimulate the inflow of private investments into the economy of the region, it is necessary to create favorable conditions for their use. This, in its turn, requires the study of key factors in the formation of the investment attractiveness of the region and the degree of their influence. For this purpose, it is

necessary to develop certain methods for assessing investment attractiveness that will satisfy the needs of potential investors.

RESEARCH METHODOLOGY.

The purpose of this study is to conduct a factor analysis of socio-economic data, as well as an analysis of key factors. The study is intended to develop an econometric method for assessing the investment attractiveness of a region, as well as to analyze the key factors influencing it. The object of the study is Navoi region of the Republic of Uzbekistan. To model the investment attractiveness of the region, as well as to identify the most significant factors, the methods of factorial, correlation and regression analysis were used. In the course of the study, official statistical data of the Agency of Statistics under the President of the Republic of Uzbekistan were used.

ANALYSIS AND RESULTS.

For factor analysis, taking into account the specifics of the study and the availability of data, indicators of Navoi region from 2010 to 2021 were selected. The information base for the study was the data of the Agency of Statistics under the President of the Republic of Uzbekistan [2]. A more detailed structure of the selected indicators is given in Table 1.

Table 1.
Initial list of factors affecting investment attractiveness

Nº	Name of the indicator
1	Retail turnover, x_1
2	Scope of services, x_2
3	Real total per capita income, x_3
4	Average annual population, x_4
5	Number of university graduates, x_5
6	The number of labor resources, x_6



7	Economically active population, x_7
8	Total number of unemployed, x_8
9	Number of registered crimes, x_9
10	GDP, x_{10}
11	Number of enterprises, organizations in the region (<i>without household and farm units, at the end of the year</i>), x_{11}
12	The number of small businesses in the region (<i>without household and farm units, at the end of the year</i>), x_{12}
13	Number of liquidated enterprises and organizations (<i>without household and farm units, at the end of the year</i>), x_{13}
14	Volume of industrial production, x_{14}
15	Consumer goods manufacturing, x_{15}
16	Agricultural production, x_{16}
17	Construction works, x_{17}
18	Export, x_{18}

Next, to assess the relationship between various factors, we will build a correlation matrix. This procedure is necessary to start factor analysis, and it is the main prerequisite for its implementation.

As it is acknowledged, the correlation coefficient [3] is the number r , determined by the formula (1):

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}} \quad (1)$$

where: $(x_i, y_i), i = 1, 2, \dots, n$ are random variables, and \bar{x} is the weighted average of the random variable:

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

Recall that a strong correlation is when the correlation coefficient is greater than 0.7 [4].

Корреляции (Таблица 1 ста)																		
Отмеченные корреляции значимы на уровне $p < 0.05000$																		
N=12 (Построчное удаление ГД)																		
Переменная	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15	x16	x17	x18
x1	1.000000	0.997946	0.994409	0.989375	-0.005948	0.911929	0.706394	0.513362	-0.705210	0.969782	0.939379	0.936596	0.644908	0.950478	0.992954	0.996763	0.976056	-0.399279
x2	0.997946	1.000000	0.997309	0.979499	0.042902	0.920681	0.691115	0.311198	-0.684818	0.979046	0.952664	0.950160	0.683777	0.961759	0.986026	0.996165	0.985893	-0.347926
x3	0.994409	0.997309	1.000000	0.973331	0.054586	0.914643	0.681870	0.889816	-0.642979	0.980380	0.954612	0.952630	0.705191	0.964251	0.985693	0.995238	0.982952	-0.322190
x4	0.989375	0.979499	0.973331	1.000000	-0.081754	0.904103	0.762165	0.900879	-0.731869	0.928272	0.897439	0.983716	0.555124	0.901849	0.990174	0.981482	0.938652	-0.509948
x5	-0.005948	0.042902	0.054586	-0.081754	1.000000	0.177203	-0.177047	0.005390	0.166758	0.134913	0.186395	0.187885	0.320016	0.160086	-0.064569	0.043388	0.132710	0.657389
x6	0.911929	0.920561	0.914643	0.904103	0.177203	1.000000	0.772727	0.853700	-0.628081	0.894892	0.871797	0.869215	0.641561	0.875200	0.885706	0.924614	0.913520	-0.302889
x7	0.706394	0.691115	0.681870	0.762165	-0.177047	0.772727	1.000000	0.564276	-0.431886	0.566930	0.515140	0.511315	0.383231	0.518305	0.711509	0.694262	0.616300	-0.671320
x8	0.513362	0.311198	0.889816	0.900879	0.005390	0.853700	0.564276	1.000000	-0.879866	0.911133	0.887167	0.883622	0.462759	0.900909	0.887653	0.912186	0.924576	-0.309504
x9	-0.705210	-0.684818	-0.642979	-0.731869	0.166758	-0.628081	-0.431886	-0.879866	1.000000	-0.670418	-0.654666	-0.649467	-0.033384	-0.662468	-0.694321	-0.683633	-0.687603	0.448645
x10	0.969782	0.979046	0.980380	0.928272	0.134913	0.894892	0.566930	0.911133	-0.670418	1.000000	0.982622	0.991748	0.706830	0.997242	0.961669	0.972037	0.994349	-0.187301
x11	0.939379	0.952664	0.954612	0.897439	0.186395	0.871797	0.515140	0.887167	-0.654666	0.982622	1.000000	0.999905	0.706434	0.997617	0.919369	0.940269	0.963868	-0.110261
x12	0.936596	0.950160	0.952630	0.883716	0.187885	0.869215	0.511315	0.883622	-0.649467	0.991748	0.999905	1.000000	0.708105	0.997266	0.916315	0.937628	0.982278	-0.103710
x13	0.644908	0.683777	0.705191	0.555124	0.320016	0.641561	0.383231	0.462759	-0.033384	0.706830	0.706434	0.708105	1.000000	0.702465	0.609092	0.678702	0.714491	0.171148
x14	0.950478	0.961759	0.964251	0.901849	0.160086	0.875200	0.518305	0.900909	-0.662468	0.997242	0.997617	0.997266	0.702465	1.000000	0.931566	0.952166	0.988984	-0.134734
x15	0.992954	0.986026	0.985693	0.990174	-0.064569	0.885706	0.711509	0.887653	-0.694321	0.951669	0.919369	0.916315	0.609092	0.931566	1.000000	0.983186	0.954492	-0.447085
x16	0.996763	0.996165	0.995238	0.981482	0.043388	0.924614	0.694262	0.912186	-0.683633	0.972037	0.940269	0.937628	0.678702	0.952166	0.983186	1.000000	0.979456	-0.358696
x17	0.976056	0.985893	0.982952	0.938652	0.132710	0.913520	0.616300	0.924576	-0.687603	0.994349	0.983868	0.982278	0.714491	0.985984	0.954492	0.979456	1.000000	-0.211200
x18	-0.399279	-0.347926	-0.322190	-0.509948	0.657389	-0.302889	-0.671320	-0.309504	0.448645	-0.187301	-0.110261	-0.103710	0.171148	-0.134734	-0.447085	-0.358696	-0.211200	1.000000

Fig. 1. Correlation matrix of indicators of the Navoi region.

Figure 1 shows that all indicators are correlated with each other, since there is not a single parameter for which all coefficients are less than 0.5. It is also worth noting that many indicators are highly correlated with others, since the correlation coefficient is greater than 0.9. This circumstance makes it possible to make an assumption about the presence of some hidden factors that affect these parameters, which, in turn, is the basis for factor analysis.

Now let us do a factor analysis using the selected data. As a result, we obtain a table of factor loads of indicators (Fig. 2).

Analysis of the table of factor loadings in fig. 2 shows that it is enough to choose two factors that together describe $77.1+12.6=89.7\%$ of the total variability.



Фактор.нагрузки (Эквимакс нормализ.) (Таблица 1.ста) Выделение: Главные компоненты (Отмечены нагрузки >,700000)		
Перемен.	Фактор 1	Фактор 2
x1	0,99253	-0,088648
x2	0,99665	-0,030014
x3	0,99284	-0,000746
x4	0,96984	-0,212961
x5	0,07503	0,833042
x6	0,93383	0,008577
x7	0,67864	-0,430961
x8	0,92710	-0,097762
x9	-0,70514	0,361511
x10	0,98691	0,116639
x11	0,96694	0,185269
x12	0,96475	0,190792
x13	0,67706	0,488598
x14	0,97355	0,160691
x15	0,97725	-0,143627
x16	0,99321	-0,039429
x17	0,99332	0,092282
x18	-0,31023	0,903898
Общ.дис.	13,87001	2,270731
Доля общ	0,77056	0,126152
%	77,09735	12,573410

Fig. 2. Table of factor loads.

The first factor (Factor 1) is the general one, it absorbs 77.1% of all variability. A greater contribution to the first factor is given by: retail turnover, x1; volume of services, x2; real total per capita income, x3; average annual population, x4; number of labor resources, x6; total number of unemployed, x8; GRP, x10; number of enterprises, organizations in the region (without household and farm units, at the end of the year), x11; the number of small businesses in the region (without household and farm units, at the end of the year), x12; volume of industrial production, x14; production of consumer goods, x15; production of agricultural products, x16; construction work, x17.

The second factor (Factor 2) takes in 12.6% of the variability. The largest contribution to the second factor is made by exports, x18, and the number of university graduates, x5.

Indicators "Economically active population, x7" and "Number of liquidated enterprises and

organizations (excluding household and household units), x13" did not fall into any of the factors. It means that these indicators are weakly correlated with other indicators.

Analyzing the matrix of factor loads, we can give the following interpretation of the factors.

The first factor can be called **the general socio-economic factor**, since it includes both social and economic indicators.

The second factor can be called **additional indicators**.

Let us study the dynamics of the number of university graduates (Fig. 3). The population peaked in 2012, when the number of university graduates in the Navoi region was 3,530 people. The smallest number of graduates falls on 2013. In 2021, there is a sharp increase in the number of graduates, which is explained by the opening of new universities and an increase in the quota for admission starting from 2017.

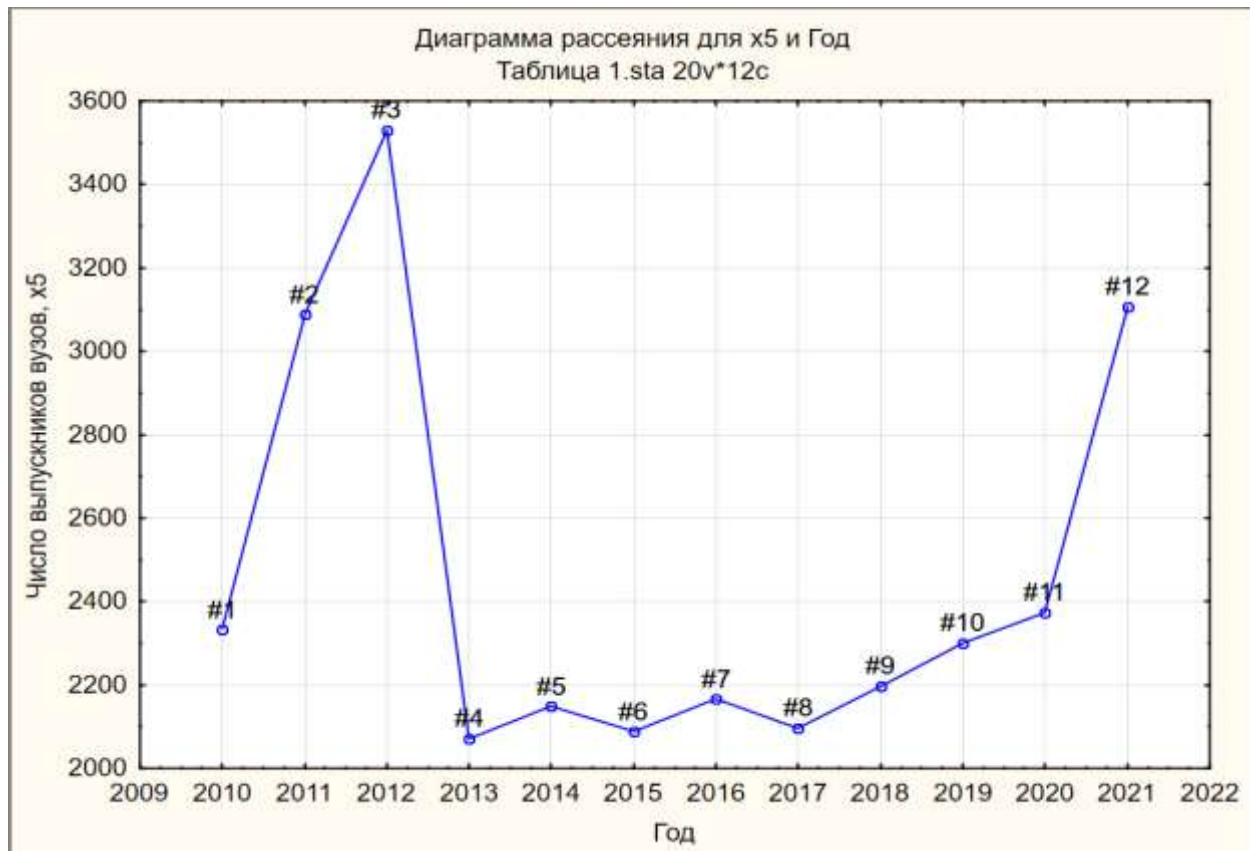


Fig. 3. Dynamics of the number of university graduates, (persons).

Let us look at the dynamics of the volume of exports of the Navoi region (Fig. 4). The maximum export volumes were observed in 2010 and 2011, which may be due to the creation in 2008 of Navoi Free Economic Zone. It is also worth noting that in 2018 the territory of Navoi FEZ was expanded, and since 2018 there has been a gradual increase in exports.

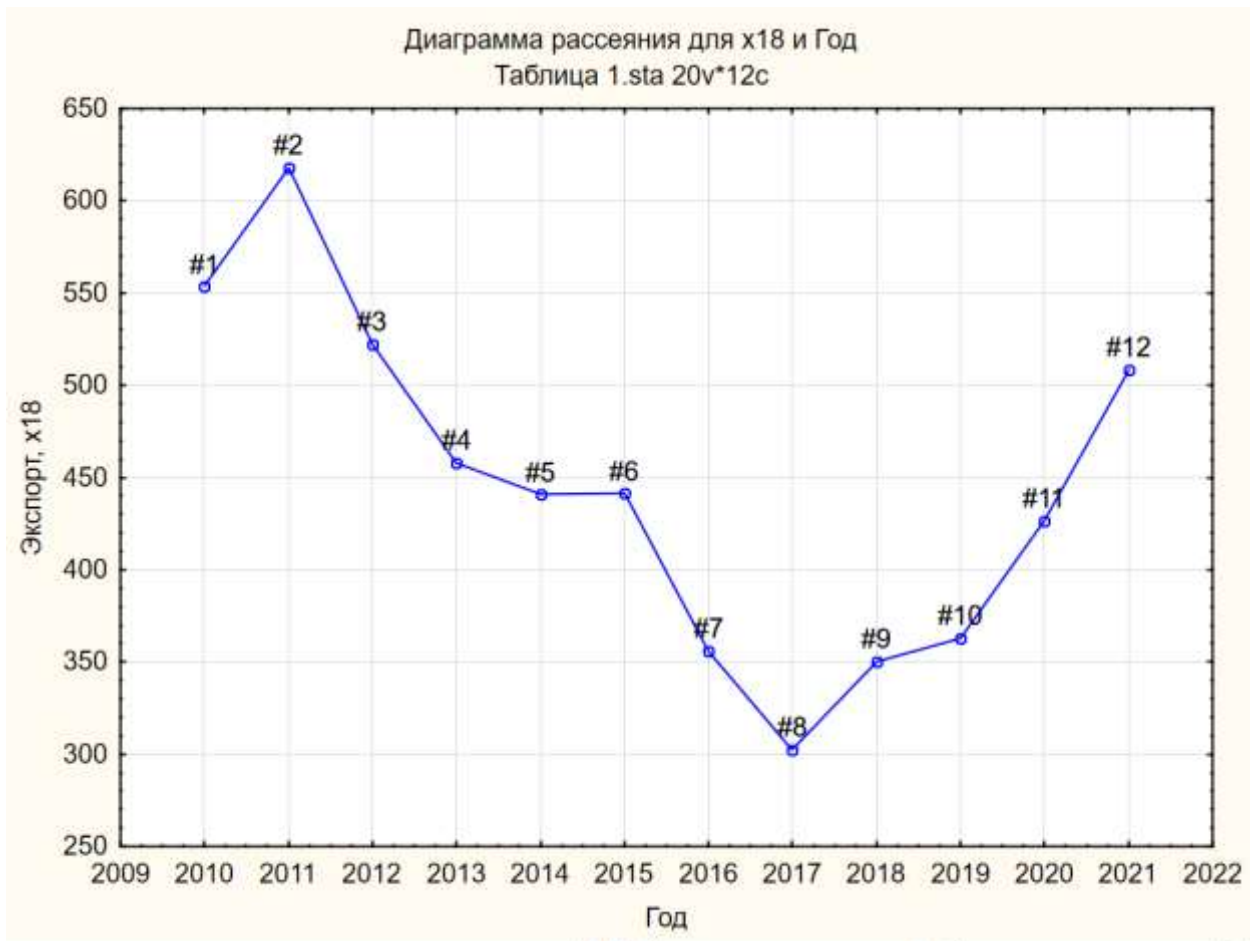


Fig. 4. Dynamics of export volume, (mln. USD).

Let us build a graph of positioning indicators of the investment attractiveness of the Navoi region in the factor space (Fig. 5). Against the background of the general socio-economic factor (Factor 1), there is another factor "Additional indicators" (Factor 2).

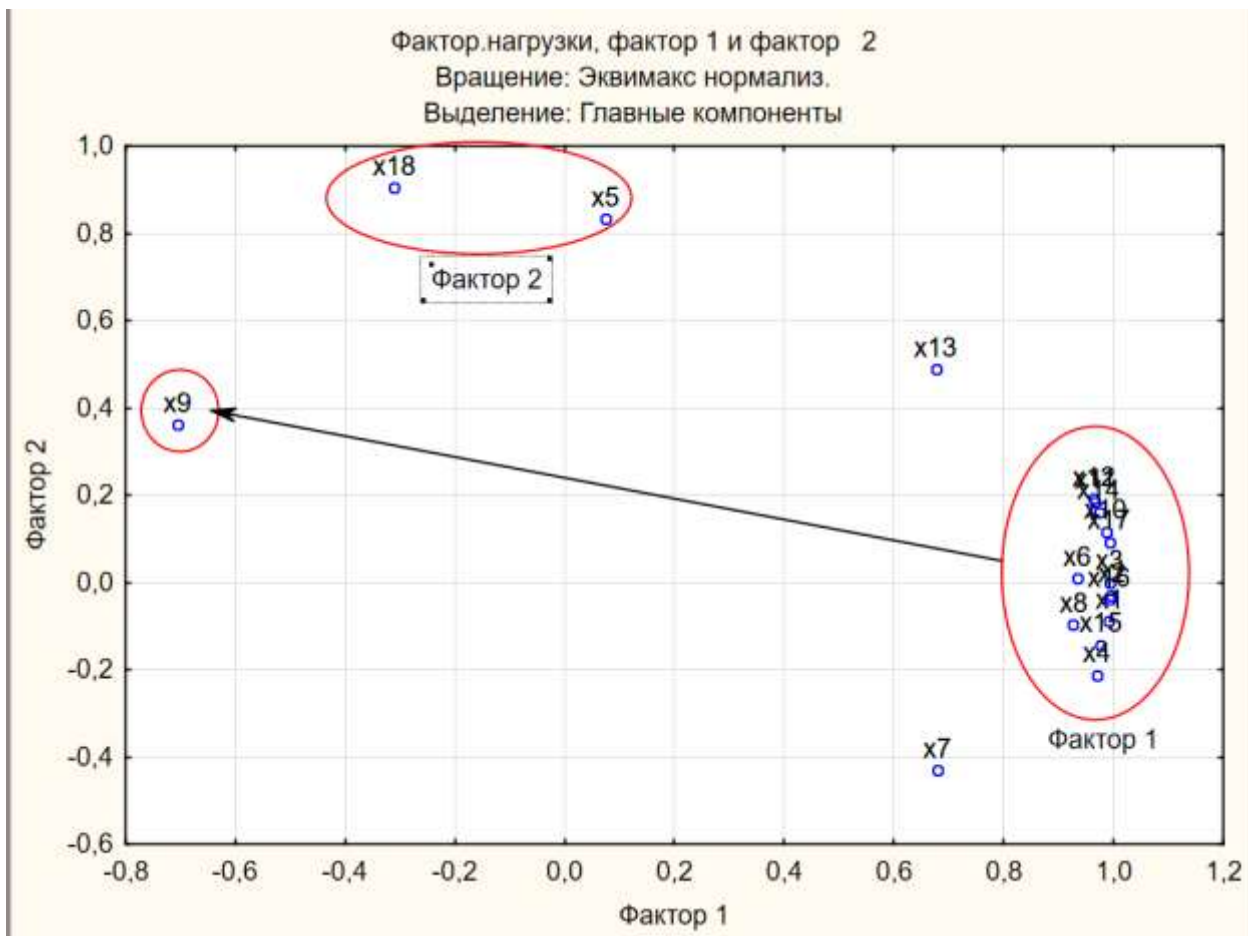


Fig. 5. Positioning of indicators of investment attractiveness in the factor space.

CONCLUSIONS AND PROPOSALS.

Thus, the performed factor analysis allows us to identify indicators that have a stronger influence on the investment attractiveness of the region, and which need to be paid more attention to by local authorities in order to improve the investment climate. Based on the foregoing, the following conclusions and suggestions can be formulated:

1. Improve the conditions for doing business, since the indicators "Number of enterprises, organizations in the region (excluding household and farm units, at the end of the year)", "Number of small businesses in the region (excluding household and farm units, at the end of the year)", "Retail turnover", "Volume of services" fell into the first factor. Improving the business environment is one of the most important conditions for economic growth in most countries of the world.
2. Creation of favorable conditions for enterprises in the manufacturing industry. Improving the activities of the Free Economic Zone to stimulate

industrial enterprises and increase the production of export-oriented goods.

3. The first factor also included the indicators "Real total income per capita", "Average annual population", "Labor resources". It follows from this that it is necessary to pursue an active social policy aimed at improving the standard of living of the population, strengthening health, and increasing the life expectancy of people. It is also necessary to improve the conditions for obtaining higher education, since the indicator of the number of university graduates is highly correlated with other indicators. The development of economic sectors largely depends on the number and qualifications of personnel.

Summing up, we can conclude that the current model of factor analysis allows us to identify the key factors that affect the investment attractiveness of the region. However, it does not exclude the need to search for new growth points. As a result of factor analysis,



recommendations were received to improve the investment climate in the region.

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