ECONOMETRIC ASSESSMENT OF FACTORS INFLUENCING THE DEVELOPMENT OF PRIVATE BUSINESS ENTITIES

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Annotation: This article provides a comprehensive assessment of macroeconomic factors affecting the number of private business entities operating in the Republic of Uzbekistan for 2010–2024 using econometric methods. The main objective of the study is to determine the relationship between the number of private enterprises and tax incentives, electricity production rates, fixed capital investments, and the consumer price index using correlation-regression analysis and to develop a multifactor econometric model.

The scientific novelty of the study lies in the assessment of the development of the private sector using complex econometric modeling based on several macroeconomic indicators at the same time. The practical significance of the results is manifested in the possibility of using them to improve the state's fiscal and investment policy, optimize entrepreneurship support mechanisms, and develop long-term economic forecasts.

Keywords: private business entities, small business, macroeconomic factors, econometric modeling, correlation analysis, multifactor regression, investments, tax incentives, electricity generation, consumer price index, forecasting, fiscal policy.

INTRODUCTION

In recent years, liberalization of the economy, improvement of the business environment and support for the private sector have become one of the priority areas of state policy in the Republic of Uzbekistan. Private business entities play an important role in forming a significant part of the country's gross domestic product, creating new jobs, developing a competitive environment and expanding innovative activities. Therefore, a deep economic and statistical analysis of the dynamics of growth in the number of private enterprises and the factors affecting it is an urgent scientific task.

According to economic theory, the development of the private sector is formed under the influence of many macroeconomic factors. In particular, increased fiscal stimulus measures, improved tax incentives, increased investment in fixed capital, and improved production infrastructure, particularly energy supply, have a direct impact on business activity. At the same time, inflationary processes and price level changes also appear as important factors affecting the stability of the business environment.

Between 2010 and 2024, there was a significant increase in the number of private enterprises operating in Uzbekistan, with fluctuations in some years. During this period, the volume of investments increased sharply, the number of entities granted tax benefits increased, and changes occurred in electricity production indicators. It is of scientific and practical importance to determine how these processes are interconnected and which factor has a stronger impact on the development of the private sector.

The purpose of this study is to assess the relationship between the number of private enterprises operating in the Republic of Uzbekistan and macroeconomic factors based on correlation-regression analysis and to build an econometric model. The research objectives are:

1. to determine the correlation between the main factors;

2. to form a multifactor regression model;

3. to assess the statistical significance of the model parameters;

4. to determine the functional form of the relationship between investments and energy indicators;

5. provide economic interpretation and justify forecasting possibilities.

The scientific novelty of the study is that the dynamics of changes in the number of private enterprises was assessed using a complex econometric approach based on several macroeconomic indicators at the same time. The practical significance is manifested in the possibility of using the results of the model in the process of making strategic decisions to support the private sector, improving fiscal policy, and increasing investment efficiency.

LITERATURE REVIEW

The role and importance of small businesses in economic development is one of the fundamental issues that has long been studied in the theory of the world economy. While the theoretical foundations of entrepreneurial activity were formulated in the works of classical economists Richard Cantillon and Adam Smith [13], modern economic literature emphasizes the role of small businesses in the formation of gross domestic product (GDP), employment, innovation, and economic diversification [14] [15]. International experience shows that the export-oriented activities of small businesses are an important catalyst in improving the country's foreign trade structure and accelerating its integration into global markets [16].

S.S. Gulyomov ("Entrepreneurship and Small Business")[4] and B.Yu. Khodiev, M.S. Qosimova, A.N. Local scholars such as Samadov ("Small Business and Private Entrepreneurship")[6] created works aimed at studying the processes of formation of entrepreneurship in Uzbekistan in the early years of independence, its difficulties and prospects. Their works are considered the main sources for understanding the role and importance of the private sector in the economy of our country.

U.V. Gafurov in his doctoral dissertation ("Improvement of economic mechanisms of state regulation of small business")[3] deeply analyzed the regulatory role of the state in the development of small business. He developed proposals on such practical issues as tax policy, lending mechanisms and the elimination of administrative barriers, which were reflected in the decrees and resolutions of the President.

Scientific articles by I.E. Kenjaev, M.T. Baltabayev, Sh.Sh. Abdurakhmonov ("Foreign Investments in Small Business")[7] and A.M. Siddikov, M.T. Baltaboyev, Sh.Sh. Abdurakhmonov ("Formation and Development of Small Business in Uzbekistan")[8] analyze the impact of the reforms implemented in recent years on the development of small business, including attracting foreign investment. The studies scientifically substantiate the effectiveness of the favorable investment environment being created within the framework of the "New Uzbekistan" strategy.

The article by Sh.Sh. Abdurakhmonov ("Development of Small Business and Private Entrepreneurship in the Economy of Uzbekistan")[9] analyzes the current state, export potential and future prospects of small business in our country.

RESEARCH METHODOLOGY

This study aims to assess the relationship between the number of private enterprises operating in the Republic of Uzbekistan for 2010–2024 and macroeconomic factors based on econometric methods. The research process used economic and statistical analysis, correlation analysis, multivariate regression modeling, selection of functional linkage forms, and forecasting methods.

In recent years, the private sector in the Republic of Uzbekistan has been becoming the leading driver of the economy. Private business entities play an important role in ensuring employment, increasing export potential, accelerating regional development, and stabilizing economic growth. At the same time, along with a significant increase in the number of private enterprises for 2010–2024,

some fluctuations were also observed.

These processes are not accidental, but are inextricably linked to factors such as investment policy, fiscal incentives, energy infrastructure, and macroeconomic stability. In particular, a sharp increase in the volume of investments in fixed capital and the expansion of the tax incentives system are gaining importance in the development of the private sector.

In this regard, quantitative assessment of factors affecting the number of private business entities, determination of their impact and forecasting based on econometric models are scientifically and practically relevant. This is important for the effective formulation of state economic policy and optimal allocation of resources.

Table 1.

Data for correlation-regression analysis to determine the relationship between the number of private enterprises operating in the Republic of Uzbekistan and the factors affecting them [19]

	Y	X_1	X_2	X_3	X_4
2010	51976	42,5	103,1	16463,7	107,5
2011	53806	47,8	101,6	19500	107,3
2012	55778	53,2	100,4	24455,3	107,2
2013	56039	58,6	103,1	30490,1	107
2014	61671	63,9	102,1	37646,2	106,4
2015	65476	69,3	103,4	44810,4	105,5
2016	70381	75,1	102,5	51232	105,6
2017	70839	82,4	102,9	72155,2	109,5
2018	70058	91,7	103,4	124231,3	117,5
2019	72424	103,5	101,0	195927,3	114,5
2020	83558	112,8	104,7	210195,1	112,9
2021	90721	124,6	107,3	239552,6	110,85
2022	89148	137,9	104,1	266240	110,45
2023	93141	152,4	105,0	356071,4	111,66
2024	64384	168,2	101,4	36245	107,98

Table 1 provides data for correlation-regression analysis to determine the relationship between the number of private enterprises operating in the Republic of Uzbekistan in 2010-2024 and the factors affecting them, according to which Y-Number of private enterprises operating (annual) https://siat.stat.uz/reports-filed/3518/table-data; X1- Number of small businesses and private entrepreneurs granted tax incentives (thousands); X2- Electricity generation rate, https://siat.stat.uz/reports-filed/440/table-data; X3-Volume of investments in fixed capital (annual) billion soums, https://siat.stat.uz/reports-filed/1326/table-data; X4- Annual dynamics of the Consumer Price Index (by type) (compared to the corresponding period of the previous year).

The presented Table 2 is a matrix of Pearson correlation coefficients between the number of private enterprises operating in our republic (Y) and various macroeconomic indicators for the period 2010–2024. This correlation analysis serves to identify the main factors affecting the development of the private sector at the national level. The analysis revealed that there is a very strong positive correlation between Y - the number of private enterprises operating - and some independent variables, while moderate correlations are observed with some (Table 2).

The correlation between the number of operating private enterprises and the number of small businesses and private entrepreneurs granted tax incentives is 0.762, which indicates a moderate to high positive correlation. This means that as the number of small businesses and private entrepreneurs

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[19] Siat.stat.uz Author's development based on site information

International Scientific-Electronic Journal "Pioneering Studies and Theories"
ISSN: 3060-5105
www.pstjournal.uz

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granted tax incentives increases, the total number of private enterprises in the country also increases. This makes economic sense - because tax incentives reduce the costs of doing business, create incentives for new enterprises to open, and reduce the likelihood of the closure of existing ones.

Table 2.
Correlation matrix between the number of private enterprises operating in the republic and the factors affecting them.

	Y	X1	X2	X3	X4
Y	1.000000	0.762342	0.730331	0.932676	0.514112
X1	0.762342	1.000000	0.393450	0.708710	0.434105
X2	0.730331	0.393450	1.000000	0.645967	0.286467
X3	0.932676	0.708710	0.645967	1.000000	0.621741
X4	0.514112	0.434105	0.286467	0.621741	1.000000

The correlation between the number of operating private enterprises and the rate of electricity production is 0.730, which also indicates a strong positive correlation. This means that as the number of private enterprises in a country increases, the volume of electricity production also increases. This can have a double effect: the increase in enterprises increases energy demand, and also the improvement in energy supply allows for the emergence of new enterprises.

One of the highest coefficients is 0.932 between the number of operating private enterprises and the volume of investments in fixed capital, which is a very strong positive correlation. This shows that in a year when investments in fixed capital increase, the number of private enterprises also increases sharply. This is because investments are directed to means of production, infrastructure and technologies, which creates conditions for the opening of new businesses and the development of existing ones.

The correlation between the number of operating private enterprises and the consumer price index is 0.514, which is a moderately positive correlation. This indicates that there is no direct and stable relationship between the inflation rate and the number of private enterprises, but an increase in economic activity can also affect the general price level in some cases. Therefore, with a high correlation, it is possible to conduct a regression analysis according to these characteristics.

In conclusion, it should be noted that in the data of Tables 1 and 2, the correlation-regression analysis of the relationship between private entrepreneurship entities operating in the Republic of Uzbekistan and the factors affecting their activities was studied, and the negative impact of factors affecting private entrepreneurship activities was identified based on the results obtained above, which serves to determine the prospects for entrepreneurial activity.

Table 3.
Results of calculating multivariate regression using application programs.

CONCLUSION					
Regression statistics					
Plural R	0,96				
R-squared	0,93				
Normalized R-squared.	0,90				
Standard error.	4370,63				

Observations	15				
Dispersion analysis					
	df	SS	MS	F	F importance
Regression	4	2436674331	609168582,8	31,88960748	1,14E-05
Remainder	10	191024170,9	19102417,09		
Total	14	2627698502			

Table 3 uses a number of statistical indicators to evaluate the results of the regression analysis. The presented regression table is aimed at determining the statistical relationship between several economic indicators that affect the development of the private sector in the country. The main goal of this analysis is to determine which factors explain the number of private enterprises and how strong their influence is. The R in the multivariate is 0.96, which is a very high indicator, indicating that the correlation between the independent variables (factors) in the model and the resulting variable (the number of operating private enterprises) is 96%. This is an almost ideal relationship, which means that the factors are very well selected. The coefficient of determination or R-squared = 0.93 means that the model can explain 93% of the changes in the number of private enterprises. From the point of view of economic analysis, this is a very large value, since in most cases 70–80% is also considered a good result. Normalized R-squared = 0.90 — this is also a high indicator, indicating that the result is very stable, even considering the number of factors in the model. This means that each variable added to the model really contributed to the accuracy of the result. Standard error = 4370.63 — this means that the average difference between the predicted values and the actual values is about 4370 enterprises. This is a relatively small value, especially considering that the number of private enterprises in the country is in the tens of thousands.

F = 31.89 — this indicates that the statistical significance level of the regression model is very high. In practice, the larger the F value, the more reliable the model is. A large value such as 31 is almost ideal.

So the regression equation looks like this:

$$Y = -107424,5 + 80,7 * X_1 + 1811,85 * X_2 + 0,08 * X_3 - 238,75 * X_4 \quad (1)$$

Here, Y is the number of active private enterprises, X1 is the number of tax-exempt entities, X2 is the electricity production index, X3 is the volume of investments, and X4 is the consumer price index.

The economic model is a multiple linear regression model based on the above regression equation. It explains Y through X1, X2, X3, and X4. The model makes economic sense: an increase in investments (X3) and tax exemptions (X1) will increase the number of enterprises, while an increase in the price index (X4) may have a negative effect (due to inflation).

Considering the statistical significance of the model parameters, the P-values (significance level, significant if $p < 0.05$):

➢ Constant: 0.353 (not significant)
➢ X1: 0.085 (marginal, significant at the 10% level)
➢ X2: 0.070 (marginal, significant at the 10% level)
➢ X3: 0.003 (significant, at the 1% level)
➢ X4: 0.01595 (significant, at the 1% level)

The values of the short-term change in the number of private enterprises operating in the Republic of Uzbekistan under the influence of selected factors, i.e. in 2026–2030, taken for analysis using a multifactor econometric model, are presented in Figure 4 based on Table 1. The forecast indicators for 2026–2030 were formed based on the dynamic extrapolation and regression model. First of all, 2023 was taken as the base year as the last stable observation period. When forecasting for subsequent years, annual growth rates based on economic logic were determined for each

International Scientific-Electronic Journal "Pioneering Studies and Theories"
ISSN: 3060-5105
www.pstjournal.uz

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independent factor (X1 - the number of entities granted tax benefits, X2 - the rate of electricity generation, X3 - the volume of investments in fixed capital, X4 - the consumer price index). These increases were calculated according to the principle of compound interest, that is, each year's value was determined by adding a certain percentage to the previous year's indicator. As a result, forecast values of factors X1–X4 were formed for 2026–2030.

Table 4

The number of private enterprises operating in the Republic of Uzbekistan in 2026–2030 and the forecast values of the indicators of factors influencing its change [20]

Year	X1	X2	X3 (billion soums)	X4	Forecast Y
2026	160.02	106.05	384 557	113.89	**101 208**
2027	168.02	107.11	415 322	116.17	**105 693**
2028	176.42	108.18	448 547	118.49	**110 415**
2029	185.24	109.26	484 431	120.86	**115 392**
2030	194.51	110.36	523 186	123.28	**120 642**

Then, the values of X1, X2, X3 and X4 calculated for each year were inserted into the previously defined multifactor regression equation. This equation expresses the empirical relationship between the factors and the resulting indicator - the number of operating private enterprises (Y). The regression coefficients reflect the marginal impact of each factor on Y. Thus, the forecast values for the factors were entered into the model and a mathematically calculated forecast level of Y was obtained for each year. Thus, the forecast of Y directly depends on the expected dynamics of the factors X1–X4, and the model is deterministic in nature, that is, external shocks or unexpected institutional changes were not taken into account. As a result, a gradual growth trend in the number of private enterprises was formed in 2026–2030.

Figure 1 shows the dynamics of the number of private enterprises operating in the Republic of Uzbekistan for 2010–2030 and three forecast scenarios for 2026–2030. The left part of the graph depicts the actual indicators for 2010–2023, which generally demonstrate a steady growth trend: from approximately 52 thousand enterprises in 2010, they reached more than 93 thousand by 2023. Although there were slowdowns or short-term fluctuations in some years during this period, the overall trend remained positive. In 2024, a sharp decrease was observed, which can be explained by extra-model factors or statistical changes.
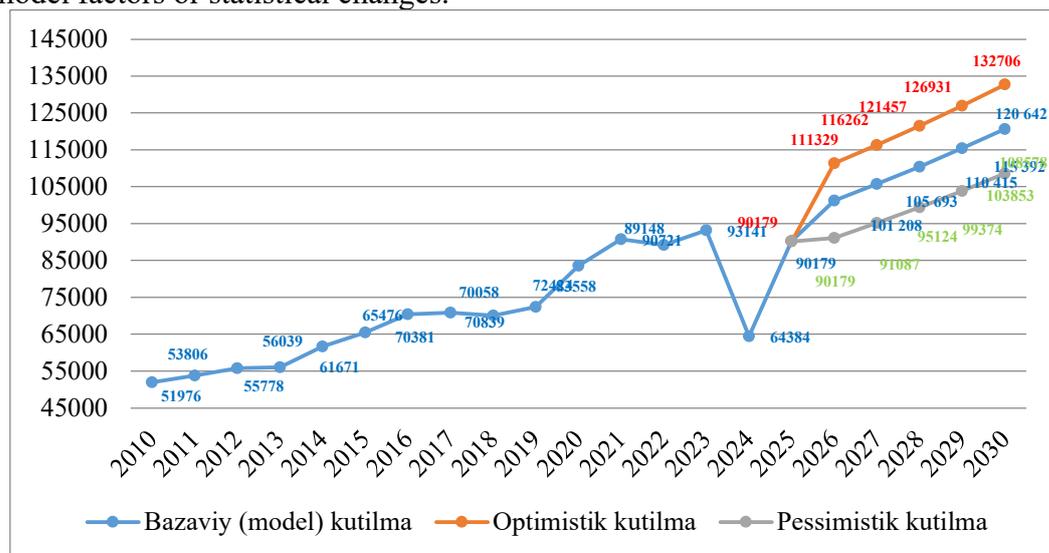

Figure 1. Changes in the number of private enterprises operating in the Republic of Uzbekistan in 2010–2030 [21], (2026–2030- years forecast).

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[20] Developed by the author.
[21] Developed by the author.

The right part of the graph presents the baseline, optimistic and pessimistic forecast scenarios for 2026–2030. According to the baseline (model) scenario, the number of private enterprises is expected to gradually increase and exceed 120 thousand by 2030. Under the optimistic scenario, growth may accelerate further due to increased investments and fiscal stimulus, reaching a level above 130 thousand. Under the pessimistic scenario, the growth rate will slow down relatively, but the overall trend will still remain positive. In general, the picture clearly demonstrates the long-term positive dynamics of private sector development and the significant impact of economic policy factors on the forecast results.

SCIENTIFIC NOVELTY OF RESEARCH

1. The relationship between macroeconomic factors affecting the number of private business entities in the Republic of Uzbekistan for the period 2010–2024 was assessed for the first time based on a complex multifactor econometric model.

2. The fact that investments in fixed capital are a priority determinant of private sector development was empirically substantiated ($r=0.93$; $p<0.01$), and its marginal impact was quantitatively assessed.

3. The existence of a statistically significant positive correlation between the number of entities granted tax benefits and the number of active private enterprises was established, and the economic efficiency of fiscal incentive mechanisms was scientifically substantiated.

4. The direct impact of the rate of electricity production on private sector development was statistically proven, and energy infrastructure was substantiated as an important factor of entrepreneurial activity.

5. The mechanism of indirect and marginal impact of the consumer price index (inflation) on the number of private enterprises was identified, and the functional relationship between macroeconomic stability and the business environment was substantiated.

6. A multifactor regression model with high accuracy ($R^2=0.93$) was developed, and on its basis, baseline, optimistic, and pessimistic forecast scenarios for 2026–2030 were formed.

7. A practical econometric tool was proposed that can be used to forecast private sector development and formulate economic policy.

CONCLUSION

The results of this study confirmed that the number of private business entities operating in the Republic of Uzbekistan for 2010–2024 has a strong and statistically significant relationship with macroeconomic factors. The correlation analysis showed that there is a very strong positive relationship ($r=0.93$) between the number of private enterprises and the volume of investments in fixed capital, which indicates that investment processes are the most important driver of private sector development. A significant positive relationship was also observed with the number of tax incentives ($r=0.76$) and the rate of electricity production ($r=0.73$). The relationship with the consumer price index was found to be moderate, indicating that the inflation factor has an indirect effect on the activities of the private sector. The multifactor regression model is characterized by a high level of accuracy ($R^2=0.93$; $F=31.89$).

This model shows that the selected factors can explain 93% of the changes in the number of private enterprises. Statistical analysis of the parameters confirmed that investments and the consumer price index are the most important factors, while tax incentives and energy indicators are of marginal importance. Thus, in the economic sense, investment activity and the expansion of fiscal stimulus mechanisms are the main factors ensuring the growth of the private sector. The forecast results for 2026–2030 showed that the number of private enterprises will maintain a gradual growth trend. According to the baseline scenario, the number of operating private enterprises is expected to exceed 120 thousand by 2030. Under optimistic conditions, the indicator may reach even higher levels as a result of increased investments and fiscal support. Even in the pessimistic scenario, the positive trend is projected to remain, albeit with a slowdown in growth.

International Scientific-Electronic Journal "Pioneering Studies and Theories"
ISSN: 3060-5105
www.pstjournal.uz

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January, February, March 2026

In general, the results of the study justify the need to strengthen the policy of support for private entrepreneurship by expanding investments, developing energy infrastructure, and creating a stable fiscal environment. This econometric model is of practical importance in planning state economic policy, optimal allocation of resources, and developing long-term strategic forecasts.

Based on the results of the study, the following scientific and practical proposals can be put forward to further accelerate the development of private entrepreneurship in the Republic of Uzbekistan:

- strengthening investment activity;
- optimizing fiscal incentive mechanisms;
- developing energy infrastructure;
- ensuring macroeconomic stability;
- improving the forecasting and monitoring system;
- conducting a regional differential policy.

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