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ECONOMETRIC MODELING AND FORECASTING THE IMPACT OF TAX BURDEN ON ENTERPRISE PERFORMANCE INDICATORS

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Abstract. The scientific article presents proposals and recommendations for identifying factors affecting the optimization of the tax burden of oil and gas industry enterprises through econometric models, increasing enterprise income, reducing taxes and mandatory payments, and identifying ways to optimize the tax burden.

Keywords:tax, tax burden, oil and gas industry enterprises, econometric models, total taxes and payments, enterprise sales revenue at contractual prices, value of fixed assets, investments in production, cost of goods sold.

Today, the excessive tax burden on businesses is considered a negative factor that hinders their proper functioning and obstructs entrepreneurial activity. High tax burdens can lead to the economy shifting into the shadow sector. When tax rates are high, some entrepreneurs and individuals may attempt to move into the informal economy to avoid or reduce their legal tax obligations. Thus, an important aspect of successful management is the application of tax optimization methods that take into account the specific aspects of each enterprise. Effective tax optimization requires the use of a set of existing tax enforcement methods, constantly adapting them to the unique characteristics of the enterprise. Reviewing and improving existing methods for reducing the tax burden, taking into account the frequent changes in domestic tax legislation, determines the relevance of the chosen research topic.

According to the Decree of the President of the Republic of Uzbekistan No. PF-158 dated September 11, 2023, on the "Uzbekistan 2030" Strategy, the following goals have been set to ensure the prosperity of the population through sustainable economic growth: leveraging opportunities to expand the tax base by reducing the "Shadow Economy," transitioning to a "Green Economy" with a significant increase in the use of renewable energy, gradually shifting monopoly sectors to market principles, increasing the share of the private sector in the economy, creating favorable conditions for entrepreneurs to operate freely, ensuring the stability of the tax system, guaranteeing that value-added and profit tax rates will not be increased for three years, fully digitizing and simplifying the tax system, creating equal opportunities for entrepreneurs, and establishing all necessary conditions to ensure the dominance of the formal sector over illegal activities by 2030.

Based on the above, it is considered important to identify and describe the factors influencing the optimization of the tax burden on oil and gas industry enterprises through econometric modeling of their mutual impact and using statistical data.

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Analysis of literature on the topic. The study of the impact of the tax burden on the organization and regulation of socio-economic processes has historically been one of the important research directions. The results obtained have attracted the attention of numerous researchers, policymakers, and practitioners. They have primarily focused on issues such as the impact of the tax burden on economic activity, the distribution of the tax burden among economic entities and individuals, the painless transfer of the tax burden to other entities, and mitigating its impact on the financial condition of taxpayers. However, despite this, the issue of determining the optimal level of the tax burden still remains unresolved.

There are similar and closely related approaches among scholars and experts regarding the determination of the tax burden at the macro level. The characteristics of the tax burden as the weight of tax obligations at the macro level, i.e., its impact on the entire economy, are observed in the works of F. Justi[2], K. Brauer[3], A.V. Vahobov and A.S. Juraev[4], K. Yahyaev[5], and T.S. Malikov[6]. Sh.Sh. Turaev, in a number of scientific studies, has explained the tax burden at the micro level as the ratio of taxes and payments to the volume of sales of products by an economic entity[7].

Enterprises generate a certain economic profit as a result of their economic activities. A portion of this profit is paid to the state budget in the form of corporate income tax. At the same time, the increase in the types of taxes for enterprises, on the one hand, limits their capabilities, and on the other hand, provides opportunities to choose new directions of activity.

Today, questions about what the tax burden should be for enterprises and what they should focus on to reduce the tax burden are among the most pressing issues for enterprises.

Research Methodology. The research employs a methodology to identify factors influencing the tax burden on enterprise performance indicators through econometric models, taking into account expected changes in the enterprise in the coming years, and thereby studying the optimization of the tax burden. Based on expert opinions, the study utilizes methods such as scientific abstraction, analysis and synthesis, induction and deduction, statistical grouping, systematic approach, observation, correlation and regression analysis, comparative analysis, factor analysis, economic-mathematical modeling, and forecasting. These methods are used to propose ways to optimize the tax burden for oil and gas industry enterprises. Additionally, conclusions and specific recommendations for optimizing the tax burden have been developed, focusing on the key tasks of tax obligations for oil and gas industry enterprises from the fourth quarter of 2024 to the first quarter of 2026.

Analysis and Results. In this research, the issues of econometric modeling of the impact of the tax burden on the economic indicators of enterprises were examined. For this purpose, the construction of a multifactorial econometric model is required. The main distinguishing feature of multifactorial econometric models compared to other types of models is that they take into account the combined influence of all factors on the resulting factor.

To construct a multifactorial econometric model, it is necessary to identify the resulting factor and the influencing factors. Based on the purpose of the article, the resulting factor is the total taxes and payments, million soums (Y), while the influencing factors are the enterprise's revenue from sales at contractual prices, million soums (X1), the value of fixed production assets, million soums (X2), investments in production, million soums (X3), and the cost of goods sold, million soums (X4).

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The information base for the multifactorial econometric model consists of data from the State Statistics Agency of the Republic of Uzbekistan and the " Buxoro neftni qayta ishlash zavodi " LLC.

Descriptive statistics were conducted for all influencing factors and the resulting factor based on the data from "Buxoro neftni qayta ishlash zavodi" LLC, which will be used to construct the multifactorial econometric model. (The data covers the period from the first quarter of 2019 to the third quarter of 2024). For this purpose, specialized econometric modeling software – Eviews10 – was used. The results of the descriptive statistics are presented in Table 1 below.

Table 1

Results of Descriptive Statistics Calculated Among Factors

	Y	X1	X2	X3	X4
Mean	246164,5	1926681,	308908,2	90342,39	1642222,
Median	216547,0	1950000,	304892,0	88987,00	1635872,
Maximum	364787,0	2544247,	394301,0	289734,0	2740009,
Minimum	183245,0	1253013,	226077,0	9776,000	1013414,
Std. Dev.	59376,33	379476,6	38442,16	76086,04	444530,4
Skewness	0,547545	-0,206778	-0,074555	1,178479	0,490525
Kurtosis	1,715353	1,967578	3,104006	3,878180	2,674171
Jarque-Bera	2,730809	1,185386	0,031674	6,062848	1,024096
Probability	0,255277	0,552837	0,984288	0,048247	0,599267
Sum	5661785,	44313667	7104888,	2077875,	37771104
Sum Sq. Dev.	7,76E+10	3,17E+12	3,25E+10	1,27E+11	4,35E+12
Observations	23	23	23	23	23

Table 1: Descriptive Statistics of Variables

The table provides the following statistics for each factor:

- Mean: The average value of each factor.
- Median: The middle value of each factor.
- Maximum: The highest value of each factor.
- Minimum: The lowest value of each factor.
- Standard Deviation (Std. Dev.): This indicates how much each variable deviates from the mean. It shows the spread of the data points around the mean.

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Skewness: This is the asymmetry coefficient. If the skewness is zero, it indicates a normal distribution and symmetry in the data. If the skewness coefficient significantly differs from zero, the distribution is considered asymmetric (i.e., not symmetric).

- If the skewness coefficient is greater than zero (positive), the distribution is skewed to the right, meaning the right tail of the distribution is longer.

- If the skewness coefficient is less than zero (negative), the distribution is skewed to the left, meaning the left tail of the distribution is longer.

From the data presented in Table 1, it can be observed that:

- The skewness coefficients for factors **X1** and **X2** are negative, indicating that the distribution of these factors is skewed to the left, with the "left tail" being longer than the "right tail."

- On the other hand, the skewness coefficients for factors **Y**, **X3**, and **X4** are positive, indicating that the distribution of these factors is skewed to the right, with the "right tail" being longer than the "left tail."

The calculated values in Table 1 show that all factors included in the multi-factor econometric model follow a normal distribution.

To select the factors for the multi-factor econometric model that will be constructed to analyze the impact of various factors on the total taxes and payments made by the " Buxoro neftni qayta ishlash zavodi " LLC (Y), a correlation analysis was conducted between the factors. The results are presented in the correlation matrix in Table 2.

Table 2

Correlation Matrix

Covariance Analysis: Ordinary

Date: 12/10/24 Time: 11:49

Sample: 2019Q1 2024Q3

Included observations: 23

Correlation

t-Statistic

Probability	Y	X1	X2	X3	X4
LNY	1,000000				
LNX1	0,731840	1,000000			

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t-Statistic	4,612028	-----			
Correlation	0,0019	-----			
LNX2	-0,647895	0,604591	1,000000		
t-Statistic	-3,619737	3,478292	-----		
Correlation	0,0032	0,0052	-----		
LNX3	-0,732454	0,585888	0,640616	1,000000	
t-Statistic	-4,612376	3,319227	3,623182	-----	
Correlation	0,0019	0,0026	0,0032	-----	
LNX4	0,675104	0,647665	0,588748	0,590613	1,000000
t-Statistic	3,311281	3,620729	3,337780	3,356944	-----
Correlation	0,2039	0,0033	0,0051	0,0049	-----

The correlation between the total taxes and payments made by the "Buxoro neftni qayta ishlash zavodi" LLC (Y) and the company's revenue from sales at contractual prices (X1) is 0.7318. This indicates a moderate to strong positive relationship between these two factors, meaning that as revenue from sales increases, the total taxes and payments also tend to increase. The correlation between the total taxes and payments made by the "Buxoro neftni qayta ishlash zavodi" LLC (Y) and the value of the company's fixed production assets (X2) is -0.6479. This shows a moderate inverse relationship between these two factors, meaning that as the value of fixed production assets increases, the total taxes and payments tend to decrease. The correlation between the total taxes and payments made by the "Buxoro neftni qayta ishlash zavodi" LLC (Y) and the investments made in production (X3) is-0.7324. This indicates a moderate to strong inverse relationship between these two factors, meaning that as investments in production increase, the total taxes and payments tend to decrease. The correlation between the total taxes and payments made by the "Buxoro neftni qayta ishlash zavodi" LLC (Y) and the price of sold products (X4) is 0.6751. This suggests a moderate to strong positive relationship between these two factors, meaning that as the price of sold products increases, the total taxes and payments also tend to increase.

In addition, Table 2 provides the calculated pairwise correlation coefficients between the influencing factors. These coefficients are used to identify multicollinearity among the factors. If the calculated pairwise correlation coefficient between influencing factors (Xi, Xj) is greater than 0,7, it is concluded that multicollinearity exists between the factors.

From the partial and pairwise correlation coefficient matrix calculated in Table 2, it can be observed that the pairwise correlation coefficients between the factors influencing the total taxes and payments made by the "Bukhara Oil Refinery" LLC (Y) do not exceed **0.7**. This, in turn, satisfies the condition for including all selected factors in the multi-factor econometric model.

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Another method to check for the absence of multicollinearity among the influencing factors is to calculate the **VIF (Variance Inflation Factor)** coefficients. The VIF coefficients calculated for each factor are presented in Table 3 below.

Table 3

Measuring the Effect of Multicollinearity Among Influencing Factors

Variance Inflation Factors

Date: 12/10/24 Time: 11:53

Sample: 2019Q1 2024Q3

Included observations: 23

Variable	CoefficientVariance	CenteredVIF
X_1	0,009897	1,233707
X_2	0,153937	1,969154
X_3	0,074013	3,708841
X_4	0,009590	6,404201
C	1,18E+10	NA

The VIF coefficients are used to assess the degree of multicollinearity. A VIF value greater than **10** typically indicates significant multicollinearity, while values below this threshold suggest that multicollinearity is not a major concern. The calculated VIF coefficients for each factor are provided in Table 3.

If multicollinearity exists among the influencing factors, the **Centered VIF (Variance Inflation Factor)** will be greater than **10**. From Table 3, it can be observed that the VIF coefficients for all influencing factors related to the total taxes and payments made by the " Buxoro neftni qayta ishlash zavodi" LLC are less than **10**. This, like the correlation analysis, indicates that **multicollinearity is not present** among the influencing factors.

Therefore, taking into account the absence of multicollinearity among the factors, we construct a multi-factor econometric model for the total taxes and payments made by the " Buxoro neftni qayta ishlash zavodi" LLC (Y) and its influencing factors (Xi). This multi-factor econometric model takes the following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \qquad (1)$$

Where:

Y is the dependent variable (total taxes and payments),

X1 ,X2 ,X3 ,X4 are the independent (influencing) factors,

β0 ,β1 ,β2 ,β3 ,β4 are the unknown parameters to be estimated,

ϵ is the random error term.

To estimate the unknown parameters (β0 ,β1 ,β2 ,β3 ,β4) in the multi-factor econometric model (1), we used the **Ordinary Least Squares (OLS)** method. The results are presented in Table 4 below.

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Table 4
Estimated Parameters of the Multi-Factor Econometric Model
Dependent Variable: LNY

Method: Least Squares

Date: 12/10/24 Time: 11:53

Sample: 2019Q1 2024Q3

Includedobservations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X_1	0,035121	0,009486	3,702404	0,0011***
X_2	-0,171600	0,077348	-2,218540	0,0599**
X_3	-0,658310	0,272053	-2,419750	0,0083***
X_4	0,106153	0,048930	2,169487	0,0614**
C	116652,2	108752,1	1,072643	0,6684
R-squared	0,810172	Mean dependent var		246164,5
Adjusted R-squared	0,779099	S.D. dependent var		59376,33
S.E. of regression	50413,99	Akaike info criterion		24,68359
Sum squared resid	4,57E+10	Schwarz criterion		24,93043
Loglikelihood	-278,8612	Hannan-Quinn criter		24,74567
F-statistic	31,29346	Durbin-Watson stat		1,853380
Prob(F-statistic)	0,000536			

Note: *** - 0.05 percent accuracy, ** - 0.1 percent accuracy

The table provides the estimated values of the parameters (β0 ,β1 ,β2 ,β3 ,β4) along with their corresponding statistical significance levels, standard errors, and confidence intervals. These results allow us to interpret the impact of each influencing factor on the total taxes and payments made by the "Buxoro neftni qayta ishlash zavodi" LLC.

Using the data from Table 4, we express the calculated multi-factor econometric model for the total taxes and payments made by the "Bukhara Oil Refinery" LLC (Y) in its analytical form as follows:

$$\hat{Y} = 116652{,}2 + 0{,}035X_1 - 0{,}172X_2 - 0{,}658X_3 + 0{,}106X_4 \qquad (2)$$

multi-factor econometric model shows the following relationships: If the company's revenue from sales at contractual prices (**X1**) increases by 1 million soums on average, the total taxes and

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payments (**Y**) made by the company will increase by 0.035 million soums on average. If the value of the company's fixed production assets (**X2**) increases by 1 million soums on average, the total taxes and payments (**Y**) made by the company will decrease by 0.172% on average. If the investments made in production (**X3**) increase by 1 million soums on average, the total taxes and payments (**Y**) made by the company will decrease by 0.658 million soums on average. If the price of sold products (**X4**) increases by 1 million soums on average, the total taxes and payments (**Y**) made by the company will increase by 0.106 million soums on average.

In testing the quality of the multifactor econometric model (2) constructed for the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC, we use the coefficient of determination. The coefficient of determination shows the percentage of the resulting factor that is explained by the factors included in the model. The calculated coefficient of determination (R2 - R-squared (Table 4)) is equal to 0.8105. This indicates that 81.05% of the total taxes and payments (Y) paid by "Buxoro neftni qayta ishlash zavodi" LLC are explained by the factors included in the calculated multifactor econometric model (2). The remaining 18.95% (100.0 - 81.05) indicates the influence of unaccounted factors.

To test the statistical significance of the multifactor econometric model (2) constructed for the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC, we determine the tabulated value of Fisher's F-criterion. The tabulated value of the $F_{tabulated}$=2,91. Since the calculated value of the F-criterion, $F_{calculated}$=31,2935, is greater than the tabulated value, $F_{tabulated}$=2,91, and the condition $F_{calculated}>F_{tabulated}$ is satisfied, the multifactor econometric model (2) can be considered statistically significant.

We test the reliability of the parameters in the calculated multifactor econometric model (2) using the Student's t-test. The tabulated value of the t-test is equal to [value]. The calculated values of the t-test for all factors included in the multifactor econometric model are greater than the tabulated value at a significance level of [value] (Table 4). This indicates that all factors are reliable and allows their inclusion in the multifactor econometric model.

To check for the presence of autocorrelation in the residuals of the resulting factor (lnY) in the multifactor econometric model (2) constructed for the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC, we use the Durbin-Watson (DW) test. The calculated DW value is compared with the tabulated values of DW_L and DW_U. If $DW_{calculated}<DW_L$, it is concluded that autocorrelation exists in the residuals of the resulting factor. If $DW_{calculated}>DW_U$, it is concluded that there is no autocorrelation in the residuals of the resulting factor. The lower bound value of the Durbin-Watson test is DW_L=0,99, and the upper bound value is DW_U=1,79. The calculated DW value is $DW_{calculated}$=1,8534. Therefore, since $DW_{calculated}>DW_U$, there is no autocorrelation in the residuals of the resulting factor (total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC (lnY)).

Based on these findings, we use the multifactor econometric model (2) to perform forecast calculations for the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC for future periods.

To achieve this, we first construct a trend model for each influencing factor. A trend model is a function of the influencing factor over time and generally takes the following form:

$$X_i = \beta_0 + \beta_1 \ t + \varepsilon \qquad (3)$$

The trend model for the company's revenue from sales at contractual prices (X_1) takes the following form:

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$$X_1 = 1454593{,}0 + 39340{,}71\ t \quad (4)$$

$R^2 = 0{,}7031$, $F_{calculated} = 20{,}5342$, $t_{calculated} = 4{,}5315$

The trend model for the value of fixed production assets (X_2) takes the following form:

$$X_2 = 258608{,}0 + 4191{,}583\ t \quad (5)$$

$R^2 = 0{,}7395$, $F_{calculated} = 25{,}3488$, $t_{calculated} = 5{,}0348$

The trend model for investments in production (X_3) takes the following form:

$$X_3 = 31432{,}4 + 10147{,}9\ t \quad (6)$$

$R^2 = 0{,}9046$, $F_{calculated} = 94{,}5602$, $t_{calculated} = 9{,}7242$

The trend model for the price of sold products (X_4) takes the following form:

$$X_4 = 1051836{,}0 + 49198{,}83\ t \quad (7)$$

$R^2 = 0{,}7506$, $F_{calculated} = 27{,}1057$, $t_{calculated} = 5{,}2063$

The analysis of the trend models constructed between the influencing factors and the time factor shows that all calculated coefficients in the trend models (4) – (7) are statistically significant, and the reliability of their parameters has been confirmed. Therefore, we calculate the trend models (4) – (7) and substitute their calculated values into the multifactor econometric model (2). First, we determine the forecast values of the influencing factors (X_j), and then we perform forecast calculations for the resulting factor (Y). As a result, we obtain the forecast values of the variables included in the multifactor econometric model (2) for the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC during the forecast period (Table 5).

Table 5

Total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC in 2019-2024 and forecast calculations of the indicators affecting them for 2024-2026 [1]*

Years	Total Taxes and Payments, million UZS, Y	Revenue from Sales at Contractual Prices, million UZS, X_1	Value of Fixed Production Assets, million UZS, X_2	Investments in Production (Capital Investments), million UZS, X_3	Price of Sold Products, million UZS, , X_4
2019.1	281672,0	1805232,0	263452,0	9776,0	1456829,0
2019.2	321589,0	1852704,0	226077,0	11687,0	1451951,0
2019.3	332587,0	1950000,0	287144,0	12458,0	1624898,0
2019.4	364787,0	2150000,0	301229,0	12756,0	1854789,0

[1] Author development

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Journal: https://www.academicpublishers.org/journals/index.php/ijai

2020.1	183245,0	1324725,0	245964,0	24569,0	1013414,0
2020.2	187963,0	1356539,0	256879,0	25478,0	1125875,0
2020.3	192587,0	1452175,0	302145,0	26587,0	1125365,0
2020.4	206978,0	1645877,0	339629,0	26695,0	1245857,0
2021.1	196321,0	1253013,0	296321,0	65789,0	1186247,0
2021.2	216547,0	1587965,0	314587,0	72147,0	1154789,0
2021.3	225789,0	1625321,0	301258,0	78214,0	1221539,0
2021.4	223309,0	1745874,0	329363,0	88987,0	1256987,0
2022.1	294205,0	1874592,0	302878,0	99563,0	1635872,0
2022.2	305982,0	2145879,0	301489,0	100235,0	1752478,0
2022.3	321489,0	2015487,0	305214,0	101254,0	1758365,0
2022.4	312583,0	2341873,0	394301,0	99833,0	1950086,0
2023.1	187653,0	2187525,0	304892,0	110008,0	1857321,0
2023.2	198756,0	2156987,0	312589,0	114133,0	1885471,0
2023.3	190258,0	2231000,0	314258,0	115789,0	1954789,0
2023.4	215427,0	2376893,0	356672,0	123578,0	2157371,0
2024.1	197002,6	2211932,2	344944,0	217546,0	2160807,0
2024.2	203485,7	2477826,7	349496,0	251059,0	2199995,0
2024.3	301569,3	2544247,0	354107,0	289734,0	2740009,0
2024.4*	**260118,2**	**2498769,8**	**359208,3**	**212117,2**	**2232607,2**
2025.1*	**259480,0**	**2538110,5**	**363400,0**	**222265,1**	**2281806,0**
2025.2*	**258841,8**	**2577451,2**	**367591,7**	**232413,0**	**2331004,8**
2025.3*	**258203,6**	**2616791,9**	**371783,4**	**242560,9**	**2380203,6**
2025.4*	**257565,5**	**2656132,6**	**375975,0**	**252708,8**	**2429402,4**
2026.1*	**256927,3**	**2695473,3**	**380166,7**	**262856,7**	**2478601,2**

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Journal: https://www.academicpublishers.org/journals/index.php/ijai

Using the calculated data in Table 5, the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC are on a downward trend from 2019 to 2021, and based on forecast indicators, the forecast calculations of total taxes and payments for future periods during 2024 and 2026 will decrease, while the enterprise's revenue from sales at contractual prices, the value of fixed production assets, investments in production, and the cost of products sold have a tendency to increase. These indicators indicate that it is possible to optimize the tax burden at the enterprise.

Conclusions and suggestions. In conclusion, the results of the above research show that a number of factors affect the total taxes and payments paid by "Buxoro neftni qayta ishlash zavodi" LLC.

The multi-factor econometric model developed as a result of our research showed that:

- an average increase in the enterprise's sales revenue at contract prices by 1.0 percent, the total taxes and payments paid by the enterprise by 0.035 percent;
- an average increase in the value of fixed production assets at the enterprise by 1.0 percent, the total taxes and payments paid by the enterprise by 0.172 percent;
- an average increase in investments in production at the enterprise by 1.0 percent, the total taxes and payments paid by the enterprise by 0.658 percent;
- It was determined that the cost of products sold at the enterprise will increase by an average of one million soums, and the total taxes and payments paid by the enterprise will increase by an average of 0.106 percent.

Based on the research conducted, in the current rapidly changing environment, even monopoly enterprises must be flexible. Only then will we need to begin work on creating a competitive infrastructure.

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