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FACTORS AFFECTING DAIRY PRODUCTION EFFICIENCY: CORRELATION AND REGRESSION ANALYSIS

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Abstract. This article analyzes the financial performance of “Uzbegin Agro Uzbekistan–Germany” for the period 2015–2024 using economic-statistical and econometric methods. The study examines the dynamics of the enterprise’s net profit, period expenses, and investment volumes, and evaluates the relationships among these indicators through correlation and regression analysis. The results show a strong positive relationship between net profit and period expenses ($r = 0.8594$), as well as a very strong relationship between investment and net profit ($r = 0.8913$). In addition, a logarithmic regression model is used to assess the impact of investment and expenses on enterprise profitability, confirming that investment is one of the key factors contributing to net profit growth.

The article also analyzes regional trends in milk production in Uzbekistan from 2010 to 2024. The research findings indicate that milk production in the country has shown steady growth, with Samarkand, Kashkadarya, Fergana, and Khorezm regions ranking among the leading regions in this area. The obtained results may serve as a basis for developing scientific and practical recommendations aimed at increasing the economic efficiency of dairy enterprises, improving investment policy, and effectively utilizing regional production potential.

Keywords: dairy industry, investment, net profit, period expenses, correlation analysis, regression model, econometric analysis, regional development, economic efficiency, milk production.

Аннотация. В данной статье на основе экономико-статистических и эконометрических методов проведён анализ финансовой деятельности предприятия «Uzbegin Agro Uzbekistan–Germany» за 2015–2024 годы. В ходе исследования изучена динамика чистой прибыли, периодических расходов и объёмов инвестиций предприятия, а также оценена взаимосвязь между данными показателями с использованием корреляционного и регрессионного анализа. Полученные результаты показали наличие сильной положительной связи между чистой прибылью и периодическими расходами ($r = 0,8594$), а также очень тесной связи между объёмом инвестиций и чистой прибылью ($r = 0,8913$). Кроме того, на основе логарифмической регрессионной модели была оценена степень влияния инвестиций и расходов на прибыльность предприятия, что позволило подтвердить значимую роль инвестиций как одного из ключевых факторов роста чистой прибыли.

В статье также проанализированы тенденции развития производства молока в регионах Узбекистана за период 2010–2024 годов. Результаты исследования свидетельствуют о стабильном росте объёмов производства молока в стране, при этом Самаркандская, Кашкадарьинская, Ферганская и Хорезмская области занимают лидирующие позиции по данному показателю. Полученные результаты могут служить основой для разработки научно-практических рекомендаций, направленных на повышение экономической эффективности предприятий молочной отрасли, совершенствование инвестиционной политики и более эффективное использование регионального производственного потенциала.

Ключевые слова: молочная промышленность, инвестиции, чистая прибыль, периодические расходы, корреляционный анализ, регрессионная модель, эконометрический анализ, региональное развитие, экономическая эффективность, производство молока.

INTRODUCTION

The agricultural sector, particularly livestock and dairy production, plays a crucial role in the sustainable development of the national economy. The importance of dairy production in ensuring food security, developing the processing industry, and increasing export potential is growing every year. Therefore, improving the economic efficiency of enterprises operating in this field and conducting an in-depth analysis of the factors affecting their financial results are among the most relevant scientific and practical issues.

In recent years, large-scale reforms have been carried out in Uzbekistan to modernize agriculture and the food industry, introduce advanced technologies, and improve the investment climate. As a result, the volume of dairy production has increased, and positive changes have been observed in the financial indicators of enterprises operating in the sector. However, the profitability and economic efficiency of such enterprises largely depend on investment volumes, production costs, and other economic factors.

In this study, the financial activities of “Uzbegin Agro Uzbekistan–Germany” for 2015–2024 are analyzed, and the relationships between the enterprise’s net profit, period expenses, and investments are evaluated using correlation and regression methods. In addition, the dynamics of milk production in Uzbekistan by region are examined, and the contribution of regions to the country’s total milk production volume is assessed based on an econometric approach.

The aim of the study is to identify the main factors influencing the financial results of dairy industry enterprises, evaluate the role of investments and expenses in enterprise profitability, and substantiate the national significance of regional milk production indicators using econometric methods. The research results may serve as a basis for making effective management decisions in dairy industry enterprises, improving investment policy, and ensuring the sustainable development of the sector.

LITERATURE REVIEW

Assessing the efficiency of enterprise activities and determining the impact of investments and expenses on financial results are among the widely studied areas in economic science. In particular, the role of investment activity in increasing net profit, profitability, and enterprise competitiveness has been substantiated in numerous scientific studies.

In studies devoted to the relationship between economic growth and investment, investment is recognized as an important factor in expanding production capacity, introducing technological innovations, and improving the financial performance of enterprises. Robert Solow, one of the founders of economic growth theory, emphasized that investment contributes to increasing production volumes and income through the accumulation of capital. It is also recommended to widely apply production functions and econometric modeling methods when evaluating investment efficiency.

Issues related to the relationship between enterprise expenses and profit are widely discussed in scientific works on management accounting and financial analysis. Researchers note that effective cost management helps ensure the financial stability of an enterprise, increase profit, and promote the rational use of resources. From this perspective, studying the relationship between costs and profit through correlation and regression analysis is an important tool for assessing enterprise performance.

In studies on the dairy industry and livestock production, the role of the sector in ensuring food security is particularly emphasized. According to scientific sources, the growth of dairy production is directly linked to population growth, increased livestock productivity, the introduction of modern technologies, and investment activity. At the same time, the natural and climatic conditions of regions, the feed base, and production infrastructure significantly influence milk production volumes.

In studies conducted by domestic economists, issues related to increasing the economic efficiency of agricultural and food industry enterprises are widely covered. These studies substantiate the importance of attracting investment, applying innovative technologies, optimizing production costs, and making management decisions based on economic and mathematical models.

ANALYSIS AND RESULTS

The analyzed scientific literature indicates that assessing the relationship between investment, expenses, and enterprise financial results using econometric methods is one of the relevant areas of contemporary economic research. However, studies that combine enterprise-level financial indicators with regional milk production factors, particularly in the context of dairy industry enterprises, remain insufficient.

Therefore, this study comprehensively examines the activities of “Uzbegin Agro Uzbekistan–Germany” and the regional characteristics of milk production in Uzbekistan on the basis of correlation and regression analysis (Figure 1).

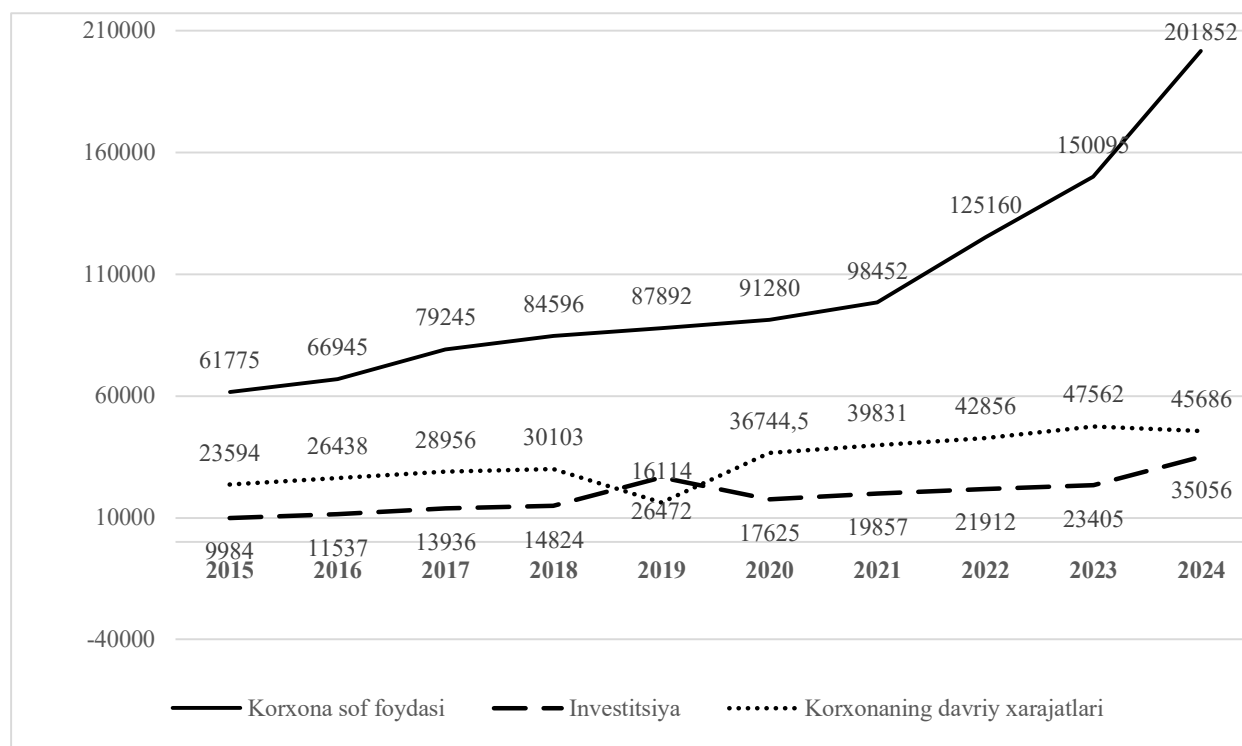


Figure 1. Dynamics of changes in the financial results of the “Uzbegin agro Uzbekistan-Germany” enterprise (in million soums)¹

The results of the study show that the net profit of “Uzbegin Agro Uzbekistan–Germany” demonstrated significant positive growth over the last three years. In 2015, the enterprise's net profit amounted to 61.775 billion soums, while in 2021 it reached 98.452 billion soums. In 2022, the enterprise achieved 27% higher net profit compared to the previous year. By 2024, the net profit of “Uzbegin Agro Uzbekistan–Germany” exceeded 200 billion soums, which is 205% higher than in 2021. In 2023, the enterprise's net profit increased by nearly 25 billion soums, representing one of the most notable growth periods in the company's recent development.

An analysis of the dynamics of enterprise expenses shows that in 2019, expenses decreased sharply. In that year, the enterprise's expenses fell to 16.114 billion soums, representing the minimum value for the analyzed period. This figure was almost twice as low as in 2018. Despite the decline in expenses, the company's profit continued to grow steadily, supported by investments made in the enterprise.

The largest increase in investment dynamics occurred in 2019, when investment volume reached 26.472 billion soums, which was twice as much as in 2018. In 2020, the volume of investments decreased by 17.625 billion soums. However, due to the steady growth of investments in subsequent years, investment volume reached 35.056 billion soums by 2024.

Based on the research results, the correlation between enterprise expenses, investment volume, and the net profit of “Uzbegin Agro Uzbekistan–Germany” was determined (Table 1).

Table 1

Results of the Pearson coefficient between certain indicators of the “Uzbegin agro Uzbekistan-Germany” enterprise and the enterprise's net profit²

Indicators	Enterprise's net profit	Periodic expenses of the enterprise	Investment
Enterprise's net profit	1.0000		
Periodic expenses of the enterprise	0.8594	1.0000	
Investment	0.8913	0.8023	1.0000

¹ author's development

² author's development

As a result of the study, it can be concluded that the enterprise's expense accounting is properly organized. The period expenses of the enterprise have a strong positive relationship with its net profit, with a Pearson correlation coefficient of 0.86. Based on the table data, there is also a very strong positive correlation between the net profit of "Uzbegin Agro Uzbekistan–Germany" and the volume of investments made in the enterprise. The correlation coefficient between investment volume and net profit is 0.89 (Figure 2).

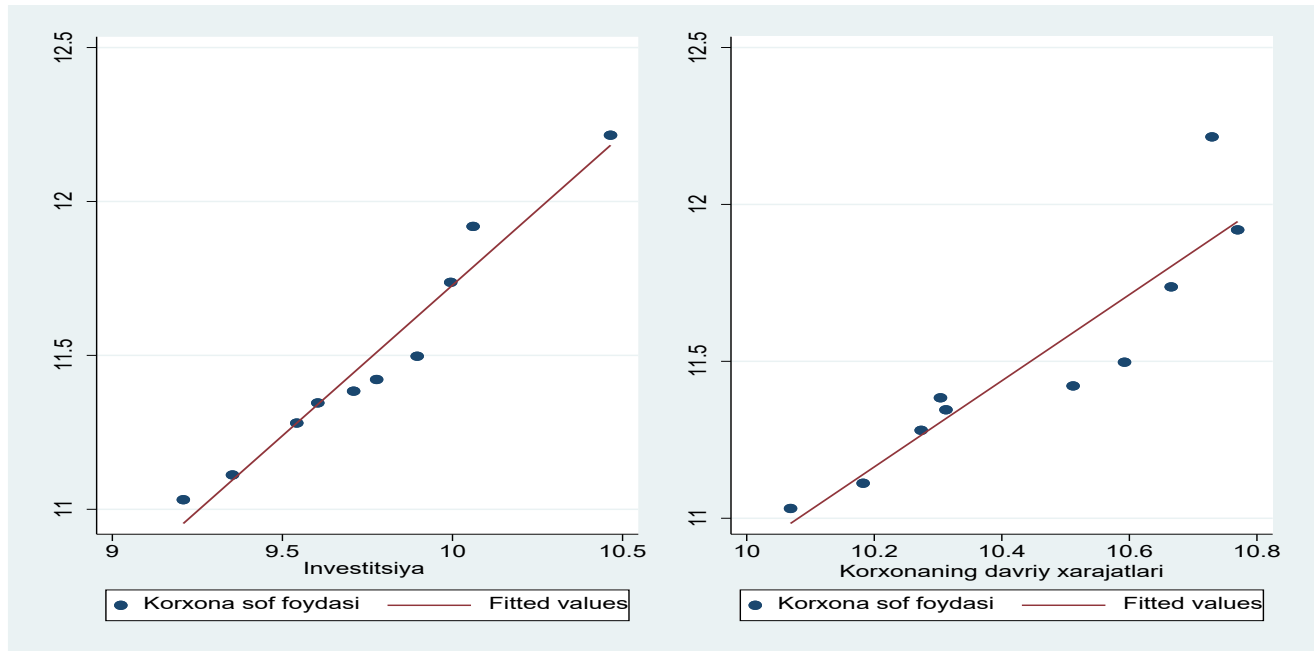


Figure 2. Regression dependence of certain indicators of the "Uzbegin agro Uzbekistan–Germany" enterprise on the enterprise's net profit³

Based on the scientific research conducted, a logarithmic regression model was developed to assess the impact of investments and enterprise expenses on the net profit of "Uzbegin Agro Uzbekistan–Germany". The results show that each parameter of the regression model is statistically significant, as the p-values are less than 0.05. This indicates that the model parameters are significant at the 5% significance level.

Furthermore, the Durbin–Watson statistic for the model is 1.95, which indicates that there is no autocorrelation problem. Since the Durbin–Watson coefficient is close to 2, the regression model can be considered statistically reliable in terms of the absence of autocorrelation.

$$\ln profit = 0,6 * \ln cost + 1,05 * \ln inv + 1,66$$

Based on the results of the regression model, it can be concluded that, if other variables remain unchanged, a 1% increase in the enterprise's investment volume leads to a 1.05% increase in the net profit of "Uzbegin Agro Uzbekistan–Germany". In addition, a 1% increase in enterprise expenses is associated with a 0.6% increase in net profit.

The coefficient of determination of the model is 0.88, which means that the model explains 88% of the variation in net profit (Table 2).

3 author's development

Table 2
Dynamics of milk production in our country⁴

		2010	2015	2020	2024	Share %da
Uzbekistan Republic of Uzbekistan	Y	6133.8	8994.8	10930.1	12422.1	100
Republic of Karakalpakstan	X_1	181.1	320.3	399	466	3.6
Andijan	X_2	540.9	822.1	977.8	1117.5	9.0
Bukhara	X_3	538.4	777.9	1001.2	1130.7	9.0
Jizzax	X_4	326.9	486.7	617.7	711.1	5.6
Kashkadarya	X_5	657.1	952.2	1173.4	1378.3	10.4
Navoi	X_6	268.9	384.9	479	563.5	4.4
Namangan	X_7	384.3	581	720.4	803.9	6.5
Samarkand	X_8	745.5	1132.3	1305.4	1455.5	12.2
Surxondaryo	X_9	508.2	748.2	881.9	975	8.2
Syrdarya	X_{10}	200.4	287.7	356.1	414.5	3.3
Tashkent	X_{11}	561	780	915.5	1072	9.0
Fergana	X_{12}	588.8	854.1	1047.1	1190.3	9.5
Khorezm	X_{13}	632.3	867.4	1053.7	1137.4	9.5
Tashkent city	X_{14}	0	0	1.9	6.4	0.0

At the next stage of our research, we will obtain empirical results on the impact of regions on the volume of milk production in the country. Based on the above data, we evaluate the impact of regions on the country's milk production volume using the least squares method (Table 3).

Table 3
Correlation of milk production indicators in the Republic of Uzbekistan and its regions⁵

	Uzbekistan Republic of Uzbekistan	Karakalpakstan Republic of Uzbekistan	Andijan	Bukhara	Jizzax	Kashkadarya	Navoi	Namangan	Samarkand	Surxondaryo	Syrdarya	Tashkent	Fergana	Khorezm	Tashkent city
Uzbekistan Republic of Uzbekistan	1.0														
Karakalpakstan Res.	0.99	1.0													
Andijan	0.98	0.87	1.0												
Bukhara	0.95	0.84		1.0											
Jizzax	0.94	0.81			1.0										
Kashkadarya	0.99	0.86				1.0									
Navoi	0.97	0.85					1.0								
Namangan	0.98	0.86						1.0							
Samarkand	0.97	0.85							1.0						
Surxondaryo	0.95	0.84								1.0					
Syrdarya	0.94	0.81									1.0				
Tashkent	0.92	0.80										1.0			
Fergana	0.96	0.83											1.0		
Khorezm	0.93	0.81												1.0	
Tashkent city	0.93	0.82													1.0

⁴ author's development

⁵ author's development

Statistical data show that over the last 15 years, the volume of dairy production in the country's regions has doubled. In 2010, dairy products worth 6,133.8 billion soums were produced in the republic, while by 2024 this figure had reached 12,422.1 billion soums.

In terms of regional distribution, Samarkand region has remained the leading region in dairy production for many years. According to the research results, an average of 12.2% of the country's dairy products were produced in Samarkand region over the last 15 years. The closest region to Samarkand in terms of this indicator is Kashkadarya region, which accounts for 10.7% of the country's milk production. Fergana and Khorezm regions occupy the next positions, each with an average milk production share of 9.5%.

Andijan, Bukhara, and Tashkent regions are also among the leading producers of dairy products in the country. According to the research findings, these three regions together produce an average of 27% of the country's dairy products annually, with each region contributing approximately 9%.

The research results indicate that, except for Tashkent region, milk production volumes in all regions demonstrate a trend that is largely consistent with the overall trend of dairy production in the country. Therefore, the correlation coefficients for most regions are considered to be very close to 1. At the same time, the impact of individual regions on national milk production can be assessed using regression models.

CONCLUSION AND RECOMMENDATIONS

In this study, the financial activities of "Uzbegin Agro Uzbekistan–Germany" for 2015–2024 and regional trends in milk production in Uzbekistan were analyzed using economic-statistical and econometric methods.

The results show that the enterprise's net profit has maintained a steady growth trend in recent years. In particular, net profit increased from 61,775 million soums in 2015 to 201,850 million soums in 2024, representing nearly 3.3-fold growth. This confirms the increasing efficiency of the enterprise's activities and the positive outcomes of investment activity.

The correlation analysis revealed a strong positive relationship between net profit and period expenses ($r = 0.8594$), as well as a very strong positive relationship between net profit and investment volume ($r = 0.8913$). This indicates that investment is an important factor in improving the financial performance of the enterprise. The regression model showed that a 1% increase in investment volume leads, on average, to a 1.05% increase in net profit, while a 1% increase in expenses is associated with a 0.6% increase in net profit. The coefficient of determination of 0.88 indicates the high explanatory power of the model. In addition, the Durbin–Watson statistic of 1.95 confirms the absence of an autocorrelation problem in the model.

The analysis of milk production volumes across the regions of the Republic of Uzbekistan showed that, between 2010 and 2024, national milk production more than doubled. Samarkand region holds the leading position, accounting for an average of 12.2% of the country's milk production. Kashkadarya, Fergana, Khorezm, Andijan, Bukhara, and Tashkent regions were also identified as regions with significant shares in total milk production. The correlation analysis showed a very high positive relationship between national milk production and regional indicators, indicating that growth in regional milk production directly contributes to the increase in the country's total production volume.

Based on the research results, the following recommendations are proposed: further expansion of investment activities in dairy industry enterprises; improvement of profitability through the optimization of production costs; acceleration of the introduction of modern technologies and innovative management methods; development of production infrastructure in regions with a relatively low share of dairy production; and expansion of the export potential of the dairy industry through the implementation of regional investment projects.

Overall, increasing investment and ensuring the efficient use of production resources are among the key factors for improving the economic efficiency of dairy industry enterprises and further expanding milk production in the country.

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