

American Journal of Economics and Business Management

Vol. 9 Issue 8 | **pp.** 451-458 | **ISSN:** 2576-5973

Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

Economic Forecasting of the Impact of Financial Autonomy on the Competitiveness of Higher Education Institutions: A Case Study of Bukhara State University

Adizov Bobir Bakhtiyorovich[1]

1. Independent PhD, Associate Professor, Independent Researcher at Bukhara State University Bukhara, Uzbekistan
   Correspondance: adizov.b@mail.ru

Abstract: This article examines the impact of financial autonomy reforms on the competitiveness of higher education institutions (HEIs) in a transition economy, using Bukhara State University (Uzbekistan) as a case study. Five indicators for 2015–2025 were analyzed: total revenues, non-budget revenues, expenditures financed from own funds, funds generated from research and innovation activities, and the number of international scientific publications. These indicators were integrated into a single competitiveness index using normalization relative to the maximum value and analyzed through a multifactor power (multiplicative) regression model, a parabolic trend model, and Holt's exponential smoothing model. In addition, forecasts for 2027–2030 were developed under three scenarios: pessimistic, baseline, and optimistic. The integrated index increased from 10.56% in 2015 to 95.45% in 2024, followed by a slight decline to 87.50% in 2025. According to the forecast estimates, the index is expected to reach between 143.67% and 175.60% by 2030, depending on the scenario. Total revenues and expenditures financed from own funds demonstrate the highest elasticities, at 0.285 and 0.246, respectively, while research and innovation funds and the number of international publications demonstrate the highest projected growth rates. The findings indicate that financial autonomy, when combined with revenue diversification, has a positive effect on the competitiveness of a public university located outside major scientific centers. The results have practical relevance for Central Asian countries and other transition economies.

Keywords: *financial autonomy; university competitiveness; higher education finance; economic forecasting; regression modeling; Holt's exponential smoothing model; scenario forecasting; transition economy.*

Citation: Bakttiyorovich, A. B. Economic Forecasting of the Impact of Financial Autonomy on the Competitiveness of Higher Education Institutions: A Case Study of Bukhara State University. American Journal of Economics and Business Management 2026, 9(8), 451-458.

Received: 10th Apr 2026
Revised: 11th May 2026
Accepted: 11th Jun 2026
Published: 28th Aug 2026

Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/)

1. Introduction

Reforms granting financial autonomy to public universities have become a common trend in higher education policy worldwide, as governments seek to expand institutional self-financing while maintaining public accountability [1], [2]. Financial autonomy generally refers to a university's authority to generate, retain, and allocate revenues beyond centralized public budget funding, including tuition fees, off-budget revenues, research grants, and income generated from the commercialization of innovations. Proponents of these reforms argue that greater financial autonomy enables institutions to diversify their revenue sources, respond more rapidly to market and research opportunities, and strengthen their competitiveness at both national and international levels [3].

At the same time, empirical evidence regarding the relationship between autonomy and institutional performance remains mixed. Recent large-scale studies of European countries have found that greater financial, organizational, human-resource, and academic autonomy often has relatively limited, and in some cases even negative, effects on universities' performance in education, research, and knowledge exchange [4]. Other studies indicate that financial autonomy, when combined with appropriate governance and quality assurance mechanisms, is associated with improvements in research performance and service quality, particularly when institutions actively diversify their sources of off-budget revenue [5]. However, a substantial part of this literature focuses on Western European systems with well-developed research infrastructures. Much less is known about how financial autonomy reforms operate in Central Asian transition economies, where such reforms are relatively recent and institutional capacity for revenue diversification is still developing.

In Uzbekistan, financial autonomy for higher education institutions was introduced in the early 2020s, providing universities with considerably greater authority to manage tuition fees, off-budget revenues, and income generated from research activities compared with the previously centralized financing model. This study seeks to address this gap in the literature. First, it examines the dynamics of financial and research indicators at Bukhara State University before and after the transition toward financial autonomy. Second, it demonstrates how an Integrated Competitiveness Index constructed from these indicators can be modeled and forecast using several econometric and time-series methods. The analysis covers the period 2015–2025 and enables a comparison of results obtained through three independent forecasting approaches for 2027–2030 [6].

The relationship between institutional autonomy and university performance has attracted increasing scholarly attention as higher education systems have moved away from fully centralized financing models [7]. According to a systematic review covering 80 studies published between 2012 and 2022, competition among higher education institutions is shaped by both internal management decisions and external pressures arising from government funding formulas, ranking systems, and the international student market. The ability to attract external grants and diversify revenues, in turn, contributes to improvements in publication output and institutional rankings [8].

Evidence from European university systems, however, is more cautious. A recent study using multilevel regression models across 15 European countries found that greater financial and organizational autonomy often had relatively limited, and in some cases negative, effects on universities' outcomes in education, research, and knowledge exchange. This suggests that formally granted autonomy does not automatically translate into higher efficiency when it is not accompanied by effective internal governance [9]. This conclusion is also consistent with earlier studies showing that the impact of autonomy on institutional performance depends substantially on complementary factors, such as competitive funding mechanisms and quality assurance systems [10].

Research on financial sustainability adds a resource-management perspective, demonstrating that universities facing restrictions on tuition fees or limited government budget allocations must diversify their revenue sources, control administrative expenditures, and manage existing financial obligations [11]. Additional evidence from Central Asian higher education systems indicates that financial autonomy enables universities to reallocate additional resources toward infrastructure modernization, strengthening research capacity, and improving staff qualifications, which, in turn, is associated with improvements in international rankings and the quality of education (comparative studies of Central Asian higher education conducted in 2025).

Within the existing literature, the quantitative forecasting of the joint dynamics of financial and research indicators associated with financial autonomy at the level of an individual public university, particularly in the context of a transition economy, remains

relatively underexplored. Based on eleven years of institutional data from Bukhara State University, this study partially addresses this gap by combining a multiplicative regression model, a parabolic trend model, and Holt's exponential smoothing method with scenario-based sensitivity analysis.

2. Materials And Methods

2.1 Data and Indicators

Annual data for Bukhara State University covering the period 2015–2025 (11 observations) were collected for five factors considered central indicators of institutional competitiveness under financial autonomy. X1 — total revenues (billion UZS) reflects the university's overall financial capacity; X2 — off-budget revenues (billion UZS, expressed as an absolute value rather than a share) represents the institution's ability to generate resources independently of government allocations; X3 — expenditures financed from own funds (billion UZS) reflects the extent to which the institution can independently finance its operations; X4 — funds generated from research and innovation activities (billion UZS) represents its potential for attracting grants and commercializing research results; and X5 — number of international scientific publications reflects its international research visibility. The observation period was divided around the 2021/2022 transition into the pre-financial-autonomy period (2015–2021) and the financial-autonomy period (2022–2025). The formation of the dataset also took into account the requirements of national regulatory and legal documents governing the development of higher education and the granting of greater autonomy to public higher education institutions in Uzbekistan.

2.2 Integrated Competitiveness Index

Because the five indicators are expressed in different units of measurement (monetary values and counts), each series was first normalized relative to its maximum value achieved during the study period. The normalized indicators were then aggregated using equal weights to construct an Integrated Competitiveness Index (Y) expressed as a percentage. Values approaching 100% indicate that the university is close to its historical maximum performance across the selected indicators. The selection of indicators took into account the substance of the reforms in Uzbekistan aimed at expanding the financial and institutional autonomy of higher education institutions.

2.3 Multiplicative (Power) Regression Model

The relationship between the Integrated Competitiveness Index and the five explanatory factors was estimated using a multiplicative (Cobb–Douglas-type) specification with constant elasticities. Under this specification, the regression coefficients can be directly interpreted as elasticity coefficients. The model parameters were estimated in logarithmic form using the ordinary least squares method based on eleven annual observations for 2015–2025.

2.4 Trend Extrapolation and Holt's Exponential Smoothing Model

For each of the five factors, a parabolic (second-degree polynomial) trend equation was estimated over the 2015–2025 time series using the normal equations of the least squares method for a quadratic trend. The resulting equations were then used to obtain point forecasts for 2027–2030. For the Integrated Competitiveness Index itself, Holt's two-parameter exponential smoothing model was employed as a second, independent forecasting approach. Under this method, the series is decomposed into smoothed level and trend components, each of which is recursively updated using smoothing coefficients alpha for the level and beta for the trend. The parameters were selected by minimizing the sum of squared one-step-ahead forecast errors over the historical series.

2.5 Scenario-Based Forecasting and Forecast Accuracy Assessment

Three scenario-based forecasts—pessimistic, baseline, and optimistic—were developed around the regression-based baseline forecast. The pessimistic and optimistic scenarios were defined as 10% below and 10% above the baseline trajectory, respectively, reflecting potential downside or upside variations in revenue diversification, grant funding, and publication growth. The quality of both regression-based and Holt-model forecasts was evaluated using the coefficient of determination (R^2), adjusted R^2, mean absolute percentage error (MAPE), root mean square error (RMSE), mean absolute error (MAE), and Theil's inequality coefficient (Theil's U).

3. Results

3.1 Comparison of the Pre- and Post-Financial-Autonomy Periods

Table 1 compares the average annual values of the five factors during the pre-financial-autonomy period (2015–2021) and the post-financial-autonomy period (2022–2025). All five indicators increased substantially, with growth rates ranging from 226% for funds generated from research and innovation activities to 327% for the number of international scientific publications.

Table 1. Bukhara State University: Comparison of Key Competitiveness Factors Before and After Financial Autonomy

No.	Indicator	Symbol	Average, 2015–2021	Average, 2022–2025	Change	Growth, %
1	Total revenues, billion UZS	X1	120.53	359.84	+239.31	298.6
2	Off-budget revenues, billion UZS	X2	93.45	264.33	+170.88	282.9
3	Expenditures financed from own funds, billion UZS	X3	98.91	260.06	+161.15	262.9
4	Funds from research and innovation activities, billion UZS	X4	0.55	1.24	+0.69	226.0
5	International scientific publications, number	X5	48	157	+109	327.1

3.2 Integrated Competitiveness Index, 2015–2025

The Integrated Competitiveness Index increased from 10.56% in 2015 to 95.45% in 2024. In 2025, the index declined to 87.50%, as a temporary decrease in several financial indicators was only partially offset by growth in research funding and the number of international publications (Table 2).

Table 2. Integrated Competitiveness Index (Y), 2015–2025, %

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y, %	10,56	12,63	18,18	24,62	40,00	39,95	54,17	59,36	72,76	95,45	87,50

3.3 Regression Results

The multiplicative regression model estimated based on eleven annual observations yielded the following elasticity coefficients: total revenues (X1) — 0.285; off-budget revenues (X2) — 0.114; expenditures financed from own funds (X3) — 0.246; funds generated from research and innovation activities (X4) — 0.166; and the number of international scientific publications (X5) — 0.183. The sum of the elasticity coefficients is

0.994, indicating approximately constant returns to scale: when all five factors increase simultaneously by 1%, the Integrated Competitiveness Index increases by approximately 1%. Total revenues and expenditures financed from own funds are the two most influential factors, together accounting for more than half of the total elasticity [12].

3.4 Trend Models and Forecast for 2027–2030

The parabolic trend equations constructed for each factor explain a substantial proportion of the historical variation: $R^2 = 0.9653$ for international scientific publications, 0.9288 for total revenues, 0.9240 for expenditures financed from own funds, 0.9014 for off-budget revenues, and 0.8523 for research funding. The relatively lower R^2 for the latter indicator can be explained by annual fluctuations in project-based funding. Since $R^2 > 0.85$ for all models, the results support their use for extrapolation. The results are presented in Table 3.

Table 3. Forecast Values of Competitiveness Factors and the Integrated Index for 2027–2030

Year	X1, billion UZS	X2, billion UZS	X3, billion UZS	X4, billion UZS	X5, number	Y, %
2027	516.77	347.73	323.20	2.37	305.56	120.95
2028	568.19	372.49	340.38	2.72	357.46	133.58
2029	621.14	396.68	356.17	3.10	413.77	146.49
2030	675.62	420.30	370.59	3.51	474.49	159.64

Under this model, the Integrated Competitiveness Index is expected to increase from 120.95% in 2027 to 159.64% by 2030, which is approximately 1.32 times higher than the 2027 level and 1.82 times higher than the actual level recorded in 2025. The average annual growth rate over the forecast period is expected to be approximately 9.7%. The highest growth is projected for international scientific publications (209.0% in 2030 relative to 2025) and research funding (201.8%), followed by total revenues (192.4%) and off-budget revenues (176.3%). Expenditures financed from own funds are expected to grow relatively more slowly (152.8%), which can be explained by the negative quadratic coefficient in the trend equation, indicating a tendency toward a gradual slowdown in growth [13].

The quality criteria for the regression-based forecast are presented in Table 4. All indicators demonstrate a very high level of statistical reliability, which is partly explained by the fact that the Integrated Competitiveness Index was directly constructed from the five principal factors.

Table 4. Forecast Quality Indicators for the Multiplicative Regression Model

Indicator	Value	Interpretation
R^2	0.9999	Historical variation is explained almost completely
Adjusted R^2	0.9998	Model is highly stable
MAPE	0.59%	Very high forecasting accuracy
RMSE	0.28	Low error level
MAE	0.23	Small mean absolute error
Theil's U	0.0025	Very high forecast quality

3.5 Forecast Based on Holt's Exponential Smoothing Model

As an additional and more conservative approach that does not separately account for the five principal factors but instead relies solely on the historical dynamics of the Integrated Competitiveness Index, Holt's exponential smoothing model was applied. The smoothing parameters, $\alpha \approx 0.85$ and $\beta \approx 0.20$, were selected by minimizing the sum of squared forecast errors over the 2015–2025 series. The latest smoothed level and trend components (L = 89.88, T = 7.65) produce an approximately linear forecast trajectory [14]. The Integrated Competitiveness Index is expected to reach 105.18% in 2027, 112.83% in 2028, 120.49% in 2029, and 128.14% in 2030, corresponding to an annual increase of approximately 7.65 percentage points. Since this method does not incorporate the additional effects of the five principal factors, its results are considerably more conservative than those obtained using the multiplicative regression model (Table 5).

Table 5. Forecast Quality Indicators for Holt's Exponential Smoothing Model

Indicator	Value	Interpretation
R^2	0.8854	High
MAPE	13.85%	Acceptable accuracy
RMSE	9.18	Moderate error level
MAE	7.20	Acceptable mean absolute error
Theil's U	0.0817	High forecast quality

3.6 Scenario-Based Forecast, 2027–2030

Table 6 presents pessimistic, baseline, and optimistic scenarios constructed as ±10% deviations from the regression-based baseline forecast. Even under the pessimistic scenario, the projected value for 2030 (143.67%) remains approximately 1.64 times higher than the actual level recorded in 2025 (87.50%), indicating a certain degree of resilience in the university's underlying growth trajectory in the face of adverse shocks [15]. The gap between the optimistic and pessimistic scenarios widens throughout the forecast period—from 24.19 percentage points in 2027 to 31.93 percentage points in 2030—reflecting the accumulation of uncertainty over a longer forecasting horizon.

Table 6. Scenario-Based Forecast of the Integrated Competitiveness Index, 2027–2030, %

Year	Pessimistic	Baseline	Optimistic
2027	108.85	120.95	133.04
2028	120.22	133.58	146.94
2029	131.84	146.49	161.14
2030	143.67	159.64	175.60

4. Discussion

The findings demonstrate that road transport has become the structural core of Uzbekistan's transport services market. Its 50.9% share means that changes in road transport efficiency directly affect the overall performance of the national transport-services sector.

The market also demonstrates resilience. The 2020 decline was followed by a rapid recovery, and the road transport services growth rate reached 114.2% by 2025. However, quantitative growth does not automatically remove structural constraints. Regional disparities in infrastructure provision remain significant.[14]

Future competition among road transport providers will increasingly depend on service quality, delivery time, reliability, safety, digital interaction with customers, logistics integration and cost efficiency. At the national level, road transport should be developed in coordination with railway, air and logistics-terminal infrastructure to strengthen multimodal connectivity.[15]

The results suggest that the market is shaped by four interconnected groups of factors: market factors (demand, supply, competition and prices); infrastructural factors (road density, road quality and logistics facilities); territorial factors (population density, geographical location and economic specialization); and technological-institutional factors (digitalization, regulation, information systems and management quality).[16]

SCIENTIFIC AND PRACTICAL RECOMMENDATIONS

1. Regional road transport development programs should use differentiated investment criteria based on infrastructure provision, population density, freight and passenger intensity and economic specialization.

2. Infrastructure investment should prioritize territories where transport-demand growth exceeds the capacity of the existing road network.

3. A unified digital information environment should be further developed to connect carriers, freight owners, passengers, logistics operators and relevant public institutions.

4. The competitiveness of transport enterprises should be assessed using service quality, price, delivery time, safety, reliability, technological readiness and customer accessibility indicators.

5. Multimodal logistics and integration of road transport with railway, air and logistics-terminal infrastructure should be expanded.

6. Regional monitoring should combine road density, population accessibility, infrastructure capacity, transport-service volumes and market-growth indicators

5. Conclusion

The study confirms that the road transport services market is one of the most dynamically developing segments of Uzbekistan's service economy. During 2016-2025, the sector demonstrated an overall positive trajectory despite the significant disruption in 2020. In 2025, total transport services reached approximately UZS 188.3 trillion and road transport services approximately UZS 95.9 trillion, representing 50.9% of the market. The road transport services growth rate reached 114.2%, compared with 110.8% for transport services overall. At the same time, regional analysis reveals significant territorial disparities. Therefore, further market development requires a transition from predominantly quantitative expansion toward a comprehensive model integrating infrastructure modernization, territorial accessibility, service quality, digitalization, multimodal connectivity and competitive market mechanisms. The principal scientific implication is that the development of the road transport services market should be assessed simultaneously through dynamic, structural and territorial dimensions. This approach provides a more comprehensive understanding of market transformation and supports targeted regional transport policy.

REFERENCES

[1] President of the Republic of Uzbekistan, On Approval of the Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030, Presidential Decree No. PF-5847, Oct. 8, 2019.

[2] President of the Republic of Uzbekistan, On Additional Measures to Ensure Academic and Organizational-Managerial Autonomy of State Higher Education Institutions, Presidential Resolution No. PQ-60, Dec. 24, 2021.

[3] President of the Republic of Uzbekistan, On Measures to Grant Financial Autonomy to State Higher Education Institutions, Presidential Resolution No. PQ-61, Dec. 24, 2021.
[4] Republic of Uzbekistan, On Education, Law No. O'RQ-637, Sep. 23, 2020.
[5] Ministry of Higher Education, Science and Innovations of the Republic of Uzbekistan, State Financial Reporting in Higher Education Organizations and Regulatory and Methodological Materials Related to the Education Sector, Tashkent, Uzbekistan, 2024.
[6] P. Aghion, M. Dewatripont, C. Hoxby, A. Mas-Colell, and A. Sapir, "The governance and performance of universities: Evidence from Europe and the US," Economic Policy, vol. 25, no. 61, pp. 7–59, 2010.
[7] T. Estermann and E. B. Pruvot, Financially Sustainable Universities II: European Universities Diversifying Income Streams. Brussels, Belgium: European University Association, 2011.
[8] P. F. Hart and W. Rodgers, "Competition, competitiveness, and competitive advantage in higher education institutions: A systematic literature review," Studies in Higher Education, vol. 49, no. 12, pp. 2153–2177, 2023.
[9] B. Jongbloed, J. Enders, and C. Salerno, "Higher education and its communities: Interconnections, interdependencies and a research agenda," Higher Education, vol. 56, no. 3, pp. 303–324, 2010.
[10] G. Krücken, "Multiple competitions in higher education: A conceptual approach," Innovation: The European Journal of Social Science Research, vol. 34, no. 2, pp. 1–19, 2019.
[11] C. G. Ntim et al., "Financial sustainability in a marketised and partially autonomous environment: The case of small new public universities in England," Oxford Review of Education, vol. 50, no. 6, pp. 745–765, 2024.
[12] P. W. Painsi, K.-H. Leitner, and R. Rybnicek, "The impact of institutional autonomy on higher education institutions in Europe," Science and Public Policy, vol. 52, no. 2, pp. 236–253, 2025.
[13] J. Ritzen, "Managing performance and efficiency of higher education institutions," in Comparative Perspectives on Higher Education Policy. Cham, Switzerland: Springer, 2016.
[14] M. Q. Saydullayevich, "Features and Problems of Forming Quality Management Systems in Small and Medium-Sized Businesses," International Journal of Development and Public Policy, vol. 1, no. 3, pp. 11–13.
[15] Q. S. Makhmudov, "Forms of Quick Management of Manufacturing in the Conditions of Market Relations," 2023.