ECONOSCITECH INTEGRATION

ISSUE 8

INTERNATIONAL SCIENTIFIC ELECTRONIC JOURNAL

TASHKENT STATE UNIVERSITY OF ECONOMICS

American University of Technology
Powered by Arizona State University®

ISSN: 3060-5075

Acceptance of articles
PUBLISHED EVERY MONTHLY

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER DENMARK

CONTACT: +998 94 3540880 https://econoscitech-integration-journal.uz

2026

THE SCIENTIFIC-POPULAR ELECTRONIC JOURNAL **"ECONOSCITECH-INTEGRATION"** HAS BEEN REGISTERED UNDER THE NUMBER C-5669651 BY THE AGENCY FOR INFORMATION AND MASS COMMUNICATIONS (AOKA) OF THE REPUBLIC OF UZBEKISTAN, EFFECTIVE FROM OCTOBER 9, 2024.

In accordance with Resolution No. 384/6 dated April 10, 2026, issued by the Presidium of the Supreme Attestation Commission under the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan, this journal is included in the list of recommended international scientific publications for publishing the primary research findings of doctoral dissertations in the field of Economic Sciences.

Partners: Tashkent State University of Economics / American University of Technology in Tashkent (AUT)

Electronic publication. Issue 8. 374 pages.
Approved for publication in August 2026.

Editorial Board Members:

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EMPIRICAL ASSESSMENT OF INTERNAL AND EXTERNAL FACTORS AFFECTING THE COMPETITIVENESS OF THE FOOD INDUSTRY IN UZBEKISTAN

Urolova Sevara Bekhzod qizi
PhD Student, Tashkent State University of Economics
ORCID: 0009-0004-3891-5908

Abstract. This article examines the internal and external competitiveness of Uzbekistan's food industry using quarterly data covering the period 2010–2025. Internal competitiveness is assessed based on value-added labour productivity, while external competitiveness is evaluated through the industry's relative export position. The analysis incorporates investment intensity, import substitution, price and environmental factors, labour productivity, trade openness, exchange rate movements, and logistics pressure. The findings indicate that domestic production efficiency and investment intensity are the primary factors associated with stronger competitiveness, whereas rising production costs, environmental pressures, and logistics constraints tend to weaken the sector's competitive performance. The study provides an integrated assessment of the internal and external factors shaping the development and competitiveness of Uzbekistan's food industry.

Keywords: food industry, competitiveness, labour productivity, investment intensity, import substitution, export position, logistics pressure.

Аннотация. В статье проведена комплексная оценка внутренних и внешних факторов конкурентоспособности пищевой промышленности Узбекистана на основе квартальных данных за 2010–2025 гг. Внутренняя конкурентоспособность определяется посредством производительности труда, рассчитанной по добавленной стоимости, тогда как внешняя конкурентоспособность оценивается на основе относительной экспортной позиции отрасли. Анализ охватывает инвестиционную интенсивность, импортозамещение, ценовые и экологические факторы, производительность труда, уровень торговой открытости, динамику обменного курса и логистическое давление. Полученные результаты свидетельствуют о том, что производственная эффективность и инвестиционная интенсивность являются ключевыми факторами повышения конкурентоспособности отрасли, тогда как рост производственных затрат, экологические ограничения и логистическое давление оказывают сдерживающее влияние на её развитие. Исследование позволяет комплексно оценить внутренние и внешние условия, определяющие развитие и конкурентоспособность пищевой промышленности Узбекистана.

Ключевые слова: пищевая промышленность, конкурентоспособность, производительность труда, инвестиционная интенсивность, импортозамещение, экспортная позиция, логистическое давление.

INTRODUCTION

Uzbekistan's food industry has experienced steady growth alongside increasing domestic demand, investment, and export activity. However, higher production volumes do not necessarily translate into greater value creation or a stronger and more sustainable position in international markets. In this context, competitiveness depends on two interrelated dimensions: the efficiency with which the industry transforms labour, capital, and domestic resources into value added, and its capacity to maintain export performance under evolving trade, exchange-rate, and logistics conditions.

Existing studies have generally examined these dimensions separately, with limited attention to their combined influence on sectoral competitiveness. To address this research gap, the present study provides an integrated assessment of the internal and external competitiveness of Uzbekistan's food industry using quarterly data for the period 2010–2025. Specifically, it identifies the key factors influencing value-added labour productivity and the industry's relative export position, while evaluating the effects of investment intensity, import substitution, price dynamics, carbon intensity, trade openness, exchange-rate movements, and logistics pressure on the sector's overall competitive performance.

LITERATURE REVIEW

Food industry competitiveness is commonly assessed through the relationship between production potential and market performance. Łukiewska and Juchniewicz (2021) identify labour productivity and productive capacity as key determinants of the competitive position of the European Union (EU) food industry. Investment also contributes to production efficiency, although its effects may emerge with a time lag, as the introduction of new equipment requires installation, organisational adjustment, and workforce adaptation (Geylani & Stefanou, 2013).

Trade-related studies identify productivity and product quality as the principal drivers of export performance. Olper et al. (2014) found that import competition can stimulate productivity by increasing competitive pressure on less efficient producers, while Curzi and Olper (2012) demonstrated that firms with higher productivity achieve stronger export performance when production efficiency is combined with product quality. Bojnec and Fertő (2017) further showed that the long-term competitiveness of the agri-food sector depends on export diversification and the ability to sustain comparative advantages across different product groups. These findings suggest that the expansion of domestic production enhances competitiveness only when it is accompanied by higher value added, improved product quality, and greater market resilience.

External conditions also influence the extent to which production capacity is translated into export performance. Kandilov (2008) found that exchange-rate volatility reduces agricultural trade, particularly in developing economies with limited risk-management instruments. Baek and Koo (2011) reported that processed food products are more sensitive to exchange-rate fluctuations than bulk agricultural commodities, while Vardar et al. (2025) highlighted the importance of transport infrastructure, customs efficiency, and logistics services in supporting export competitiveness. Although previous studies have examined productivity, investment, trade exposure, exchange-rate dynamics, and logistics factors individually, relatively limited attention has been given to their combined effects. To address this gap, the present study integrates these factors by assessing the internal and external competitiveness of Uzbekistan's food industry within a unified quarterly analytical framework.

RESEARCH METHODOLOGY

This study employs a quantitative time-series approach based on quarterly data for Uzbekistan's food industry covering the period from 2010 to 2025. Internal competitiveness is measured using real value-added labour productivity, whereas external competitiveness is assessed through the industry's relative export position. All monetary indicators were converted into constant 2010 prices, and logarithmic transformations were applied to minimise scale differences and facilitate the interpretation of the estimated coefficients in relative terms.

Descriptive statistical analysis was conducted to examine the distribution and variability of the selected indicators. The stationarity of the variables was tested using the Augmented Dickey–Fuller (ADF) test. The internal competitiveness model was estimated in logarithmic levels, whereas the external competitiveness model was estimated using first logarithmic differences to ensure stationarity.

Both models were estimated using the ordinary least squares (OLS) method with robust standard errors. Model adequacy was evaluated based on the coefficient of determination (R^2), the F-statistic, and the statistical significance (p-values) of the estimated coefficients. In addition, the Variance Inflation Factor (VIF) was employed to assess multicollinearity, while the Breusch–Pagan test was used to detect heteroskedasticity.

To improve linguistic accuracy and enhance the clarity of the manuscript, artificial intelligence (AI)-assisted language support was used during the editing process. The contribution of AI-assisted tools was limited to approximately 10% of the manuscript and was restricted to language refinement, grammar correction, and stylistic improvement. All research design, data analysis, interpretation of findings, and final scientific conclusions were developed and verified by the author.

ANALYSIS AND RESULTS

The analysis examines the internal and external competitiveness of Uzbekistan's food industry over the period from 2010 to 2025. Internal competitiveness is measured using real value-added labour productivity, whereas external competitiveness is represented by the industry's relative export position.

The internal competitiveness model includes investment per employee, capital renewal intensity, real wages, import substitution, relative food prices, and carbon intensity. The external competitiveness model evaluates the effects of output-based labour productivity, the investment-to-output ratio, trade openness, the real bilateral exchange rate, world food prices, and logistics pressure. The empirical analysis is based on 64 quarterly observations. Table 1 presents the descriptive statistics, including the mean values and observed ranges, of the variables incorporated into both models (Table 1).

Table 1. Summary Characteristics of the Variables Used in the Analysis[1]

Indicator	Mean (minimum-maximum)
Internal competitiveness indicators	
Value-added labour productivity LP_{VA}, million UZS per employee	16.799 (11.574-24.884)
Investment per employee INV_E, million UZS	1.957 (0.635-7.866)
Capital renewal intensity *CR*, ratio	0.234 (0.055-0.748)
Real wage *W*, million UZS	2.008 (1.280-3.090)
Import substitution *IS*, ratio	0.693 (0.470-0.881)
Relative food prices *RFP*, index	90.728 (81.216-102.531)
Carbon intensity CO_2, kt CO2-eq./million kWh	0.845 (0.609-1.323)
External competitiveness indicators	
Relative export position *REP*, ratio	0.570 (0.242-1.284)
Output-based labour productivity LP_Q, million UZS per employee	39.343 (14.570-100.330)
Investment-to-output ratio INV_Q	0.048 (0.021-0.078)
Trade openness *TO*, ratio	0.511 (0.282-0.685)
Real bilateral exchange rate *RER*, index	3569.540 (1553.233-5503.406)
World food prices *FFPI*, index	105.974 (80.610-147.570)
Logistics pressure *LVI*, index	5.085 (1.489-7.860)

Table 1 reveals a substantial gap between the two productivity measures. Average output-based labour productivity reached 39.343 million UZS per employee, which was 2.34 times higher than the average value-added labour productivity of 16.799 million UZS per employee. The latter accounted for approximately 42.7% of the average output-based measure. This difference suggests that increases in physical output were not fully translated into higher value added.

The internal indicators also exhibited uneven dynamics. Investment per employee varied by more than twelvefold, while capital renewal intensity increased across a 13.6-fold range. In contrast, real wages increased by only 2.4 times between their minimum and maximum values, and relative food prices varied by approximately 26%. These results indicate that capital formation was considerably more volatile than labour remuneration and domestic price conditions.

The external indicators displayed similarly pronounced fluctuations. Output-based labour productivity ranged from 14.570 to 100.330 million UZS per employee, representing an almost 6.9-fold difference between the lowest and highest observations. Both the relative export position and logistics pressure varied by more than fivefold, while the real bilateral exchange rate changed by approximately 3.5 times.

By comparison, trade openness ranged from 0.282 to 0.685, whereas world food prices increased by approximately 83% between their minimum and maximum values. These patterns indicate that the food industry operated under substantial changes in production capacity, export conditions, and logistics, while fluctuations in global food prices were comparatively less pronounced.

The subsequent stage of the analysis examines whether the observed changes in investment, capital renewal, import substitution, relative prices, and carbon intensity were reflected in value-added labour productivity. The estimation results of the internal competitiveness model are presented in Table 2.

Table 2. Estimated Effects on Value-Added Labour Productivity[2]

Factor	Coef.	NW SE	p-value	Result
Investment per employee	0.232	0.069	0.001	Positive, significant
Capital renewal intensity	-0.121	0.033	0.001	Negative, significant
Real wage	0.173	0.177	0.334	Not significant
Import substitution	0.581	0.138	0.000	Positive, significant
Relative food prices	-1.266	0.344	0.001	Negative, significant
Carbon intensity	-0.416	0.110	0.000	Negative, significant
Constant	8.218	1.562	0.000	Significant
Model statistics: N=64; R^2=0.864; F=128.688; model p<0.001				

1 The mean is reported first; minimum and maximum values are shown in parentheses. The dataset covers 64 quarters from 2010 to 2025. Source. Author calculations based on data from the National Statistics Committee of the Republic of Uzbekistan, FAO, the World Bank, UNIDO, EDGAR and the Federal Reserve Bank of New York.

2 **Note.** Newey-West standard errors are reported. Statistical significance is evaluated using the p-values shown in the table. **Source.** Author calculation

The internal competitiveness model explains 86.4% of the variation in value-added labour productivity. The strongest positive effect is associated with import substitution: a 1% increase in this indicator corresponds to a 0.581% increase in productivity. This coefficient is approximately 2.5 times larger than the estimated effect of investment per employee, which amounts to 0.232%. These findings suggest that capital accumulation generates greater economic returns when combined with domestic sourcing, higher capacity utilisation, and deeper local value addition.

Production costs and resource inefficiencies represent the principal constraints on internal competitiveness. A 1% increase in relative food prices is associated with a 1.266% decline in value-added labour productivity, indicating that cost pressure is the most influential factor in the model. Similarly, a 1% increase in carbon intensity is associated with a 0.416% reduction in productivity, linking environmental inefficiency to outdated equipment and excessive energy consumption. Capital renewal intensity also has a negative coefficient (−0.121). This finding may reflect short-term adjustment costs, temporary production disruptions, or the underutilisation of newly installed assets, rather than indicating a generally adverse effect of modernisation.

Real wages have a positive coefficient (0.173); however, the relationship is not statistically significant. This suggests that wage growth alone does not necessarily improve labour productivity unless it is accompanied by technological upgrading, workforce skills development, and more efficient production organisation. Overall, internal competitiveness depends on the industry's ability to transform investment and domestic resources into higher value added while effectively managing production costs and energy intensity.

The subsequent analysis examines whether labour productivity, investment conditions, and external market pressures influence the relative export position of Uzbekistan's food industry. The estimation results of the external competitiveness model are presented in Table 3.

Table 3. Estimated Effects on the Relative Export Position of the Food Industry[3]

Factor	Coef.	NW SE	p-value	Result
Output-based labour productivity	1.128	0.050	0.000	Positive, significant
Investment-to-output ratio	0.455	0.071	0.000	Positive, significant
Trade openness	0.611	0.348	0.085	Positive at 10%
Real bilateral exchange rate	-0.411	0.195	0.040	Negative, significant
World food prices	0.177	0.426	0.679	Not significant
Logistics pressure	-0.054	0.025	0.039	Negative, significant
Constant	-0.022	0.021	0.309	Not significant
Model statistics: N=63; R^2=0.895; F=177.250; model p<0.001				

The external competitiveness model explains 89.5% of the variation in the relative export position. Labour productivity is identified as the principal driver of external competitiveness: a 1% increase in real output per employee is associated with a 1.128% improvement in the industry's relative export position. Investment intensity provides an additional positive contribution, although its estimated elasticity is lower at 0.455. These findings indicate that export performance responds more strongly to productivity gains generated by investment than to investment growth alone.

External factors exhibit comparatively weaker and less stable effects. Trade openness has a relatively large positive coefficient (0.611), but it is statistically significant only at the 10% level, suggesting that broader access to international markets does not automatically translate into stronger export performance. The real bilateral exchange rate has a negative coefficient (−0.411) under the adopted model specification. This result may reflect the food industry's reliance on imported machinery, packaging materials, and intermediate inputs, whereby exchange-rate movements can increase production costs before any potential export-price advantage is realised.

Logistics pressure also has a negative effect on the industry's relative export position, whereas the FAO Food Price Index is not statistically significant. These findings suggest that increases in global food prices did not constitute a reliable source of competitiveness during the study period. Instead, improvements in domestic production efficiency emerged as the principal source of competitive advantage, while logistics constraints and dependence on imported inputs limited the translation of output growth into sustainable export performance.

Taken together, the two models highlight one central finding: external competitiveness is largely shaped by conditions within the industry. Investment per employee and import substitution contribute positively to

3 **Source.** Author calculation

value-added labour productivity, while output-based labour productivity is the strongest determinant of the relative export position. The findings therefore support a sequential mechanism in which improvements in domestic production efficiency provide the foundation for stronger export performance. This relationship should be interpreted as analytical rather than causal because the two models employ different dependent variables and model specifications.

The gap between the two productivity measures is economically significant. Average output per employee reached 39.343 million UZS, whereas average value added per employee amounted to 16.799 million UZS. Consequently, value added represented approximately 42.7% of the output-based productivity measure. These results indicate that higher production volumes do not necessarily generate proportional increases in domestic value creation, particularly when expenditures on raw materials, machinery, packaging, energy, and transport account for a substantial share of production costs.

The estimated investment coefficients further clarify this relationship. Investment per employee increases internal competitiveness through a 0.232% improvement in value-added labour productivity, whereas investment intensity enhances the external competitiveness indicator by 0.455%. However, capital renewal intensity has a negative estimated coefficient (−0.121). This finding suggests that the key challenge lies not in the volume of investment itself, but in its effective transformation into productive capacity. Rapid capital replacement may initially increase adjustment costs, create temporary excess capacity, and disrupt production processes. Its long-term effectiveness depends on technological quality, workforce skills, and the efficient utilisation of newly installed equipment.

External factors play a comparatively more limited role. Although trade openness has a positive coefficient, its statistical significance remains marginal, while world food prices do not exhibit a measurable short-run effect. In contrast, exchange-rate movements and logistics pressure adversely affect export performance. Overall, the findings indicate that improved market access and favourable international prices cannot fully offset high production costs, dependence on imported inputs, and logistics constraints. Accordingly, strengthening domestic processing, improving the utilisation of new capital, enhancing energy efficiency, and upgrading logistics systems appear to be more effective strategies for improving long-term competitiveness than relying primarily on export promotion measures.

CONCLUSION AND RECOMMENDATIONS

The findings indicate that the competitiveness of Uzbekistan's food industry is determined primarily by domestic production efficiency. Import substitution and investment per employee contribute positively to value-added labour productivity, whereas relative food prices and carbon intensity have adverse effects. In the external competitiveness model, output-based labour productivity emerges as the strongest determinant of the industry's relative export position, while exchange-rate movements and logistics pressure reduce export competitiveness. By contrast, trade openness and world food prices exhibit comparatively less stable effects.

A key structural challenge identified by the analysis is the gap between production volume and value creation. On average, value added per employee accounts for only approximately 42.7% of output-based labour productivity, indicating that increases in production volume are not fully translated into higher domestic value creation.

The findings suggest that policy measures should place greater emphasis on the quality and effectiveness of investment rather than on its volume alone. Support for industrial modernisation should be accompanied by improvements in equipment utilisation, workforce training, energy efficiency, and deeper domestic processing. Import substitution policies are likely to be most effective when they promote the development of competitive domestic suppliers of raw materials, packaging materials, and intermediate inputs. Similarly, export-support measures should prioritise improvements in storage infrastructure, product certification, transport reliability, and supply-chain efficiency, as broader market access alone cannot fully offset high production costs and logistics constraints.

The estimated models identify sector-level relationships rather than definitive causal effects. Future research based on firm-level or regional data could provide additional evidence on the identified mechanisms across individual food-processing subsectors and contribute to a more comprehensive understanding of the factors influencing industry competitiveness.

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Proofreader: Xondamir Ismoilov

Layout and Designer: Hasan Maqsudov

2026. № 8

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