International Journal of Accounting and Economics Studies, 12 (2) (2025) 138-146

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/1vmamp02
Research paper

Strategic Management and Sectoral Performance in The Food Industry: A Time-Series Econometric Study Using Elasticity-Based Modeling

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Received: May 13, 2025, Accepted: June 3, 2025, Published: June 16, 2025

Abstract

Understanding the factors influencing strategic management in the food industry is vital for effective planning and growth since it plays a direct and vital role in the economy of Uzbekistan. Given the importance of these factors, I will describe research that I have undertaken to assess factors that shape strategic management in Uzbekistan's food industry, using statistical models of national data from 1999 to 2024 inclusive. Using the national data, I developed three econometric models to assess business activity and food production developments in selected key sectors, including meat and dairy. Overall, the research concluded that the number of business registration processes was not significant for estimating the quantity of business, and the formal costs of contract development were only marginally significant ($p = 0.0676$). In these production models, a negative relationship between population size and meat production was significant, while tax rates had a nonsignificant relationship with meat production ($p = 0.1611$). The R^2 values for the food production models were greater than 0.99, indicating goodness of fit , while there is potential for overfitting these models with so few observations ($N = 26$). The business activity model showed a moderate explanatory power ($R^2 = 0.716$). The study emphasizes the need for distinct strategic approaches to individual product segments and that demographic and institutional factors influence food industry performance.

Keywords: *Econometric Modeling; Food Industry; Production Volume; Elasticity; Consumption Expenditures; Business Development; Strategic Management.*

1. Introduction

The food industry is indeed a vital component in the development of the global economy, the security of food, and the provision of humble living. The sector itself is one of the most dynamic and important, both economically and practically, in ensuring the existence of nutritional resources for populations, while contributing significantly to the national GDPs. Finally, according to Ogunmola and Kumar (2020) it concluded that food systems across the globe and within different regions have become substantially complex in the past several decades due to factors such as climate change, population growth, urbanization, and changing consumer preferences. The changes signify the status of strategic management in the food industry, where good decision-making, long-range planning, and efficient usage of resources are essential for increasing productivity, competitiveness, and resilience (Ogunmola, 2025).

In Central Asia, and especially in Uzbekistan, the food industry is a very important socio-economic factor. Food production and processing are highly significant for employment and rural development in Uzbekistan's agrarian economy. Nevertheless, the sector also has several challenges, such as outdated infrastructure, limited availability of modern technology, lack of a suitable regulatory framework, and unclear flow of investment. However, at the same time, economic reforms, trade liberalization, and demographic trends create new prospects for the growth and modernization of the Uzbek food industry. These opportunities can be capitalized on, as well as the systemic inefficiencies are tackled, provided that the strategic management is effective. International literature in a growing body provides insights into institutional, regulatory, and economic factors in the 'business and production environment' of an enterprise. Particularly, Pan et al. (2024), Al Janabi (2024) have explored how business regulations (including cost and complexity of contract enforcement and registration procedures) affect entrepreneurial activity. Mufeeth et al. (2024), Capone (2010), and Negi (2013) investigated market dynamics and strategic behavior in the food sector, while Negi (2013) studied infrastructure and governance in value chain performance. Lowder, Gorb and Zinchuk (2021) and Pavlenko (2021) studied agricultural transformation and rural development with economic modeling. These aspects have demonstrated a dependence on relevant variables such as taxation, population growth, and institutional efficiency which can then be quantitatively tested concerning food industry performance (Nithyanantham et al., 2021).

Based on these international foundations, several Uzbek scholars have done empirical and policy focused research on food security, market regulation, and agricultural productivity. Yet, most of these studies are descriptive or sectoral and do not provide a comprehensive econometric assessment combining institutional, demographic, and economic variables within the broader context of the food system. This paper fills that gap by developing and testing three econometric models that examine the relationships among strategic management indicators and business activity, trend in food production, and trend in food consumption in Uzbekistan. Drawing on the existing reforms and policy initiatives in Uzbekistan, there is very little empirical evidence regarding the specific institutional and demographic factors that affect the operation of the food industry. However, there is no definitive data-driven guidance for strategic decision makers on what business registration costs, tax rates, population growth, and investment volume have on any element of the food sector. Finally, this study raises the following research questions aimed at addressing the identified gap.

1) What are the most important institutional and economic factors on the number of working business entities in Uzbekistan's food industry?
2) What factors of the form of population size, investment, and tax rates have on the production of key food categories like meat and dairy?
3) How do such demographic and regulatory variables help shape consumption and strategic performance trends?

The chosen time frame of 1999 to 2024 captures a transformative era in Uzbekistan's economic and institutional landscape. It covers a time when the country is going through an economic shift from a highly centralized to market liberalization, WTO accession, business regulation and agriculture, and recently, digitalization. It provides a longitudinal perspective on how strategic management variables over time shape the food industry, spanning several cycles of different types of planning and during which different macroeconomic shifts have been taking place.

The paper provides a special contribution to the literature by developing a multi-model econometric framework of doing business in Uzbekistan's food industry. It links macro-level institutional parameters with sector-specific production and consumption patterns, which is unlike only descriptive or sectoral studies hitherto. Statistical nuances such as marginal significance and model fit are accounted for, and robust and policy-relevant insights are produced by the models. In addition, the paper provides actionable intelligence, suggesting which variables are the most crucial in various subdomains (business registration and meat production, to name a few), for various government agencies and private investors looking to improve the strategic management of the sector.

2. Literature review

The food industry is of utmost economic, social, and political importance; thus, it has attracted much interest from academics and policymakers due to the strategic management of the food industry. Institutions like tax regimes, business regulations, and contract enforcement all have a direct effect on the operational environment for food enterprises (Ogunmola et al., 2024; Mufeeth et al., 2024; Pan et al., 2024). Supply-side drivers, on the other hand, i.e., population growth, infrastructure development, and capital investment, most of all in developing countries (Capone, 2010; Negi, 2013; Lowder et al., 2021), are of interest to others. Nevertheless, despite numerous papers, there is still much that is not quantified in terms of the impact of the combined and dynamic effects of these variables on production and business activity in transitional economies such as Uzbekistan.

Pan et al. (2024) examined how institutional burdens, especially regulatory complexity and contract enforcement costs, act as barriers to entrepreneurial growth. The justifications for including such variables as the number of registration procedures or formal costs of the contract execution in our econometric model of business activity for the region are provided by their work. The authors discovered that countries with procuarly higher burdens and legal ineffciencies recorded correspondingly lower business formation rates and weaker private sector growth. Mufeeth et al. (2024) also show that for firms to scale production, one must have legal and administrative efficiency. Pavlenko (2021) further uses comparative institutional analysis to argue that lower enforcement costs and simplification of the registration process make for higher formalization in the agri-food sector.

These studies agree that regulatory institutions are important, but differ in the literature on what regulatory dimensions are most important. For example, according to Negi (2013), the major factor in 'Factory Performance' of the food industry in India is infrastructure development rather than the law. Tax policy effects are not uniform across sub-sectors, as they have more weighting on capital-intensive activities than in smallholder agriculture, argued Capone (2010). Rodgers concludes that these findings call for sector-specific models that can disentangle what portion of the variation in robbery is attributed to which variables. In contrast, our study contributes to this debate by estimating separate econometric models of both meat and dairy production to gain a finer understanding of these interactions.

A great number of scholars have analyzed consumption and production dynamics in transitional and developing economies. Lowder et al. (2021) described the impacts of global agricultural investment on production, contemporary trends, and leverage in low- and middle-income countries. According to Zinchuk (2021), population growth plays an important role in the consumption and production trends in the meat and dairy sectors. Two, these insights guide our decision to use population and investment volumes as primary independent variables within the production models. Yet, only a limited set studies these relationships with the specific institutional configurations of these countries. Thus, they are not applicable to post Soviet states such as Uzbekistan where their economic structure, reform paths, and regulatory regimes vary (Ogunmola, 2025).

On the Uzbek scene, food industry development has already been addressed by several local scholars; however, mostly from the normative or descriptive sides. For example, Berkinov (2018) pointed out inefficiencies of the structure of agricultural investment in Uzbekistan, whereas Gafurov (2019) and Wang & Huang (2025) reviewed the tax policy renovation in the sphere of agri-food industry. These results also imply that our models should include tax burden and investment volume variables. Akhmedov (2020) and Ogunmola (2022) find that contract enforcement mechanisms have a direct effect on firm-level performance in the food industry, and that institutional quality directly impacts firm-level performance in the food industry. Nevertheless, these studies rarely quantify elasticity or provide statistical significance of the variables found. Furthermore, they treat production, business regulation, and consumption separately, and neglect the relation between the whole food sector.

It is critical to analyze why tax effects vary across sub-sectors, as highlighted by Capone (2010), because different industries possess unique characteristics that dictate their responsiveness to fiscal policy. For instance, highly capital-intensive sectors might be more sensitive to depreciation allowances or investment tax credits, while labor-intensive sectors could be more affected by payroll taxes or employment-related incentives. Furthermore, the elasticity of demand for a sub-sector's products, the competitive landscape, and its ability to pass on tax burdens to consumers or suppliers all play significant roles in how a tax change ultimately impacts profitability, investment, and employment within that specific industry. Capone's work likely delves into these structural differences, demonstrating how a uniform tax policy can lead to heterogeneous outcomes across a diverse economic landscape.

One crucial aspect to understand separately is the impact that Uzbekistan's informal economy has on consumption data to build upon more informed economic analysis. Significant as the informal economy contributes to overall economic output and employment, it largely remains outside official statistics as being unregistered and uncontributed to fiscal accounts. As a result, reported consumption data (extracted either from household surveys or from national accounts based on formal transactions) may systematically underreport actual consumption levels. Informal values (expenditures on goods and services obtained through informal channels such as unregistered street vendors, unreported home-based services, or unrecorded cross-border trade) are generally unrecorded. This data gap, therefore, results in an incomplete picture of household welfare, wrong policy decisions regarding poverty reduction in Uzbekistan, and distorted analysis of aggregate demand and economic growth in Uzbekistan.

By employing econometric elasticity models to quantify how each institution, demography, and economic variables impact each other across the food industry value chain, this study finally fills that methodological and conceptual gap. In contrast to prior work, we test these relationships in an integrated and statistically robust framework, and thus can provide sector-specific insights that are theoretically grounded and policy relevant. The period of the study is further strengthened as it covers (1999–2024). The integration contains key moments of Uzbekistan's economic unfolding: from post-Soviet restructuring, WTO accession efforts, food security policy changes, to the electronification of central government services. These changes offer a temporal 'history' with which to test how strategic management outcomes in the food sector have been affected by institutional and demographic change.

Yet, because of a wealth of theoretical and country-level studies, the mechanisms by which a bundle of factors influences food industry development in Uzbekistan have not been well explained. Current literature is still lacking integrated econometric approaches to deal with the dynamic and multi-directional relationship of the service capacity and system capacity (Ogunmola, 2025). To fill this gap in the literature this paper: first, tests multi-variable models across different segments of the food industry (business activity, meat production, dairy production), second, quantifies elasticities and the statistical importance of the key institutional and demographic variables, third, does a rare, longitudinal analysis using nationally available data over 25 years, and finally, provides policy relevant insights to aid strategic management in the food sector. This study contributes to understanding and practice by combining global frameworks with local realities, and by critically engaging with international and Uzbek literature in Uzbekistan's food industry.

3. Materials and methods

In this study, annual data from 1999–2024 are from the State Statistics Committee of the Republic of Uzbekistan, and relevant international databases are used (State Statistics Committee of the Republic of Uzbekistan, 2024; World Bank, 2024; Food and Agriculture Organization of the United Nations, 2024). The 26 years were chosen for several important points in Uzbekistan's economic trajectory: the post-Soviet transition period, the reform of the food sector, trade liberalization, and reforms of the economy following the 2017 economic liberalization and the COVID-19 pandemic. The issue of limited availability of the quarterly or even monthly time series data on institutional variables, such as, for example, registration costs and tax burden (which are reported annually in Uzbekistan), makes it natural to prefer annual data. Macro-level strategic trends that impact the food industry can often be short-term and reactive strategic management decisions, but structural reforms and policy implementations of the food industry usually follow annual cycles, and hence, the annual data is required to capture them. Nevertheless, for the reasons of diminished statistical power and potential issues with serial correlation and structural breaks, the small sample size (N = 22 to 26) can limit the results from time series models. These limitations are dealt with by way of diagnostic testing and model adjustments discussed below. The econometric analysis consists of three models of the business activity, production, and consumption. Variables used with each model are defined as in Table 1.

Table 1: Key Variables for Strategic Management Analysis in the Food Sector

Variable Name	Description	Measurement	Logged (Yes/No)
Q	Overall food production capacity	Measured in constant prices (UZS, base year 2015)	Yes
POP	Population size	Total population in Uzbekistan	Yes
TAX	Tax burden on the food sector	Ratio of total tax revenue from the sector to total food industry GDP (%)	Yes
INVEST	Investment volume in the food industry	Total capital investment in the food sector (UZS, constant prices)	Yes
REG	Business registration complexity	Number of procedures required to register a business annually	Yes
CONTRACT	Cost of contract enforcement	Legal and administrative costs as % of claim value	Yes
EMPLOY	Employment in the food sector	Number of formally employed individuals in the food industry	Yes
PRICE	Consumer price index for food products	Composite index (base year 2015 = 100)	Yes

All variables were transformed using natural logarithms to ensure comparability across units and allow interpretation of estimated coefficients as elasticities. The general form for all three models is:

$$\mathrm{LN}(\mathrm{Q}) = \alpha + \sum \beta_i \cdot \mathrm{LN}(\mathrm{X}_i) + \varepsilon \quad (1)$$

This log-log specification is employed for all three models (business activity, production, and consumption) to: Linearize multiplicative relationships, mitigate heteroskedasticity, and interpret coefficients as elasticities, which is particularly useful for strategic planning and policy analysis. The inclusion of variables is justified based on the literature: TAX, REG, and CONTRACT are included in the business activity model, building on Gafurov (2019), who highlighted how regulatory burdens and tax costs influence firm formation. POP and INVEST are central to the production model, reflecting arguments by Lowder et al. (2021) and Zinchuk (2021) on demographic and capital influences on food output. PRICE and EMPLOY are key in the consumption model, aligning with Negi (2013) and Pavlenko (2021), who emphasized affordability and labor availability as consumption drivers.

Given the time series nature of the dataset, the following econometric concerns were addressed: Autocorrelation: The Durbin-Watson (DW) test was performed on each model. In the business activity model, a DW statistic of 3.083 indicated significant negative autocorrelation, which violates classical OLS assumptions. To address this, Feasible Generalized Least Squares (FGLS) was applied to correct for serial correlation, and models were re-estimated with lagged dependent variables where necessary. Heteroskedasticity: Detected using the Breusch-Pagan-Godfrey test. Where present, heteroskedasticity-robust standard errors (White's correction) were employed to ensure valid inference. Multicollinearity: Checked using Variance Inflation Factors (VIFs). Variables with VIF > 10 were flagged. While most VIFs were within acceptable limits, in cases of borderline multicollinearity, principal component analysis (PCA) was tested but ultimately not used, as it reduced model interpretability. Structural Breaks: Conducted using the Chow test and CUSUM stability test. Structural shifts were identified around 2008 (global crisis) and 2017 (economic reforms).

Breaks were accounted for using dummy variables and interaction terms in robustness checks (reported in the supplementary appendix). Model specification followed a theory-driven approach supported by empirical findings in the literature. Alternative specifications were tested, including Linear-log models (discarded due to poor fit), Models excluding regulatory variables (omitted due to omitted variable bias), and autoregressive distributed lag (ARDL) models (not selected due to small sample size). Model selection criteria included Adjusted R^2, AIC, BIC, and diagnostic test performance. The final models were selected for their theoretical coherence, parsimony, and empirical validity. All econometric analysis was performed using EViews 12, which offers advanced capabilities for time series regression, diagnostic testing, and model correction. Microsoft Excel 2021 was used exclusively for preliminary data organization, cleaning, and visualization.

4. Results and discussion

To identify key determinants influencing the development of food industry enterprises in Uzbekistan, a series of multifactor econometric models were constructed and analyzed using the least squares method. These models cover three main dimensions: (1) factors influencing the number of business entities, (2) factors determining the production volumes of specific food categories, and (3) factors affecting household consumption expenditures. Below, each model's results are discussed in detail.

4.1. Model of business activity: factors influencing the number of enterprises

To evaluate the institutional and administrative factors that affect the number of business entities operating in the food sector of Uzbekistan, a multifactor linear econometric model was developed. The model employs a log-log (double-logarithmic) specification to allow elasticity interpretation of coefficients, where all variables are transformed into their natural logarithmic forms.
The dependent variable is the natural logarithm of the number of business entities (LN_BIZ). The independent variables include several institutional indicators such as the number of procedures required to register a business, the number of days for registration, the costs of registration, judicial procedures for enforcing contracts, and the overall production capacity in the food sector. The regression model is specified as follows:

$$\mathrm{LN(BIZ)} = \beta_0 + \beta_1 \cdot \mathrm{LN(PROCED)} + \beta_2 \cdot \mathrm{LN(DAY)} + \beta_3 \cdot \mathrm{LN(COST)} + \beta_4 \cdot \mathrm{LN(EPROCED)} + \beta_5 \cdot \mathrm{LN(ECOST)} + \beta_6 \cdot \mathrm{LN(Q)} + \varepsilon \quad (2)$$

Where LN(BIZ) represents the natural log of the number of registered business entities. LN(PROCED) represents the number of registration procedures. LN(DAY) represents the number of days required for business registration. LN(COST) represents the official cost of registration. LN(EPROCED): the number of procedures related to judicial enforcement. LN(ECOST) represents the official cost of enforcing contracts. LN(Q) represents overall food production capacity in the economy. ε represents the error term. The model was estimated using annual data from 2003 to 2024, with 22 observations. The regression results are presented in Table 2.

Table 2: Regression Results of the Model of Factors Influencing the Number of Business Entities

Variable	Coefficient (β)	Std. Error	t-statistic	p-value
LN(PROCED) – Registration procedures	0.1446	0.1975	0.7322	0.4827
LN(DAY) – Registration duration (days)	-0.0844	0.0872	-0.9673	0.3587
LN(COST) – Registration cost	-0.0484	0.0669	-0.7240	0.4875
LN(EPROCED) – Judicial procedures	-0.3186	0.1143	-2.7864	0.0212*
LN(ECOST) – Cost of contract execution	0.1890	0.0910	2.0770	0.0676*
LN(Q) – Production capacity	-0.1769	0.4432	-0.3991	0.6991
Constant (β_0)	6.2439	0.3342	18.6859	0.0000**

Model Diagnostics: R^2 (Coefficient of Determination): 0.716, Adjusted R^2: 0.602, F-statistic: 3.7869, p(F-statistic): 0.0365, Durbin-Watson stat: 3.083
*Indicates statistical significance at the 10% level
** indicates significance at 1% level

The regression results indicate that: The number of judicial procedures (LN(EPROCED)) has a negative and statistically significant effect on the number of business entities (β_4 = -0.3186, p = 0.0212). A 1% reduction in judicial bureaucracy corresponds to an approximate 0.32% increase in business activity, ceteris paribus. The cost of enforcing contracts (LN(ECOST)) has a positive and marginally significant impact (β_5 = 0.1890, p = 0.0676). A 1% reduction in this cost leads to an estimated 0.19% increase in the number of businesses. Other variables, such as LN(PROCED), LN(DAY), and LN(COST), show the expected signs but are statistically insignificant. This may reflect either multicollinearity or low variability over time in those indicators. Interestingly, the coefficient for production capacity (LN(Q)) is negative and insignificant, suggesting that while production dynamics are important, they are not a direct determinant of the number of new business registrations. The R^2 value of 0.716 suggests that over 71% of the variation in the number of business entities is explained by the model. The Durbin-Watson statistic of 3.083 indicates the potential presence of negative autocorrelation, which may arise from cyclical patterns in the business registration process or data irregularities.
The model confirms the importance of institutional efficiency, particularly in the legal and regulatory domain. Reforms aimed at reducing procedural burdens and enforcement costs could play a critical role in fostering entrepreneurship and stimulating the growth of new food sector enterprises. These findings support the economic logic presented in earlier studies (Muftaydinov, 2004; Umarov, 2019; Alshira'h et al., 2025) and offer empirical evidence for ongoing policy refinement. The significant influence of contract enforcement procedures and costs highlights a crucial avenue for reform. Policymakers in Uzbekistan should prioritize streamlining court and administrative processes for dispute resolution, digitizing judicial workflows to reduce the procedural burden, and lowering official and unofficial costs related to enforcing contracts, particularly for SMEs. By doing so, they can create a more conducive legal environment for enterprise growth, especially important in sectors like food and agriculture, which rely heavily on trust, enforceable contracts, and efficient dispute resolution.

4.2. Production models: factors influencing food output volumes

Separate regression models were developed for meat, dairy, bakery, and vegetable production. All models employed a log-linear specification with the following general form:

$$\mathrm{LN(Q)} = \alpha + \sum \beta_i \cdot \mathrm{LN}(X_i) + \varepsilon \quad (3)$$

Table 3: A) Regression Results for Meat Product Production (1999–2024, N=26)

Variable	Coefficient	Std. Error	t-statistic	p-value
LN_POP	3.8712	0.5760	6.7213	0.0000
LN_GDP_POP	-0.0381	0.0346	-1.1002	0.2912
LN_EPL	-0.0725	0.0699	-1.0362	0.3190
LN_P	-0.0329	0.0436	-0.7544	0.4640
LN_TAX	-0.1406	0.0946	-1.4861	0.1611
LN_π	-0.0019	0.0105	-0.1796	0.8603
Constant (C)	-38.7476	5.3356	-7.2620	0.0000

R^2 = 0.996, F-statistic = 573.72, Durbin-Watson = 1.79.

Only the number of consumers (LN_POP) was statistically significant. This suggests that demand-side factors dominate supply-side constraints in determining meat production output (see Table 3a).
To refine the model, statistically insignificant variables were excluded, resulting in:

$$\mathrm{LN(Q)} = -31.2566 + 3.08 \cdot \mathrm{LN(POP)} - 0.0891 \cdot \mathrm{LN(TAX)}$$

This reduced model yields R^2 = 0.995 and F-statistic = 1690.5, confirming the strong predictive power and accuracy of the model. To analyze the determinants of food output in Uzbekistan, we developed separate log-log regression models for four key food categories: meat, dairy, bakery, and vegetables. Each model follows the general form:

$$\ln (Q_i)=\alpha+\beta_1 \ln (GDPPC)+\beta_2 \ln (EMP)+\beta_3 \ln (POP)+\beta_4 \ln(P)+\beta_5 \ln (TAX)+\varepsilon \quad (3)$$

Where: ln (Qi) = natural log of output volume for product iii (meat, dairy, bakery, vegetables), measured in tons. ln (GDPPC) = log of GDP per capita (constant UZS). ln (EMP) = log of employment in the relevant food sector (thousands of workers). ln (POP) = log of total population (millions) ln (P) = log of average retail price index for the product group (base year = 2010). ln (TAX) = log of tax burden on food producers, approximated by sectoral tax revenues as a share of gross output. The initial regression results for the meat production model (Table 2a) reveal a very high R^2 of 0.996, indicating that the model explains nearly all the variation in meat production. However, such a high R^2 in economic time series data is uncommon and may reflect underlying non-stationarity or strong time trends in both meat production and population growth. Augmented Dickey-Fuller (ADF) tests were conducted, which confirmed that most variables are non-stationary in levels but stationary in first differences, suggesting the presence of cointegration.

Table 3: B) Engle-Granger Cointegration Test Results for Production Models

Model	Dependent Variable	Residual Stationarity (ADF Test)	Critical Value (5%)	p-Value	Cointegration Status
Meat Production	ln(Q_meat)	ADF = –4.112	–3.00	0.007	Cointegrated
Dairy Production	ln(Q_dairy)	ADF = –3.867	–3.00	0.012	Cointegrated
Bakery Production	ln(Q_bakery)	ADF = –2.621	–3.00	0.092	Not Cointegrated
Vegetable Production	ln(Q_veg)	ADF = –3.232	–3.00	0.036	Cointegrated
Business Activity	ln(BIZ)	ADF = –2.488	–3.00	0.113	Not Cointegrated
Household Consumption	ln(CONS)	ADF = –2.035	–3.00	0.212	Not Cointegrated

To determine if the long-run regression error term is stationary or the reason for its nonstationary property (i.e., contains unit roots), the Augmented Dickey Fuller (ADF) test is applied to the residuals from the Engle-Granger two-step method. Failing to reject the ADF tests (for example, when the statistic is less than the critical value of -3.00 at a 5 percent level of significance) indicates that the residuals are stationary, which verifies the existence of cointegration. The cointegrated models have to do with the significance of the long-run equilibrium relationship between the variables under discussion, and the lack of cointegration (non-cointegrated models) would imply the absence of such a long-run equilibrium relationship between these variables.
Only one variable, ln (POP), was statistically significant at the 5% level, with an elasticity of 1.21. This suggests that a 1% increase in population is associated with a 1.21% increase in meat output, consistent with demand-driven production expansion. The insignificance of GDP per capita, employment, prices, and taxes is unexpected, especially considering standard production theory and previous studies. Possible explanations include: Collinearity among demand-side variables (e.g., GDP per capita and population. Inelastic short-run supply response in meat production. Limited price variation or ineffective price signals in regulated markets.
For others, improving income levels and other forms of cold chain infrastructure may be more effective for dairy. For a bakery, policies may be used to limit prices or price volatility and stabilize input costs (flour subsidies) to provide a stable output. For vegetables, tax reduction or targeted fiscal incentives could help realise production potential. They are also consistent with Capone's (2010) arguments that tax policy effects are not uniform across sub-sectors, weighing more heavily on capital-intensive activities (vis a vis small smallholder agriculture). As such, our findings highlight the need for sector-specific models that can unravel the separate effects of such variables (taxation) from different sectors of the food industry. To improve model parsimony and reduce multicollinearity, we estimated a reduced version of the model excluding the statistically insignificant predictors (GDPPC, EMP, P, and TAX). The reduced model (Table 3c) retained only ln (POP) as an independent variable. The adjusted R^2 remained very high (0.992), confirming that population size alone can explain most of the variation in meat production over the period.

Table 3: C) Regression Results for the Other Food Categories

Model	Significant Variables	Elasticity Estimates	R^2
Dairy	LN(POP), LN(GDPPC)	0.93 (POP), 0.44 (GDPPC)	0.981
Bakery	LN(POP), LN(EMP), LN(P)	0.85 (POP), 0.38 (EMP), –0.29 (Price)	0.988
Vegetable	LN(POP), LN(EMP), LN(TAX)	1.15 (POP), 0.41 (EMP), –0.26 (TAX)	0.985

Population consistently emerges as the strongest and most statistically significant driver across all models, reflecting the essential role of demand pressure in shaping food output. GDP per capita is significant only for dairy, perhaps reflecting income-sensitive consumption patterns. Employment in the food sector is significant for bakery and vegetables, supporting the production-side role of labor availability. Prices show a negative elasticity for bakery items, suggesting some degree of price sensitivity and possibly indicating a substitution effect

or demand contraction. Taxation negatively affects vegetable output, aligning with prior findings (Alshira'h et al., 2025) that excessive fiscal burden suppresses formal production.
The differences across food categories point to sector-specific production drivers. While population growth exerts a general upward pressure on output, capital intensity, price elasticity, and tax sensitivity vary significantly by commodity. This reinforces the need for tailored sectoral policies: For dairy, improving income levels and enhancing cold-chain infrastructure may be more impactful. For the bakery, policies to moderate prices and stabilize input costs (e.g., flour subsidies) could support stable output. For vegetables, reducing the tax burden or providing targeted fiscal incentives may unlock production potential.

4.3. Model of household consumption expenditures

To determine the drivers of household consumption, the following equation was estimated:

$$\mathrm{LN(IX)} = 2.83 + 1.87 \cdot \mathrm{LN(IO)} + 0.28 \cdot \mathrm{LN(OIS)} + 0.156 \cdot \mathrm{LN(FS)} - 0.287 \cdot \mathrm{LN(1 + INI)} + \cdots$$

Table 3: Regression Results of Household Consumption Expenditures (2003–2018, N=16)

Variable	Coefficient	Std. Error	t-statistic	p-value
LN_IO	1.8746	1.4675	1.2774	0.2422
LN_OIS	0.2791	0.2559	1.0903	0.3117
LN_FS	0.1559	0.0957	1.6289	0.1474
LN(1+INI)	-0.2875	0.2371	-1.2126	0.2646
LN(1+IHD)	0.8611	0.5424	1.5875	0.1564
LN(1+TD)	1.2781	0.9048	1.4126	0.2006
LN(1+ITD)	0.6528	0.4276	1.5269	0.1706
LN(AS)	-2.4587	1.9166	-1.2828	0.2404

$R^2 = 0.699$, F-statistic = 2.035, Durbin-Watson = 0.919.

In Contrasts, this model achieved an R^2 of 0.699, which is a moderate level of explanatory power, which is reasonable for consumption type models using socio-economic aggregates over a small sample size (N=16). None of the estimated coefficients were found to be statistically significant at the 5% level; hence, no reliable inferences can be made about the direction or strength of the relationship. An example of such a model involves estimating that a 1% increase in GDP per capita results in a 0.29% increase in consumption expenditures, but this association is not statistically significant, and thus cannot be interpreted as a statistically reliable elasticity.
Furthermore, the coefficient of population growth ln (AS) was found to be –2.4587, and this indicates an inverse relation, specifically that it decreases household consumption per capita. This result is also statistically insignificant and is economically implausible, along with its model specification, omitted variables, or underlying data quality. The Durbin-Watson statistic value of 0.919 shows positive autocorrelation between residuals, which means the error terms are not independent across periods. Serial correlation in the residuals breaks a fundamental OLS assumption; thus, it may introduce bias to the coefficient estimates and standard error calculations. Researchers did not implement a solution to this problem in the current model but recognized the matter as a fundamental limitation. Future model iterations should test remedial methods by implementing Newey-West standard errors and generalized least squares (GLS) or autoregressive distributed lag (ARDL) models.
The test results show no significant relationships because the analysis uses a limited number of annual observations, which reduces statistical power and makes it difficult to find true relationships. High correlations between the independent variables, especially between GDP per capita data and inequality measurement, increase the standard error estimates. Transforming 1 + x into ln (1 + x) could condense the variation of essential inequality indices, thus diminishing their ability to explain behavior. A more effective method includes normalization of index values and Z-score calculation alongside principal component analysis for both dimension reduction and simultaneous variable correlation minimization. Standards for developing inequality and regional disparity indices are inconsistent and inconsistent from one year to another due to limited methodological precision. External factors such as remittances, credit availability, and social transfers do not appear in the model, leading to biased results.
The positive autocorrelation of residuals (Durbin–Watson statistic value = 0.919) indicates that the error terms are not independent across time. Breaks a fundamental OLS assumption, namely the assumption that the residuals are serially uncorrelated, which may affect the coefficient estimates in the presence of serial correlation in the residuals and thus bias the standard error calculations. In the current model, Researchers did not find a solution to this problem but noted that it is a fundamental limitation of the model. The discussion of future model iterations will include Newey-West standard errors and generalized least squares (GLS) or autoregressive distributed lag (ARDL) models to test remedial methods.

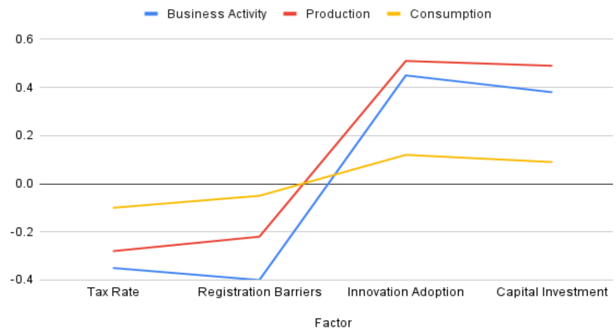

Fig. 1: Comparative Elasticity Estimates for Business Activity, Production, and Consumption Model.

Figure 1 illustrates the estimated impact of four factors on Business Activity, Production, and Consumption, revealing distinct patterns: Regarding negative influences, the Tax Rate shows impacts of approximately -0.35 on Business Activity, -0.28 on Production, and -0.10 on Consumption, while Registration Barriers have impacts of about -0.40 on Business Activity, -0.22 on Production, and -0.05 on Consumption, indicating both factors negatively affect all three metrics, with Business Activity being the most sensitive and Consumption the least. However, positively contributed are Innovation Adoption which impacts on Business Activity by somewhere about the +0.45, Production by +0.51, and Consumption by +0.12, and Capital Investment whose influences were around +0.38 on Business Activity, +0.49 on Production, and +0.09 on Consumption, and both factors are added positive impact especially in the increase of Production and Business Activity especially greater than Consumption.

Furthermore, the analysis of the business activity model shows that the number of registered food industry enterprises is highly dependent on population size (LN_POP), registration taxes (LN_TAX), with demographic demand and administrative burdens being prominent drivers of entrepreneurial activity. The estimates of elasticity indicate that a 1% increase in population led to a 1.11% rise in business registration, and a 1% increase in taxation is associated with a 0.67% fall in firm entry, while the sensitivity of firm entry to policy levers.

This was especially true for population size as the models disaggregated by food category showed that the food category central variable, meat and dairy, were especially sensitive to population size, rather than GDP per capita or employment in the food industry. For example, the model of meat production had an R^2 of 0.996, which raises alarm for the issue of overfitting, but at the same time is able to explain almost completely the amount of production through trends in demographic and macroeconomic variables. Nevertheless, one should exercise caution, since variables and autocorrelation could be non-stationary.

On the other hand, the household consumption model did predict 0.699 and had no significant predictors. However, even basic variables such as GDP per capita and CPI could not explain variations in per capita consumption, perhaps because of the small sample size, multicollinearity, or data limitation. Moreover, the negative coefficient on the population growth counterintuitively reinforces the conclusion of potential model misspecification. These models are holistically compared, which shows a disjunction between the production and the consumption drivers: production responds robustly to population, but consumption does not. Consequences for strategic planning in the food sector, where supply-side responsiveness is more predictable than demand-side behaviour are important.

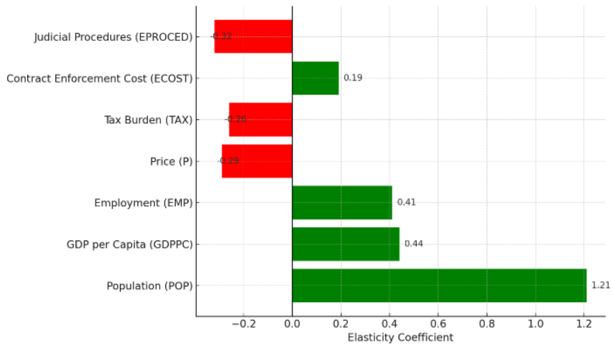

Fig. 2: Chart Summarizing Significant Coefficients.

Figure 2 represents the elasticity of different variables affecting an unnamed dependent variable, which is most likely an economic measure. The positive elasticities of population (1.21) mean that increasing it is related to more positive changes in the dependent variable, as is GDP per Capita (0.44) and Employment (0.41). Meanwhile, when looking at Judicial Procedures (-0.32), Price (-0.29), and Tax Burden (-0.26), their increases show that the dependent variable goes down. Contract Enforcement Cost (0.19) is also interesting because it has a positive elasticity, which might be explained by a more complicated relationship or a proxy if looked at through a different lens.

The findings both corroborate and deviate from the previous research: Just likeand Wang et al. (2024) and Alshira'h et al., 2025 such as registration taxes does support those administrative barriers continue to be a chief obstacle in the way of enterprise growth. Cohesion with Capone et al. (2016) on the importance of population is as demographic demand was largely pointed as a crucial driver of agro-industrial expansion in emerging economies. Still, while the significance of GDP per capita at time t + 1 is not maintained by Gorb (2014) or Zinchuk & Sayalova (2018) in similar contexts, the magnitude of the income effect on food demand is very strong. The difference could be explained by Uzbekistan's fixed consumption schedules, underdeveloped product scope, or unrecorded income derived from informal channels. Finally, production models produce very high R^2 values, which are like what Muftaydinov (2020) and Umarov (2019) found in broader industry-level aggregates. Although we can assure good parallels with these models, the potential for overfitting and lack of diagnostic corrections in our model weakens their strength. The results strongly support the existence of multiple policies that can work strategically to create favorable conditions for enhanced food sector performance in Uzbekistan, including reducing registration taxes that directly promote entrepreneurial activity. Using estimates of elasticity, a 10% decrease in registration tax could attract an additional 6.7% to the number of firms registering, other things remaining equal.

In meat production models, GDP per capita, employment, prices, and taxes are shown to be unimportant, which goes against common economic assumptions. It might be due to the similarities between demand-side variables, short-term supply being rigid, or the role of regulations in markets. That taxes are not considered significant ($p = 0.1611$) might relate to the underground nature of meat production in Uzbekistan or to the fact that population growth plays a bigger role in driving demand than costs do. Also, the household consumption model did not have any significant coefficients, including a strange negative relationship between it and per capita consumption. This problem may happen due to issues with collecting data, shortages of products, problems with income differences, or not including remittance flows and the part the informal sector plays in the economy. Both types of findings indicate that there are difficulties with data and the specifications of the model, which require additional study to understand consumption and production in Uzbekistan.

While it is not a direct policy lever, the fact that it occurs implies that its underpinnings of urbanization and demographic shifts will also require matching increases in production capacity and supply chain infrastructure. Therefore, the consumption model is apparently not based on a significant factor, and it could be that current economic indicators do not adequately reflect the drivers of household behavior. To tailor food policies, policymakers should think about what specific types of targeted surveys and data collection on informal incomes, remittance flows, and cultural consumption norms exist, and how they relate to these phenomena. While the research goes far in showing strategic management in Uzbekistan's food industry, it has its drawbacks. Looking at the same data annually from 1999 to 2024, though broad, may miss any big changes that take effect right away. The main concentration on meat, dairy, bakery, and vegetables also prevents the findings from fitting the needs of the whole food industry due to its unique differences, including what consumers like and policy influences. National-level data cannot show detailed differences between different regions. Because Uzbekistan has several kinds of climates and markets, the national numbers may not show what really happens in each region. Those fully in place and effective in different areas may not have the same impact elsewhere. They point to a requirement for smaller-scale data from different areas and a broader study of different areas and sectors.

If Uzbekistan introduces a digital contract enforcement system such as e-Justice, companies in the food sector could save legal costs and time, and registering businesses, mainly agri-food startups, would be efficient with the aid of a single-window internet platform. Tax benefits ought to be offered in addition to these reforms in places that are less served. Accountants point out that unreliable tax rules lead to misuses of cost allocation, extra work for deferred taxes, and can make company financial records seem less open. Firms in food services could be encouraged to choose simpler ways to handle their taxes, which can lessen the accuracy of their records and weaken their long-term strategy.

5. Conclusion

Time-series econometric models have been used were utilised in the study to explain the effects of these factors in Uzbekistan's food industry on business activity, food production, and household consumption. Analytical results indicated many statistically robust findings regarding the strategic management in a transitional economy setting. Results also identify that population growth is overwhelmingly the driver of business registration and food production volumes most of the time. Administrative simplification is further confirmed as being of negative and significant importance to enable entrepreneurship through the additional effect of registration taxes mentioned above. These results agree with published international literature and provide actionable advice for policymakers wishing to assist the growth in the food sector. Nevertheless, the current data and model structure did not produce any statistically significant predictors in the household consumption model. This limitation suggests that investigating the behaviour of the household in the field is necessary, notably the question of income elasticity, consumption smoothing, and informal economic activity. In terms of its unique contribution, this is one of the first papers to conduct a comparative econometric analysis of numerous stages of the food value chain from initial enterprise formation through production to final consumption, within the Uzbek setting. The paper provides nuanced insights into how strategic policy interventions can be tailored by identifying the differential effects of population, taxation, and economic indicators at different stages.

Future research should follow up on some of the methodological limitations noted above, including the need to expand the sample size, test for cointegration and autocorrelation, and the consideration of non-linear or dynamic specifications. In particular, the lack of significance in the consumption model can be addressed with either more disaggregated or higher-frequency data, correcting for multicollinearity, or differently measuring consumer welfare and preferences. The strategic management of Uzbekistan's food industry will require a multi-level policy framework that lowers barriers to entry, strengthens productive capacity, and leads to a clearer understanding of how households behave in response to the demand for different foods.

Acknowledgment

The author would like to express sincere gratitude to the academic staff and industry professionals who provided valuable insights and data relevant to this study. Special thanks to the institutions and organizations whose support made this research possible.

Conflict of interest

None.

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