EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 01, Issue 06, June, 2025
brightmindpublishing.com
ISSN (E): 3061-6972

EXPORT PERFORMANCE AND MARKETING EFFICIENCY: A STOCHASTIC FRONTIER STUDY OF UZBEKISTAN'S FRUIT AND VEGETABLE INDUSTRY

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Abstract
This study examines the effectiveness of marketing expenditures in enhancing the export performance of Uzbekistan's fruit and vegetable industry through the application of a Stochastic Frontier Analysis (SFA) approach. In the context of intensifying global competition, the development of effective marketing strategies is crucial for maximizing export potential within the agri-food sector. By employing SFA on firm-level data, this research estimates the marketing efficiency frontier and identifies the disparity between observed and optimal export performance. The results indicate significant variations in efficiency among firms, suggesting that targeted marketing research and optimized budget allocation can significantly enhance export outcomes. The paper discusses policy implications and offers recommendations for improving marketing effectiveness in Uzbekistan's horticultural exports.

Keywords: marketing research, export, SFA analysis, horticultural industry, marketing research efficiency

Introduction

On January 18, 2024, President Shavkat Mirziyoyev presided over a videoconference meeting focused on the "Priority Tasks for 2024 in the Fields of Investment, Export, and International Cooperation." During this meeting, it was underscored that currently, 50 percent of Uzbekistan's exports are concentrated in merely four markets: Russia, China, Kazakhstan, and Turkey. Furthermore, it was observed that 20 key export products are significantly reliant on a single market,

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raising concerns regarding the diversification of export destinations. It was also highlighted that Russia constitutes 13 percent of Uzbekistan's total export volume. Additionally, 12 percent of exports are directed to Kazakhstan and Kyrgyzstan, yet nearly 60 percent of the goods exported to these countries are ultimately consumed in Russia. This suggests that approximately 20 percent of Uzbekistan's total exports are effectively linked to the Russian market. Globally, the fruit and vegetable market plays a pivotal role in ensuring food security by providing a growing population with a diverse array of nutritious products. Horticulture serves as a major source of income for farmers and smallholder producers, bolstering rural economies worldwide. This market not only facilitates international trade but also enhances economic cooperation and fosters innovation in agriculture. As consumer preferences shift towards healthier and more sustainable food choices, the global fruit and vegetable market is becoming increasingly influential in shaping dietary patterns and promoting environmental sustainability. According to a global market analysis conducted by Data Bridge Market Research, the fruit and vegetable market turnover reached USD 1,231.82 billion in 2023. This figure is projected to rise to USD 2,985.19 billion by 2031, with an anticipated average annual growth rate (CAGR) of 11.70 percent during the forecast period of 2024–2031.

Literature Review

Abdullahi et al. (2022) apply SFA within a gravity model framework to measure technical efficiency in China’s agricultural exports across 114 destination countries (2000–2019). They find substantial inefficiencies—average realized performance was only 49% of potential—highlighting a sizable untapped export capacity. Their work notably combines determinants of exports (e.g., GDP, distance) with efficiency estimation.

Atif et al. (2019) examine Pakistan’s chemical exports (1995–2015), finding that these exports are well below potential levels after controlling for gravity variables. Their SFA model reveals sensitivity to tariffs and distance, and inefficiency across all partner countries. This confirms the value of SFA in identifying performance gaps and informing trade policy.

SFA has also been extensively used in evaluating agricultural technical efficiency at the farm or national level. For instance, MDPI’s study (2022) on EU agriculture finds SFA to be more precise than DEA, identifying variance in technical efficiency

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across countries and the influence of structural factors. Other sectors analyzed using SFA include industrial water use in China.

Methodology

We investigate the efficacy of corporate investments in marketing research, utilizing the Stochastic Frontier Analysis (SFA) model. A firm's performance is evaluated in terms of technical and allocative efficiency. Two principal methodologies exist for assessing technical efficiency: Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). This study employs the SFA method, which presents several advantages over alternative approaches. SFA is a parametric technique, wherein the functional form of the production frontier is predetermined and estimated using statistical methods. The primary advantages of SFA include the capacity to test hypotheses on a statistical basis, the definition of the relationship between input and output variables through a clear functional form, and the model's ability to simultaneously estimate both stochastic production variation and technical inefficiency. SFA is a regression-based approach that evaluates the relative efficiency of firms or economic units in maximizing output or minimizing costs. In this model, marketing expenditures are considered inputs, while export volume, number of export operations, and number of trading partners are regarded as outputs. The efficiency level of each enterprise is estimated using the SFA model. The model is specified as follows:

$$log(Y_1) = \beta_0 + \beta_1 \cdot log(X) + V_i - U_i$$

Where:

X denotes marketing expenditures (input);

Y_1 represents outputs: export volume, number of export operations, and number of trading partners (three outputs);

V_i is a random error term for firm

i, assumed to be independently and identically distributed as $N(0, \sigma_v^2)$ with a mean of zero and variance σ_v^2.

It is also assumed to be independently distributed from U_i; U_i is a non-negative random variable representing technical inefficiency in the firm. It is assumed to follow a truncated normal distribution with mean μ and variance σ_u^2, and is independently distributed.

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Results and Discussion

Using the Stochastic Frontier Analysis (SFA) model, we evaluated the efficiency of marketing expenditures in relation to export performance across 30 exporting firms in horticultural sector. The analysis was based on the log-linear production function where marketing expenses were treated as the input variable, and export volume, number of export operations, and number of trade partners were considered as output indicators.

Table 1: Comparative Analysis of Exports by Firms Using Marketing Research vs. Traditional Approaches

No	Name of company (utilize marketing research)	Export value (thousand USD)	Name of company (traditional)	Export value (thousand USD)	Difference +/-
1	"ALL RETAIL PLUS" LLC	855,38	"QUVA UMID AGRO" LLC	91,38	**764**
2	"AZIZBEK AGRO CHERRY" LLC	1666,55	"YASMINFAYZ AGRO" LLC	142,578	**1554,0240,89**
3	"HAVVO NOBLE" LLC	2004,5	"NARPAY HOSILDOR" LLC	203,30	**1801,2**
4	"HELLO FRUITS ONE" LLC	2086,65	"FOOD AGRO COMPANY BB" LLC	275,49	**1811,16**
5	"HAVVO GROUP" LLC	880,15	"JETONE" LLC	81,05	**799,1**
6	“EXPORT AGRO 2022” LLC	991,75	“AZIZBEK AGRO CHERRY” LLC	101,48	**890,27**
7	"UZOR FARGANA" LLC	879,23	"FARIDA FRUIT IMPEX" LLC	117,81	**761,42**
8	"AGRO LIGHT BUSINESS" LLC	401,29	"GROW SEEDS TASHKENT" LLC	31,72	**369,57**
9	"STONE ONE BEST" LLC	919,39	"AVANGARD EKSIM" LLC	97,39	**822**
10	"AGRO PROGRESS OLTIARIQ" LLC	371,34	"VALLEY FRUIT EXPORT BJ" LLC	44,78	**326,56**
11	"ROSHIDON BEST UNIVERSAL EXPORT" LLC	1014,17	"BILLUR BARAKA IMPEX" LLC	51,87	**962,3**
12	"DEUTCH" LLC FE	600,76	"CHIROQCHI-KLASTER" LLC	118,08	**482,68**
13	"AGRICOLA-EXPORT" LLC	3383,64	"OZODBEK FRESH-FRUITS" LLC	361,02	**3022,62**
14	"ALLONOV EXPORT" LLC	488,92	"ASA GRAND GR " LLC	38,45	**450,47**
15	"SANTER COMPAIGN" LLC	3310,89	"ECO EXPORT 111" LLC	299,1	**3011,79**
Total:		**19854,61**		**2025,43**	**17829,18**

Source: Author’s analysis and elaboration according to statistics and surveys

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As indicated in Table 1, the aggregate export value of 15 companies that engaged in marketing research prior to exporting reached approximately 20 million USD. In contrast, the collective export value of 15 companies that employed traditional, non-research-based methods amounted to merely 10% of this figure, or approximately 2.03 million USD. The disparity in export volume between firms that implemented marketing research and those that did not—particularly within the apricot export sector—was a significant +17.8 million USD, highlighting the pivotal role of marketing research in enhancing export performance. It is noteworthy that, out of a total of 276 apricot-exporting companies, only 15 firms utilized marketing research as the foundation for their export activities. Nevertheless, these 15 firms accounted for 50.3% of Uzbekistan's total apricot export value in 2023. According to the Uzbekistan State Committee on Statistics, the total apricot export volume in 2023 amounted to 36.1 million USD. This further illustrates that companies employing strategic, research-driven approaches significantly outperformed their counterparts in terms of export efficiency and market reach.

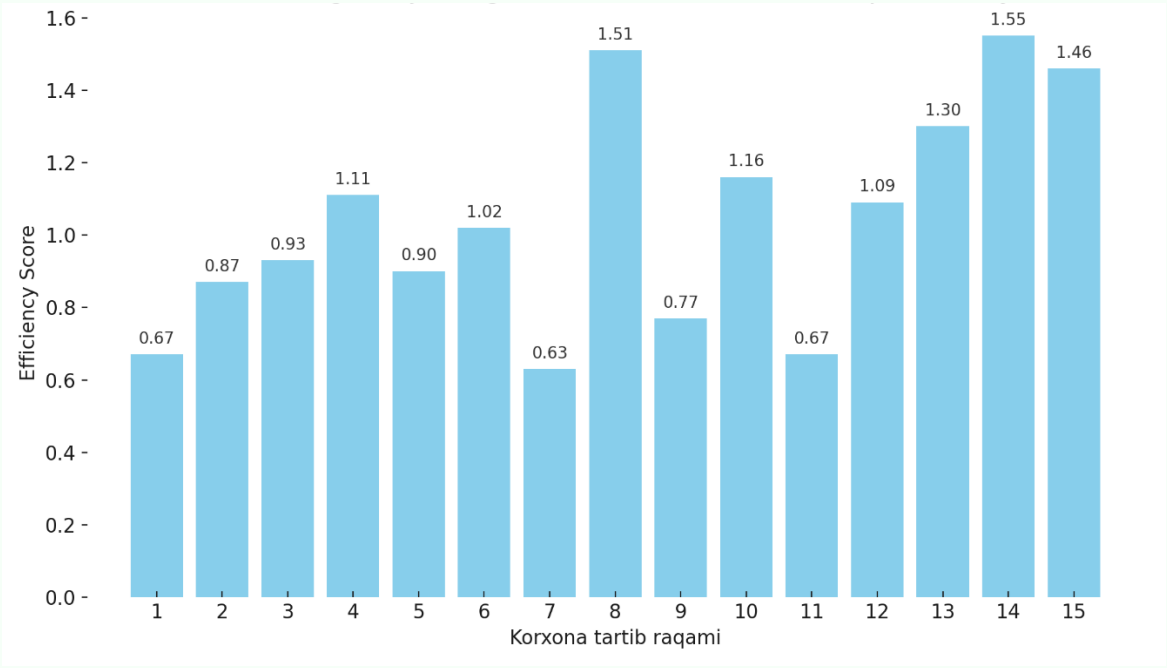

Figure 1: Results of Efficiency Analysis Based on the SFA Model

The figure above depicts the technical efficiency scores of individual firms, derived from their marketing research expenditures, as estimated through the Stochastic

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Frontier Analysis (SFA) model. Each bar corresponds to a specific enterprise, sequentially arranged along the horizontal axis by firm ID, while the vertical axis indicates their respective efficiency scores. This visualization offers a clear and practical representation of the extent to which firms have utilized their marketing investments to generate export outcomes. Firms with an efficiency score approaching 1 are deemed highly efficient, indicating they have achieved near-optimal export results relative to their level of marketing investment. Conversely, firms with scores significantly below 1, particularly those under 0.7, demonstrate suboptimal performance, suggesting that available internal resources and strategic tools have not been fully leveraged. The graph provides critical insights for policy-making and strategic planning. It can assist in: identifying best-performing firms for benchmarking purposes; reallocating marketing budgets more effectively across firms; and designing targeted interventions for underperforming enterprises, such as training, market segmentation strategies, or alternative promotion methods. Overall, the visualization serves as an analytical tool for diagnosing disparities in marketing efficiency across firms and underscores the importance of data-driven marketing decision-making in maximizing export performance. Firms falling short of the frontier may consider reviewing their marketing strategies, re-evaluating export targets, or investing in more robust market intelligence systems.

In the realm of international literature, the deficiency of comprehensive information regarding foreign markets is frequently likened to "firing a shotgun with one's eyes closed: if a duck falls from the sky, it is not due to skillful aim but pure chance." Nevertheless, merely acquiring potentially valuable data constitutes only half of the endeavor; the effective utilization of such data represents the second half, which is arguably more crucial.

Numerous companies continue to falter in international markets either due to a lack of belief in the value of international market research or because of insufficient resources and qualified personnel to conduct such research. Consequently, strategic errors and missed opportunities persist. Through our analysis, we have demonstrated the significance of effectively employing marketing research findings to avert costly mistakes and capitalize on export opportunities. Indeed, we contend that one of the primary causes of failure in international markets is inadequate preparation and a lack of pertinent market information.

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