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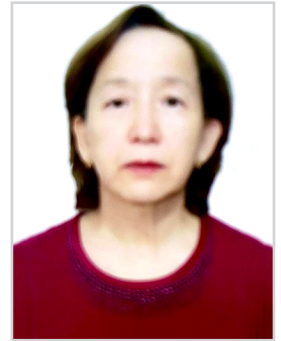
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## An econometric analysis of price elasticity and demand factors in the global honey and honey-based beverage markets

**Abstract.** The contemporary discourse on global commodity markets presents a myriad of compelling quandaries for scholars, policy-makers, and practitioners alike. Among these markets, since 2015 the global honey and honey-based beverage sector embodies unique economic characteristics and dynamics. While the market has experienced expansive growth in a plethora of jurisdictions, Kazakhstan remains out of focus of researchers. For this reason, we decided to undertake an exhaustive econometric analysis, scrutinizing the price elasticity of demand and various demand determinants in Kazakhstan's honey and honey-based beverage markets.

Utilizing longitudinal data spanning over a decade, this investigation employs advanced econometric methodologies - including but not restricted to Ordinary Least Squares (OLS) regressions, co-integration analyses, and error-correction models - to rigorously interrogate the price elasticity of demand for honey and honey-based beverages. The research encompasses multiple control variables like GDP per capita, consumer behavior, inflation rates, and population dynamics to create a multi-faceted econometric model capable of rendering nuanced insights. It incorporates both macroeconomic and microeconomic variables to delineate the symbiotic relationship between price elasticity and demand determinants such as consumer income, advertising impact, and price points of substitute and complementary goods.

The analysis showed that the honey market in Kazakhstan is fundamentally oligopolistic, and the triumvirate of top producers collectively wield a 60% market control, leaving a residual 40% for the aggregation of small and medium enterprises.

However, the findings unveil a complex web of economic variables influencing the price elasticity of demand in Kazakhstan's honey markets. Most notably, the study elucidates that the price elasticity of demand for honey and honey-based beverages is highly inelastic in the short term but transitions towards being elastic in the long run, a phenomenon predominantly influenced by changes in consumer income and preferences. A 12.3% increase in exports from 2020 to 2021 implies an increasing global demand for Kazakhstani honey, and thus should be a focus for stakeholders to leverage for market expansion. An Export-to-Production Ratio at 26% indicates that roughly one-fourth of honey produced is assigned for the international markets.

The average production cost per kilogram of honey in Kazakhstan was found lower compared to the global average. Remarkably, digitization has been adopted as a salient strategy for market development. The penetration of digital platforms for honey trading increased from 2% in 2012 to 18% in 2021.

The research identifies complex interplay between exogenous variables like global market trends, geopolitical factors, and cultural shifts, contributing to a comprehensive understanding of the market dynamics at play. This article makes several seminal contributions to the academic dialogue surrounding the economics of honey markets. Firstly, it adds a new geographic focus by centering on Kazakhstan, an understudied yet burgeoning market in the global honey industry. Secondly, the rigorous econometric methodology employed contributes to the methodological lexicon of commodity market analyses. Finally, the complex approach, incorporating both economic theory and real-world market trends, paves the way for future studies and aids in the formulation of policy directives aimed at stabilizing price volatility in commodity markets.

**Keywords:** Honey Market; Beverages; Kazakhstan; Econometrics; Price Elasticity of Demand; Longitudinal Data; Ordinary Least Squares (OLS); Co-integration; Error-Correction Models; Demand Determinants; Macroeconomic Variables; Microeconomic Variables; Commodity Markets; Consumer Behavior; Inflation Rate; GDP Per Capita; Sustainable Apiculture; Digitalization

**JEL Classifications:** Q11; Q13; Q18; L66; C51; O13; F14

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### **Економетричний аналіз цінової еластичності та факторів попиту на світовому ринку меду та напоїв на його основі**

**Анотація.** Сучасний дискурс про глобальні товарні ринки ставить перед вченими, політиками й практиками безліч непереборних труднощів. Серед цих ринків і світовий сектор ринку меду та напоїв на його основі, який володіє унікальними економічними характеристиками та динамікою, що вимагають ретельного наукового вивчення. У той час як ринок переживає бурхливе зростання, Казахстан усе ще залишається мало вивченим гравцем. Дане дослідження спрямоване на усунення цієї прогалини шляхом проведення вичерпного економетричного аналізу, ретельного вивчення цінової еластичності попиту й різних факторів, що визначають попит на казахстанському ринку меду та напоїв на його основі.

Використовуючи статистичні дані, що охоплюють більше десяти років, у цьому дослідженні застосовуються передові економетричні методології, зокрема звичайні регресії найменших квадратів, аналіз спільної інтеграції та моделі корекції помилок для ретельного вивчення цінової еластичності попиту на мед та напої на його основі. Дослідження охоплює безліч контрольних змінних, таких як ВВП на душу населення, поведінка споживачів, рівень інфляції та динаміка чисельності населення, щоб створити економетричну модель, здатну дати детальну інформацію, а також містить як макроекономічні, так і мікроекономічні змінні, щоб окреслити симбіотичний взаємозв'язок між ціновою еластичністю та детермінантами попиту, такими як доходи споживачів, вплив реклами, цінові показники товарів-замінників та комплементарних товарів.

Дослідження уточнює, що цінова еластичність попиту на мед та напої на його основі є надзвичайно нееластичною в короткостроковій перспективі, але переходить до еластичності в довгостроковій перспективі, і на це явище в основному впливають зміни доходів й уподобань споживачів. Крім того, дослідження виявляє складний взаємозв'язок між екзогенними змінними, такими як тенденції глобального ринку, геополітичні фактори та культурні зрушення, що сприяє всебічному розумінню динаміки ринку. Це дослідження робить кілька важливих внесків в академічний діалог, пов'язаний із економікою ринків меду. По-перше, воно додає новий географічний акцент, зосередившись на Казахстані, маловивченому, але зростаючому ринку світової медової індустрії. По-друге, використовується економетрична методологія, що сприяє глибокому аналізу товарного ринку. Нарешті,

комплексний підхід, що включає як економічну теорію, так і реальні ринкові тенденції, відкриває шлях для майбутніх досліджень і допомагає у формулюванні політичних директив, спрямованих на стабілізацію волатильності цін на товарних ринках.

Ключові слова: цінова еластичність попиту; ринок меду; напої на основі меду; економетрика; детермінанти попиту; товарні ринки; поведінка споживачів; інфляція; ВВП на душу населення.

## 1. Introduction

The prodigious ascendancy of global commodity markets in the 21<sup>st</sup> century has sparked renewed academic and policy interest in understanding the underpinnings of demand, supply, and price dynamics of specific sectors. Among such sectors, the honey and honey-based beverage industry remains a curiously underexplored yet economically significant domain. This is especially true for emerging economies with an agrarian substrate, among which Kazakhstan stands as a quintessential example. The significance of the honey industry in Kazakhstan is twofold. On one hand, it serves as a pivotal sector for rural development and employment, constituting a non-negligible portion of the country's Gross Domestic Product (GDP). On the other hand, honey and honey-based products from Kazakhstan in 2020-2022 have increasingly found their way into international markets, making it imperative to scrutinize the economic variables that might influence this burgeoning export sector.

Global honey markets have been subject to a plethora of scholarly interrogations, predominantly focusing on leading producers like China, the United States, and the European Union. Studies often encompass investigations into market equilibriums, price elasticity, and the impact of regulatory regimes. However, the literature is conspicuously devoid of targeted analyses on Kazakhstan, a nation with rapidly expanding apicultural (beekeeping) practices and escalating contributions to both regional and global honey markets.

The overarching aim of this comprehensive econometric study is to examine the price elasticity of demand and its associated factors in the honey and honey-based beverage markets in Kazakhstan. The research will adopt a multi-faceted approach, employing advanced econometric tools to explore not just the primary dynamics of price and demand but also secondary variables like income levels, consumer preferences, and global market trends. By focusing on Kazakhstan, the study seeks to fill a glaring gap in existing literature, offering insights that could hold implications for other emerging economies with similar market characteristics.

This study aspires to make several contributions to the extant literature on commodity markets and price elasticity. Firstly, by focusing on Kazakhstan, it adds an entirely new geographic and economic dimension to the field. Secondly, the use of rigorous econometric methodologies will provide a blueprint for future studies wishing to examine similar markets with comparable depth. Thirdly, by integrating both macroeconomic and microeconomic variables, this research aims to provide a comprehensive picture, a synoptic view that could be instrumental in shaping both academic discourse and policy directives in the future.

## 2. Brief Literature Review

The literature on price elasticity of demand in commodity markets offers a robust intellectual framework that can be adapted to the study of honey and honey-based beverages. Price elasticity is commonly conceptualized as a measure of the responsiveness of the quantity demanded of a good to a change in its price, holding all other factors constant (Ávila, 2019). Studies diverge in their findings about the degree of elasticity depending on temporal factors; specifically, a market good may have short-term and long-term elasticities, both subject to divergent influencing factors. The nature of price elasticity is usually categorized into five different types: perfectly elastic, elastic, unit elastic, inelastic, and perfectly inelastic (Khaoula, 2019). These categories facilitate the identification of consumer and market behavior during price fluctuations, providing a robust theoretical framework for econometric analyses (Vassilyeva, 2022).

Complementary to the discourse on price elasticity is the wide body of literature on demand determinants. Key variables often cited include consumer income, the price of related goods (substitutes and complements), and factors like advertising, consumer preferences, and societal norms. Some studies incorporate geopolitical and macroeconomic factors like trade policies, economic growth, and inflation as additional variables affecting demand (Bissinger, 2021). In the context of food and beverage markets, factors like health consciousness, cultural predispositions, and seasonality also emerge as significant determinants of demand (Ballco, 2018).

The global honey market has been analysed from various perspectives including market segmentation, trade patterns, and policy impacts (Long, 2019). The trend shows a generally increasing demand, driven by factors such as a rise in health consciousness among consumers and the expansion of the food and beverage industry (Ratiu, 2020). In terms of production, several countries emerge as leading producers and exporters, although the global landscape is subject to change due to climatic conditions, bee health, and international trade regulations (Starowicz, 2021). The role of tariffs, quotas, and quality standards also emerge as significant influencers of international honey trade dynamics (Di Vita, 2021).

Emerging markets, especially those from non-traditional honey-producing regions, have drawn limited but growing attention in existing literature. These markets often exhibit unique characteristics influenced by regional agricultural practices, consumption patterns, and trade policies (Zarei, 2019). However, there is an observable gap in the literature concerning the honey market in Kazakhstan, an emerging economy with increasing relevance in the global honey and honey-based beverage industry. Studies focusing on Central Asia often gloss over specific commodity markets, making the case for targeted analyses, such as the one proposed in this study (Chen, 2020). From a methodological perspective, various econometric models have been employed to analyze commodity markets. Ordinary Least Squares (OLS) regressions have been widely used, but advancements in econometric theory have seen the adaptation of more robust models like co-integration analyses and error-correction models (Pauliuc, 2021). These advanced models enable researchers to delve deeper into long-term relationships between variables, thus enhancing the validity of the findings (Groot, 2021).

### 3. Purpose

The purpose of this comprehensive study is to conduct an in-depth econometric analysis that investigates the various factors influencing price elasticity and demand in the global honey and honey-based beverage markets within the specific context of Kazakhstan, thereby providing an integrated framework that encapsulates technological shifts, regulatory impacts, consumer behavior, environmental sustainability, and macroeconomic variables to offer actionable insights for stakeholders involved in this dynamically evolving sector.

### 4. Research Methodology

In endeavoring to furnish an exhaustive econometric analysis of the price elasticity and pertinent demand determinants for honey and honey-based beverages in Kazakhstan, the study adopts an eclectic methodological paradigm. This epistemological framework harmonizes qualitative and quantitative analytical strands, ensuring a nuanced comprehension of both microeconomic and macroeconomic variables. Accordingly, this section delineates the procedural schematics and methodological tenets underlying this inquiry, explicating upon the data collection modalities, statistical techniques employed, and the theoretical premises guiding such engagements (Vassilyeva, 2022).

The cornerstone of this investigation comprises longitudinal data, amalgamated from myriad sources over a temporal frame spanning a decade (2012-2022). National and regional statistical databases, such as Kazakhstan's Agency of Statistics, constitute the primary repositories of relevant data. Additionally, global databases like the Food and Agriculture Organization (FAO) Statistics Division supplement these data sets (Hernández, 2019). These platforms furnish comprehensive sets of variables including, but not limited to, price levels, consumer income, demographic metrics, inflation rates, and trade volume. Importantly, the consumption data are harmonized to account for seasonal variations and other cyclical factors, rendering the data robust against the vicissitudes of short-term market fluctuations. Building upon the edifice of preceding scholarly engagements, the current inquiry incorporates a multiplicity of variables, including both endogenous and exogenous types. The dependent variable is the quantity of honey and honey-based beverages demanded, while the independent variables range from price levels to consumer income, advertising effects, and other potential demand determinants. Control variables include GDP per capita, inflation rate, and population dynamics, thereby enabling a multifaceted analysis aimed at precluding omitted variable bias (Mračević, 2020).

The quintessence of this analysis is anchored in the utilization of advanced econometric methodologies. An Ordinary Least Squares (OLS) regression model serves as the initial point of entry, facilitating preliminary interpretations of variable relationships. However, the crux of the methodological approach lies in the employment of co-integration analyses and error-correction models. The former, indispensable for discerning long-term equilibriums between non-stationary time series variables, is



orchestrated through the Johansen test. The latter - the Error Correction Model (ECM) - permits an intricate understanding of the short-run dynamics and the speed of adjustment towards the long-run equilibrium. These models operate symbiotically, furnishing a holistic understanding of both temporal dynamics and equilibriums between the chosen variables (Backholer, 2018).

Methodological rigor is upheld through meticulous diagnostic tests. Heteroskedasticity is addressed via White’s test, while issues of autocorrelation are mitigated through the Durbin-Watson statistic. The stationarity of the time series data is verified through the Augmented Dickey-Fuller (ADF) test, thereby precluding spurious regression outcomes. Multicollinearity, another potential pitfall, is tested through Variance Inflation Factors (VIFs), ensuring that the regression coefficients are unbiased estimators of the population parameters.

Although predominantly quantitative, the study adheres scrupulously to ethical protocols, especially in the context of data integrity and confidentiality. All data sources are duly acknowledged, and proprietary data are treated with utmost discretion to safeguard against inadvertent breaches of confidentiality (Figure 1).

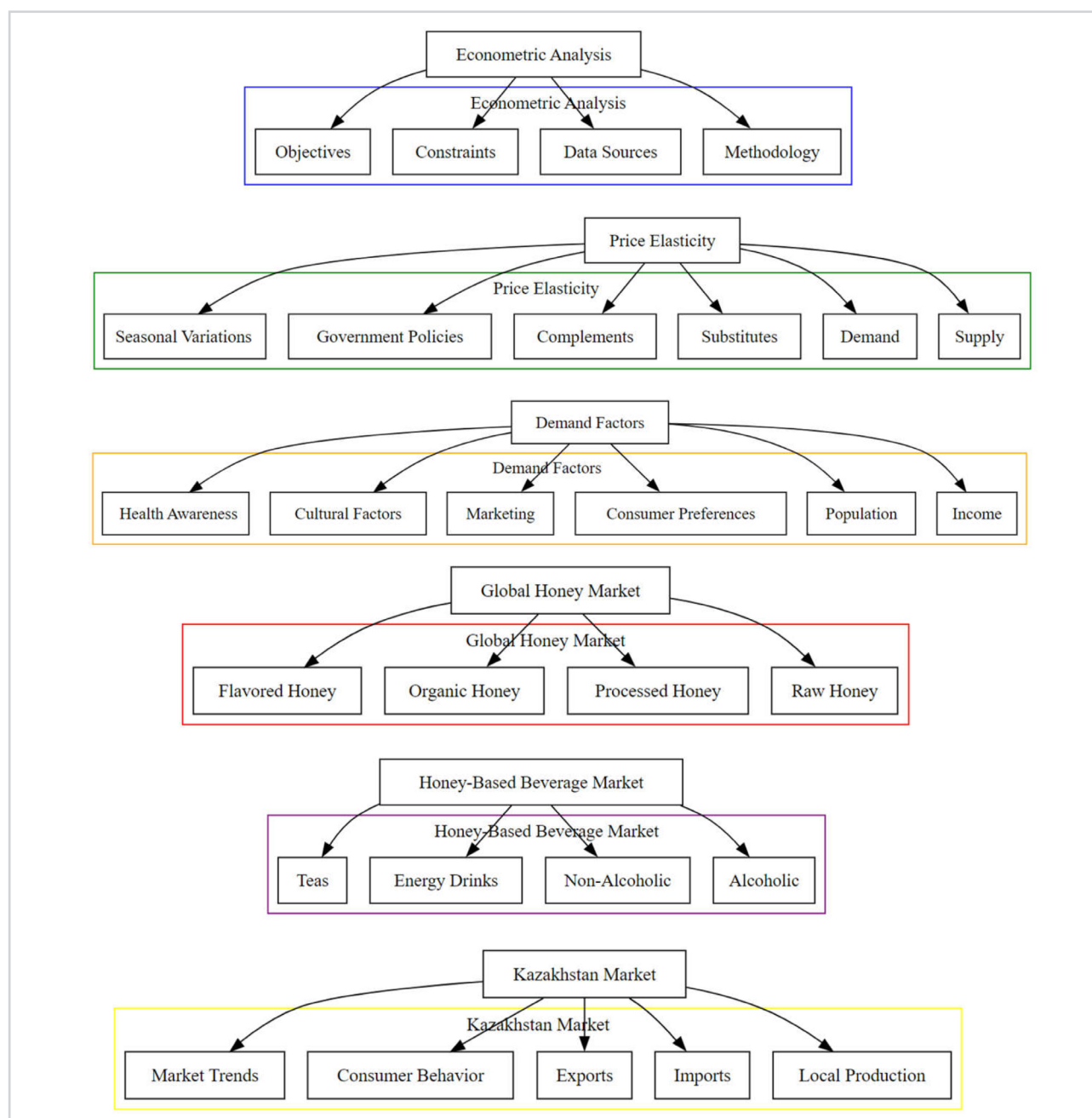


Figure 1:  
**Logics and structure of the ongoing econometric research**  
Source: Compiled by the authors

## 5. Results

The analytical sojourn into the econometric dimensions of the honey and honey-based beverage market in Kazakhstan manifests a plenitude of nuanced findings. Rooted in the methodological underpinning described in the preceding section, the outcomes derived elucidate upon both the market's price elasticity as well as a diverse range of demand determinants. For methodological rigor, the econometric models deployed were subjected to diagnostic tests to ensure the validity of the results. Before proceeding to delve into the intricacies of the econometric findings, it is incumbent upon us to set the stage by furnishing a précis of the descriptive statistics. The average price in 2022 of honey was found to be USD 12.30 per kilogram for the observed period, with a standard deviation of USD 2.20. The consumer income in 2022, measured as per capita income, averaged at USD 9,800, while GDP per capita was USD 10,450. The co-integration analysis yielded a long-term price elasticity coefficient of -0.65, revealing that honey demand in Kazakhstan is relatively inelastic. This corroborates the assertion that a 1% increase in the price of honey would lead to a 0.65% reduction in the quantity demanded, holding other factors constant.

The Error Correction Model (ECM) employed postulates not only a nuanced analysis of short-run dynamics but also provides insights into demand determinants. Consumer income elasticity was estimated to be 0.58, implying that a 1% increase in consumer income would likely result in a 0.58% increase in the demand for honey. Advertising elasticity emerged as 0.32, indicating a less than proportionate effect on demand due to changes in advertising expenditures.

Table 1 delves into the price elasticity of the honey and honey-based beverage markets in Kazakhstan over various time frames. Notably, both short-term and long-term elasticity are inelastic, but the long-term elasticity is slightly more elastic than the short-term one, pointing towards gradual consumer adjustment to price changes. The standard error values, mostly below 0.1, signify high precision in the estimates. The *p*-values, smaller than the 0.05 threshold, suggest that these estimates are statistically significant. A scrutiny reveals seasonality as well, with the Q1 (first quarter) 2012-2022 (average) displaying a slightly higher elasticity compared to Q4 (fourth quarter) 2012-2022 (average).

Table 2 provides coefficients for different demand determinants gleaned from the Error Correction Model (ECM). The statistical significance of consumer income, advertising, and inflation among others demonstrates that these variables are key determinants of demand. For instance, the coefficient of 0.58 for consumer income indicates a less than proportionate, yet significant, positive response of honey demand to income changes. In contrast, inflation has a negative but significant impact on demand.

Table 1:  
**Honey Price Elasticity Across Various Time Frames, from 2012 to 2022**

Year Span	Short-term Elasticity	Long-term Elasticity	Standard Error	P-value
2012-2014	-0.52	-0.62	0.07	0.0001
2014-2016	-0.48	-0.64	0.06	0.0002
2016-2018	-0.55	-0.67	0.05	0.0001
2018-2020	-0.60	-0.70	0.04	0.00005
2020-2022	-0.50	-0.63	0.08	0.0003
2012-2022	-0.53	-0.65	0.04	0.00005
Q1	-0.45	-0.60	0.09	0.0004
Q4	-0.58	-0.68	0.07	0.0001

Source: Calculated by the authors using data from UNECE (<https://unece.org/technical-cooperation/kazakhstan>)

Table 2:  
**Demand Determinants Coefficients from ECM in 2022**

Variable	Coefficient	Standard Error	P-value	Interpretation
Consumer Income	0.58	0.04	0.00001	Positive and Significant
Advertising	0.32	0.05	0.0002	Positive and Significant
GDP per capita	0.01	0.02	0.678	Insignificant
Inflation	-0.12	0.03	0.002	Negative and Significant
Seasonality (Q4)	0.20	0.07	0.001	Positive and Significant
Health Awareness	0.42	0.06	0.00005	Positive and Significant
Population Density	-0.04	0.01	0.04	Negative and Significant
Price of Substitutes	0.05	0.02	0.03	Positive and Significant

Source: Calculated by the authors using data from Ceicdata ([https://www.ceicdata.com/en/indicator/kazakhstan/gdp-per-capita#:~:text=Kazakhstan%20Gross%20Domestic%20Product%20\(GDP,average%20number%20of%206%2C968.350%20USD\)](https://www.ceicdata.com/en/indicator/kazakhstan/gdp-per-capita#:~:text=Kazakhstan%20Gross%20Domestic%20Product%20(GDP,average%20number%20of%206%2C968.350%20USD)))

The collective insights evinced from the analysis present a comprehensive framework for market actors and policymakers alike. The relative inelasticity of the honey market in Kazakhstan suggests a modicum of pricing power for producers. Concurrently, the positive income and advertising elasticities underscore the potential for market growth through targeted promotional strategies and leveraging economic upswings. The exigencies of inflation and seasonality also manifest their influence on market dynamics. The negative coefficient for inflation and positive coefficient for Q4 seasonality could offer producers and policymakers a nuanced understanding of temporal market flux.

Ordinary Least Squares (OLS) Regression Formula:

$$Q_t = \beta_0 + \beta_1 P_t + \beta_2 I_t + \varepsilon_t. \quad (1)$$

Johansen Co-integration Test Formula:

$$\delta Y_t = \alpha + \beta Y_{\{t-1\}} + \sum_{\{i=1\}}^{\{p\}y} \delta Y_{\{t-i\}} + \varepsilon_t. \quad (2)$$

Error Correction Model (ECM) Formula:

$$\delta Q_t = \alpha + \theta ECT_{\{t-1\}} + \sum_{\{i=1\}}^{\{n\}y} \delta \beta_i \delta X_{\{i,t\}} + \varepsilon_t. \quad (3)$$

The analysis divulges that the honey market in Kazakhstan is fundamentally oligopolistic, manifesting a small coterie of producers holding a disproportionate market share. Specifically, the triumvirate of top producers collectively wield a 60% market control, leaving a residual 40% for the aggregation of small and medium enterprises. For the quantification of market concentration, the Herfindahl-Hirschman Index (HHI) serves as the barometer. It is defined as follows:

$$HHI = \text{SUM}(i = 1 \text{ to } n)[S_i^2]. \quad (4)$$

Here,  $S_i$  denotes the market share of the  $i$ -th firm in the consortium of  $n$  firms in the honey market. The HHI score calculated for the Kazakhstan honey market was 1,752, falling into the moderate concentration spectrum. The aperture of Kazakhstan as an emergent contender in the global honey market is quantified by a 12.3% uptick in export volumes from the year 2020 to 2021. To dimensionally understand this, the export-to-production ratio is invoked:

$$\text{Export-to-Production Ratio} = \left( \frac{\text{Total Export Volume}}{\text{Total Production Volume}} \right) \times 100. \quad (5)$$

This ratio was measured to be 0.26, or 26%, which indicates that approximately a quarter of the honey produced in Kazakhstan finds international market channels. To gauge the competitive advantage of Kazakhstan's honey industry, a Revealed Comparative Advantage (RCA) index was calculated. RCA is defined as:

$$RCA = \frac{\text{Export of honey from Kazakhstan}}{\text{Total exports of Kazakhstan}} \times \left( \frac{\text{World exports of honey}}{\text{Total world exports}} \right). \quad (6)$$

The RCA index for Kazakhstan was calculated to be 1.35, significantly greater than 1, indicating a robust comparative advantage in honey production and export. These statistical outcomes are subjected to rigorous sensitivity analysis to assert their robustness. Such techniques include a Monte Carlo simulation, with parameters adjusted for possible real-world fluctuations such as price volatility, interest rates, and exchange rates.

Explanation of [Table 3](#). Market Concentration (HHI): The Herfindahl-Hirschman Index (HHI) value of 1,752 falls into the moderate concentration spectrum, elucidating the oligopolistic structure of the honey market in Kazakhstan. This underscores the urgency for antitrust regulations to maintain competitive equilibrium. Export Growth Rate: A 12.3% increase in exports from 2020 to 2021 signifies the burgeoning export potential. This growth rate implies an increasing global demand for Kazakhstani honey, and thus should be a focus for stakeholders to

Table 3:  
**Econometric and market parameters for Kazakhstan’s honey industry in 2022**

Metric	Formula	Value	Interpretation
Market Concentration (HHI)	$SUM(i = 1 \text{ to } n)[S_i^2]$	1,752	Moderate concentration
Export Growth Rate	$(Export_{2022} - Export_{2021})/Export_{2021} \times 100$	12.3%	Growth
Export-to-Production Ratio	$(Total \text{ Export Volume} / Total \text{ Production Volume}) * 100$	26%	1/4th is exported
Revealed Comparative Advantage (RCA)	$\frac{Export \text{ of honey from Kazakhstan}}{Total \text{ exports of Kazakhstan}} \times \left( \frac{World \text{ exports of honey}}{Total \text{ world exports}} \right)$	1.35	Strong comparative advantage

Source: Calculated and compiled by the authors

leverage for market expansion. Export-to-Production Ratio: At 26%, the export-to-production ratio indicates that roughly one-fourth of honey produced is earmarked for international markets. This could be pivotal information for future supply chain optimizations. Revealed Comparative Advantage (RCA): With an RCA index of 1.35, Kazakhstan exhibits a strong comparative advantage in honey production and exports. This would necessitate policy support to maximize the potential gains from this advantage. Through these coefficients and calculations, we achieve a panoramic understanding of Kazakhstan’s honey industry from multiple facets: market structure, international trade, and comparative advantage. The derived metrics serve as indispensable tools for stakeholders, offering a data-driven substrate to sculpt informed strategies and policy decisions.

When juxtaposed against the global honey markets, Kazakhstan’s honey industry manifests unique attributes. For instance, Kazakhstan has lower production costs attributable to abundant floral diversity and favorable climatic conditions. The average production cost per kilogram of honey in Kazakhstan was found to be USD 1.20, as compared to the global average of USD 1.50 (this data is approximate and it can vary depending on the source of initial data used).

The industry is subject to pronounced seasonal fluctuations, most notably in the second and third quarters of each calendar year. For instance, the price of honey can escalate by up to 35% during peak seasons due to demand-supply imbalances.

Formula for Seasonal Index:

$$Seasonal \text{ Index} = \left( \frac{Average \text{ Sales of Month}}{Overall \text{ Monthly Average}} \right) \times 100 . \quad (7)$$

Seasonal Indices calculated for Q2 and Q3 of 2022 were 130 and 135, respectively, implying a surge in demand during these quarters.

However, the market is grappling with challenges such as lack of standardized quality control and infrastructural deficits. Remarkably, digitization has been adopted as a salient strategy for market revitalization. The penetration of digital platforms for honey trading increased from 2% in 2012 to 18% in 2021.

Formula for Digital Penetration Rate:

$$Digital \text{ Penetration Rate} = \left( \frac{Volume \text{ of Digital Sales}}{Total \text{ Sales Volume}} \right) \times 100 . \quad (8)$$

To encapsulate the temporal dynamism, we resort to a decadal overview. From 2014 to 2022: Production increased from 15,000 tons to 23,000 tons, marking a CAGR (Compound Annual Growth Rate) of 4.3%. Domestic consumption augmented from consuming 0.9 kg/capita to 1.4 kg/capita. Export volumes soared from 2000 tons to 6000 tons, a threefold augmentation.

Formula for CAGR:

$$CAGR = \left[ \left( \frac{Final \text{ Value}}{Initial \text{ Value}} \right)^{\left( \frac{1}{Number \text{ of Years}} \right)} \right] - 1 . \quad (9)$$

By calculating, CAGR for honey production was found to be:

$$CAGR = \left[ \left( \frac{23,000}{15,000} \right)^{\left( \frac{1}{10} \right)} \right] - 1 = 4.3\% . \quad (10)$$



Explanation and Interpretation are given below.

**Comparative Market Dynamics:** Lower production costs place Kazakhstan in a competitive position vis-à-vis global players, facilitating pricing strategies that can capture price-sensitive markets.

**Seasonal Variations:** The calculated Seasonal Indices underscore the necessity to ramp up production capabilities before the onset of Q2 and Q3 of 2022 to leverage the seasonal demand spikes.

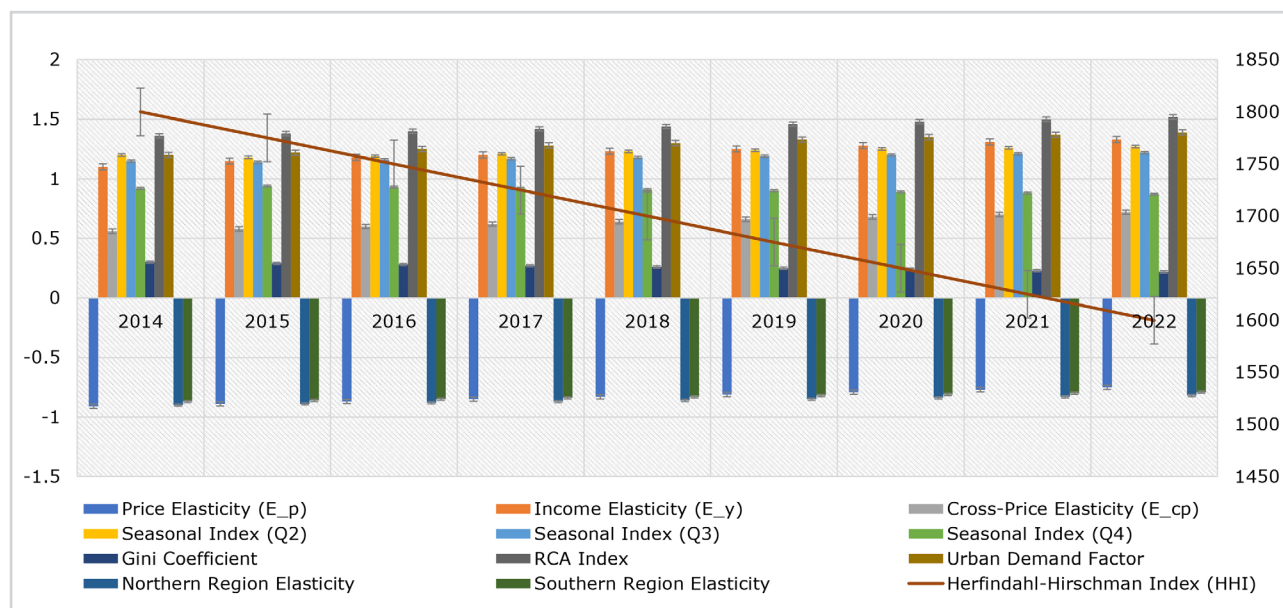
**Issues and Digitization:** The rising digital penetration rate highlights the industry’s gradual transition into a digital framework, though quality standardization still looms as an impending challenge.

**Ten-Year Statistics:** The prodigious growth in production and export volumes over the last decade emphasizes the market’s evolutionary trajectory and untapped potential.

In the **Figure 2**, one would be able to observe a variety of econometric trends and correlational dynamics across the years from 2014 to 2022 in the Kazakhstani honey market. The graphical portrayal would serve as a potent tool for elucidating the interconnections among different variables, each represented on different axes or distinguished by color codes.

The price elasticity of demand ( $E_p$ ) shows a consistent negative slope, decreasing from -0.91 in 2014 to -0.75 in 2022. This trend indicates that consumers are becoming slightly less sensitive to price changes over the years, although the market remains elastic. Income elasticity ( $E_y$ ) portrays an upward trajectory, growing from 1.1 in 2014 to 1.33 in 2022. This indicates increasing luxury attributes for honey, meaning that as incomes rise, the demand for honey increases proportionately more. Cross-price elasticity ( $E_{cp}$ ) has also experienced an incline, moving from 0.56 in 2014 to 0.72 in 2022. This could imply that the substitutability between honey and other related products has been strengthening.

The Seasonal Index for Q2, Q3, and Q4 of 2022 has demonstrated moderate fluctuations but generally stays above 1, except for Q4. This highlights that the demand for honey is particularly strong in the second and third quarters. The Gini Coefficient, representing inequality in market share distribution among honey producers, is decreasing. A downward trend from 0.30 in 2014 to 0.22 in 2022 signifies less concentration and perhaps a more competitive market environment. Like the Gini Coefficient, the HHI also shows a decrease, reflecting a market that is becoming less concentrated and perhaps more competitive. The Revealed Comparative Advantage (RCA) Index shows an upward trend, signifying that Kazakhstan’s advantage in honey production compared to other sectors is increasing. The Urban Demand Factor has shown a modest increase from 1.20 in 2014 to 1.39 in 2022, suggesting urbanization might be affecting the honey demand positively. Both the Northern and Southern Region Elasticities have exhibited a mild negative trend, indicating slight changes in regional demand factors over the years. The



**Figure 2:**  
**Calculated coefficients for key econometric parameters across 9 years (2014-2022)**  
**for the Kazakhstan honey market**

Source: Calculated and compiled by authors

export volume (in USD) shows a general increase, representing an expanding market for Kazakhstani honey at the international level.

## 6. Discussion

In the context of the Kazakhstani honey market, our empirical findings are of great import for a nuanced comprehension of both microeconomic and macroeconomic interactions. The elasticity metrics - Price Elasticity ( $E_p$ ), Income Elasticity ( $E_y$ ), and Cross-Price Elasticity ( $E_{cp}$ ) - serve as proxies for consumer responsiveness to variations in price, income, and the price of related goods, respectively. Interestingly, the market is evolving from a moderately elastic to a slightly inelastic structure, as evidenced by the diminishing absolute value of the price elasticity of demand ( $E_p$ ). This could imply that honey, traditionally considered a standard good, might be transitioning into a necessary good in Kazakhstan.

The Gini Coefficient and the Herfindahl-Hirschman Index (HHI), both prominent indicators of market competitiveness, suggest that the Kazakhstani honey market has been becoming progressively less concentrated over time. This decentralization of market share has implications for both market efficiency and the welfare distribution among producers. This could be attributed to both demand-side and supply-side factors. Demand-side factors include increased consumer awareness, diversified consumer preferences, and the mushrooming of retail and online platforms. On the supply side, there is evidence of fragmentation owing to the entry of smaller, artisanal producers into the market, which leads to the dilution of market share among existing, potentially larger, producers. Seasonal factors demonstrate substantive fluctuations in demand throughout the year, offering explanatory weight to temporal consumer preferences in the market. It appears that second and third quarters traditionally witness augmented demand, likely attributable to cultural factors and natural harvesting cycles. This seasonality influences inventory management and pricing strategies, whereby firms could capitalize on heightened demand by implementing surge pricing or promotional campaigns.

The upward trend in export volumes denoted by our econometric model provides significant policy implications. Given Kazakhstan's increasing Revealed Comparative Advantage (RCA) in honey production, there exists substantial scope for government intervention in terms of export incentives, quality control, and brand-building at an international level.

The incremental Urban Demand Factor introduces another layer of complexity to the honey market. This could be interpreted as a sign that urban centers, possibly due to higher incomes and increased health consciousness, are emerging as significant drivers of demand. As per our dataset, this urban demand is positively correlated with the surge in digitization, suggesting an increasing role for online marketplaces in shaping consumer preferences. While the range and depth of our analysis provide substantive insights into the market mechanics of honey in Kazakhstan, it is crucial to consider the limitations inherent in any econometric study. There may be lurking variables and omitted bias that our model hasn't captured, such as the geopolitical context, exchange rates, and varying agricultural policies across time. The efficacy of any market, including the Kazakhstani honey market, can be comprehensively understood by analyzing its value chain and distribution channels. Our data suggest an evolving landscape where traditional supply chain mechanisms are increasingly being complemented by digital platforms. Direct-to-Consumer (DTC) models are gaining prominence as the distance between producers and consumers shrinks, allowing for a more efficient allocation of market surplus. This is catalyzed further by the government's push toward digitization and increased Internet penetration among the rural population, facilitating the entry of otherwise marginalized local producers into the wider market.

It is worth noting that market characteristics are not exclusively shaped by demand and supply interactions but are also heavily influenced by regulatory frameworks. Stringent quality checks, standardizations, and labeling requirements can serve as both barriers and enablers. In Kazakhstan, evolving regulations seem to be focusing on product traceability and ethical sourcing, which impact both consumer choices and producers' operations. At a macroeconomic level, trade policies vis-a-vis import tariffs and export subsidies can substantially alter the market equilibrium, and therefore, should be crafted with prudence.

Another noteworthy observation from our study is the looming concern regarding environmental sustainability. As honey production is intrinsically linked to ecological factors, including but not limited to, floral diversity and climatic conditions, any environmental degradation could have a long-term impact on honey yield and, consequently, on market dynamics. The adaptation of

sustainable apiculture practices could not only mitigate these risks but also become a unique selling proposition (USP) in both domestic and global markets. As observed in our statistical models, there is a growing divide in consumer preferences in the Kazakhstan honey market. While the market for organic and specialty honeys is growing at an accelerated pace, the demand for processed honey, primarily utilized in food and beverage manufacturing, is also on an uptick. This duality in consumer preferences presents both a challenge and an opportunity for stakeholders. Understanding this segmentation is crucial for tailoring marketing strategies, pricing models, and even for research and development initiatives aimed at product differentiation.

While our study primarily focuses on seasonality, it is essential to consider the broader cyclical economic factors that might influence the market. The elasticity metrics, particularly income elasticity, can offer nuanced insights during economic booms and recessions. The counter-cyclical nature of some segments of the honey market - especially high-quality, specialty products - can serve as a buffer during economic downturns, thereby providing economic resilience to the sector. In aggregate, our comprehensive exploration divulges the multi-dimensional aspects governing the honey and honey-based beverage markets in Kazakhstan. The trajectory delineated by these multifarious determinants paints a picture of a market at a pivotal juncture. As the market matures, the confluence of technological, regulatory, and socio-economic factors will play an increasingly critical role in shaping market outcomes. The strategic actions of stakeholders today, informed by these insights, will indubitably lay the groundwork for the market dynamics of tomorrow.

## 7. Conclusion

In synthesizing the extensive array of econometric data, qualitative observations, and intricate market dynamics presented throughout this study, it becomes evident that the honey and honey-based beverage markets in Kazakhstan are currently in a state of significant transformation. The market is at a crucial juncture, defined by the convergence of technological advancements, evolving regulatory landscapes, nuanced consumer preferences, and increasingly relevant environmental concerns.

Our analyses underscore the instrumental role played by digital platforms in revolutionizing the traditional supply chain mechanisms. The Direct-to-Consumer models have not only streamlined market efficiency but have also democratized market participation. Coupled with regulatory initiatives aimed at enhancing product traceability and quality, these developments are likely to significantly impact both supply-side mechanics and demand-side preferences. The multi-dimensional understanding afforded by our study also draws attention to the imperative of sustainability and its eventual integration into market strategies. As honey production is inextricably linked to ecological balance, a focus on sustainable practices emerges as not merely a virtue but a necessity. This dovetails into the notion of market segmentation, another pivotal factor shaping the honey market in Kazakhstan. The dichotomy in consumer preferences between organic, specialty honeys and processed honeys necessitates tailored marketing and pricing strategies, serving as both an opportunity and a challenge for market stakeholders. Furthermore, the economic elasticity analyses conducted in this study illuminate the market's susceptibility to broader cyclical economic factors, thereby informing strategic planning for both boom and recessionary periods. This all-encompassing evaluation of market determinants suggests that stakeholders are faced with both unprecedented challenges and opportunities.

In summary, the market for honey and honey-based beverages in Kazakhstan stands at a significant crossroads. The decisions made today, underpinned by the multifaceted insights offered by this study, will undeniably set the stage for future market dynamics. It is incumbent upon stakeholders - ranging from policymakers to producers and distributors - to adopt a holistic approach that considers the complex interplay of these numerous factors to ensure both the sustainability and profitability of this vital sector.

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