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Kazakhstan Economy Sustainable Development:Trade Dynamics Impact

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ABSTRACT

The relevance of this study is underscored by the critical role of foreign trade in Kazakhstan's national economy, particularly in agricultural and livestock products. This research aims to comprehensively analyze the relationship between exported and imported agricultural and livestock product quantities and their respective USD values. The methodology employed includes regression analysis of Kazakhstan's trade data spanning from 2018 to 2022, focusing on evaluating these relationships' statistical significance and strength. This study's main findings underscore the audience's crucial role in implementing the study's recommendations. Import and export volumes have a profound impact, with particularly strong effects observed in the food and livestock sectors. While the export volumes of agricultural products do not significantly influence their trade values, import volumes exhibit a strong correlation. These insights emphasize the necessity for the audience's involvement in multifaceted approaches in trade policy and strategy development to foster sustainable economic growth in Kazakhstan. The study's recommendations for revising and optimizing trade strategies can enhance the efficiency and resilience of the national economy, improve policy-making and economic planning, and leverage these insights better to understand the dynamics of Kazakhstan's trade activities. The findings advocate for strategic investments in trade infrastructure, diversification of the export base, and fostering an attractive investment climate to leverage the benefits of increased trade turnover for sustainable economic development. This comprehensive approach will ensure Kazakhstan's robust integration into the global market, fostering long-term economic resilience and growth.

KEYWORDS: Sustainable Development, Economy, Import, Trade, Kazakhstan

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1. INTRODUCTION

Globally, trade is a vital component of economic development, serving as a primary engine of growth for both developed and developing nations. The exchange of goods and services across borders enables countries to access resources that are scarce domestically, optimize production efficiency, and stimulate innovation and technological advancement. Exports bring in foreign exchange, boost national income, and create jobs, while imports provide consumers and businesses with a broader range of products and services, fostering competition and lowering prices. In an increasingly interconnected world, the health of a nation's economy is closely tied to its ability to engage effectively in global trade.

Kazakhstan, a major Central Asian player, holds a significant position in global trade. According to the World Trade Organization (WTO), Kazakhstan ranks among the top 60 countries worldwide regarding export volume. The country is rich in natural resources, with substantial oil, metals, and agricultural exports. The importance of trade, both imports and exports, cannot be overstated for the national economy, as it influences economic growth, employment, and overall development. Understanding trade dynamics is crucial for policymaking, strategic economic planning, and sustaining growth in an increasingly competitive global market.

International trade plays a crucial role in the global economy. Leaders in export and import, such as China, the USA, Germany, Japan, and South Korea, significantly influence global trade flows. China is the largest exporter and importer, leading in trade volumes of goods and services. The USA follows in second place, while Germany is third, specializing in high-tech goods and automobiles. Japan and South Korea are also prominent due to their strong positions in technology and industrial production.

Kazakhstan's ties with these nations are vital for its economy. China is one of Kazakhstan's largest trading partners, importing oil, metals, and agricultural products, and exporting machinery, equipment, and consumer goods. The USA is crucial for energy and metal exports. Trade with Germany, Japan, and South Korea involves importing high-tech products and industrial equipment, aiding in the modernization of Kazakhstan's industry.

These connections boost Kazakhstan's export growth, attract investments, and develop key sectors, highlighting the importance of its integration into the global economy and strengthening trade relations with world leaders.

Import and export activities are vital to Kazakhstan's economic development. Exports bring in foreign currency, improve the trade balance, and stimulate local production, while imports provide access to essential goods and services that may not be available domestically. This trade balance impacts the country's overall economic health, affecting inflation rates, employment levels, and GDP growth. Effective trade policies can help Kazakhstan leverage its resources, enhance its global market presence, and attract foreign investments, contributing significantly to sustainable economic development.

The primary objective of this research is to comprehensively analyze the relationship between the quantities of agricultural and livestock products traded (both exports and imports) and their respective USD values. This involves investigating how variations in trade volumes influence the economic value of these products, thereby providing insights into the critical factors that determine trade values in

Kazakhstan. The study aims to inform and enhance trade policies by understanding these dynamics, contributing to sustainable economic development and strategic economic planning in Kazakhstan.

2. LITERATURE REVIEW

The agricultural and livestock sectors play a significant role in Kazakhstan's economy, contributing to national income, employment, and trade balances. Various studies have highlighted the importance of these sectors and examined the factors influencing their economic impact on export and import activities.

Some studies showed that logistics and transport costs are crucial in international trade. Gani (2017) focused on the logistics performance effect in international trade and revealed that improvements in logistics infrastructure, customs efficiency, and transport services significantly enhance trade volumes. Lun et al. (2016) analyzed the economic impact of transport complex economies and highlighted that well-developed transport systems reduce transportation costs and improve logistics operations, stimulating international trade. Both Gani (2017) and Lun et al. (2016) emphasize the importance of logistics performance and transport systems in enhancing trade. Nordås and Rouzet (2017) studied the impact of services trade restrictiveness on trade flows and found that reducing regulatory barriers leads to a significant increase in trade volumes. Nordås and Rouzet (2017) focused on regulatory barriers in the services sector, providing a complementary perspective on trade facilitation. Martínez-Zarzoso et al. (2003) examined the determinants of transport costs in the Spanish ceramic sector and demonstrated that infrastructure improvements can significantly reduce transport costs and boost trade activities. Martínez-Zarzoso et al. (2003) provide a detailed quantitative analysis of transport costs, reinforcing the importance of infrastructure in reducing trade barriers.

Majority of studies demonstrated the importance of integrating economic and regulatory perspectives to develop comprehensive strategies for enhancing the sustainability and resilience of agricultural systems and trade networks (Fiksel, 2006; Borsellino et al., 2020). In examining the impact of agricultural and livestock products on the national economy, Enahoro et al. (2014) focused on the economic impacts of livestock trade and revealed that it significantly boosts the economies of developing countries by increasing income and employment opportunities. Verburg et al. (2009) studied the effects of livestock agriculture on land use and emphasized the trade-offs between economic benefits and environmental sustainability, advocating for balanced approaches that consider both economic and ecological outcomes. Ercsey-Ravasz et al. (2012) analyzed the complexity of the international agro-food trade network and its impact on food safety. Using network analysis, they identified critical nodes and pathways in global food trade, highlighting how these networks can facilitate the spread of contaminants but also improve food safety through better regulation and monitoring. Smith and Swain (2010), Meyers et al. (2012) and Rogachev, et al. (2015) examined the economic mechanisms for managing food security within the "production-consumption-import" system in Russia. They used indicators such as food production, consumption norms, and food imports to assess the state of food security and concluded that Russia suffers from chronic food shortages and high import dependence. They suggest that forming agricultural clusters and growth poles can enhance food security by improving local agricultural production. Popescu (2022) investigated the importance of production and import for food security in Romania from 2015 to 2020 and found that although production increased for some products like fruits and meat, imports were still necessary to meet market needs. Romania relies on imports due to insufficient domestic production, especially for fish and sugar. Mancini et al. (2023) found that the export and import of food products affect the social sustainability of food systems. Social

issues are most acute in products such as rice, fruits, vegetables, and livestock products, primarily in India, Argentina, and other non-EU countries.

Other studies employed forecasting methods, in analyzing trade dynamics and can be effectively applied across various analytical approaches, making forecasting a versatile and essential tool in this field. Recent methodologies in trade analysis have brought significant advancements. Wang and Lee (2012) used fuzzy time-series models to outperform traditional ARIMA models in short-term forecasting of Taiwanese exports, demonstrating higher accuracy. Similarly, Xiao, Gong, and Zou (2009) applied fuzzy soft sets combined with forecasting accuracy criteria to enhance predictions for the Chongqing Municipality, showing robustness in specific datasets.

Veenstra and Haralambides (2001) employed multivariate autoregressive time-series models to minimize forecast errors for long-term seaborne trade estimations, using key commodity markets as independent variables. In another study, Lu et al. (2020) utilized machine learning techniques, including CEEMDAN for data denoising, to predict carbon trading volumes and prices in China, highlighting the versatility of these methods.

Overall, forecasting methods, whether traditional or modern, provide valuable insights into trade dynamics and can be effectively applied across various analytical approaches, making forecasting a comprehensive and essential tool in this field.

3. METHODOLOGY

Export and import activities are vital components of a nation's economy, driving economic growth, employment, and technological advancement. They facilitate access to foreign markets, allowing countries to capitalize on their comparative advantages. mports bring necessary goods and services that may not be available domestically, thus supporting local industries and consumer needs. The balance between export and import values significantly impacts the trade balance, influencing national economic stability and growth. A thorough literature review was conducted to identify the key indicators influencing export and import values.

The data preparation process involved several key steps. Data collection involved compiling data about export and import quantities and values expressed in USD across various product categories, including crop production, food products, livestock production, and services. Data cleaning involved the elimination of duplicate entries, the management of missing values, and the assurance of data consistency. The normalization step included converting all data values into a uniform format for precise comparison and analysis. Finally, the data were summarized by year and product category to facilitate the analysis of trends over time.

The indicators are provided as a regression tree to give a clear picture of selected data justification in Figure 1.

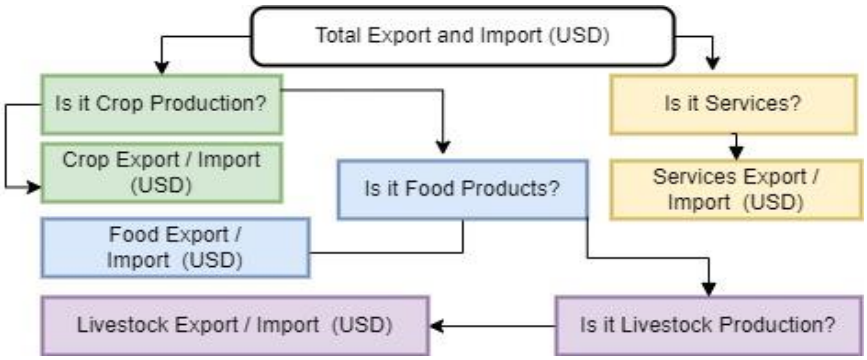

FIGURE 1. Indicators of the research

Note: complied by authors

The chosen indicators in the regression tree diagram are selected to clearly understand the USD values of exports and imports, considering both the volume of goods and services and their monetary value. The diagram categorizes the total export and import values (USD) into four segments: crop production, food products, livestock production, and services. The primary node represents the total export and import values in USD, summarizing the overall economic impact of trade. From this primary node, the tree branches into crop production or services, distinguishing between tangible goods and intangible services.

The "Is it Crop Production?" branch leads to crop exports and imports (USD). Crop production, measured in tons and USD, represents agricultural trade, which is crucial for food security and economic stability.

The "Is it Food Products?" branch splits into food exports and imports (USD). This category includes processed food items, which are essential for understanding consumable trade and how they affect market prices and supply chains.

The "Is it Livestock Production?" branch leads to livestock exports and imports (USD). Livestock production covers animal products, impacting domestic consumption and export markets, food security, and rural livelihoods.

The "Is it Services?" branch directs to services export and import values (USD). The services sector, including transportation, financial services, and IT, contributes to GDP and employment in the global economy.

Each node in the regression tree is justified by its role in providing a detailed view of trade. The correlation and regression analyses validate these indicators, showing their relationships. The dependent variable is the USD value of exports and imports. In contrast, the independent variables include the quantities of goods (in tons) exported and imported and factors like commodity prices and global economic conditions.

Overall, the chosen indicators and their relationships in the regression tree offer a framework for analyzing trade values and understanding the factors driving economic activity in international trade.

Correlation and Regression Analysis. A correlation and regression analysis were conducted to understand the indicators' relationships further. Dependent Variable (The USD value of exports and imports). Independent Variables (The quantity of goods (tons) exported and imported, along with other factors such as commodity prices and global economic conditions). The correlation analysis provided insights into the strength and direction of the relationships between the variables. In contrast, the regression analysis quantified the impact of the independent variables on the dependent variable.

We focused on data from 2018 to 2022 to capture recent and relevant trends in Kazakhstan's livestock and crop production, as well as export and import of services. This period provides the most current information, reflecting the latest economic developments and ensuring data consistency for accurate analysis. Livestock and crop production data from 2018 onward offer a comprehensive view of the agricultural sector's performance. Export and import data for services up to 2022 provide insights into the increasingly significant services sector, including transport, travel, and business services. The selected period encompasses significant events, such as the COVID-19 pandemic, which affected global trade dynamics. Analyzing this timeframe helps us understand the impact of these events on Kazakhstan's trade patterns. Using a consistent data period ensures comparability across sectors, crucial for accurate regression analysis and forecasting. Standardizing the timeframe to 2018-2022 maintains the integrity and reliability of the analysis.

4. FINDINGS AND DISCUSSION

The analysis of Kazakhstan's foreign trade from 2018 to 2022 revealed significant trends and relationships between the volumes of exported and imported agricultural and livestock products and their respective USD values. The data indicates a steadily increasing trade turnover, positively contributing to the national economy. While export volumes do not significantly impact their trade values, import volumes exhibit a strong correlation. These findings highlight the necessity for further development and optimization of trade strategies to foster sustainable economic growth in Kazakhstan.

In Table 1, there is provided information on the foreign trade turnover in Kazakhstan for the period 2018-2022.

The foreign trade turnover (FTT) analysis reveals significant insights into the dynamics of trade activities over the period from 2018 to 2022.

TABLE 1. Foreign Trade Turnover Analysis

Indicator	2018	2019	2020	2021	2022	Moving Average
FTT (USD)	94 769.7	97 774.9	86 469.9	101 736.4	135 527.4	103 055.66
FTT (% to previous year)	121.3	103.2	88.4	117.7	133.2	112.76
FTT Export (USD)	61 111.2	58 065.6	47 540.8	60 321.0	84 593.1	62 726.34
FTT (% to previous year, export)	126.0	95.0	81.9	126.9	140.2	113.98
FTT Import (USD)	33 658.5	39 709.3	38 929.1	41 415.4	50 934.4	40 929.34
FTT (% to previous year, import)	113.7	118.0	96.4	106.4	123.0	111.50

Note: compiled by authors based on Bureau of National Statistics (2022)

The moving average of 103,055.66 USD indicates a consistent increase in foreign trade turnover, suggesting an overall expansion in trade activities that positively contributes to the national economy. The year-over-year percentage change in FTT, with a moving average of 112.76%, underscores a steady growth trend in trade turnover, highlighting the robustness and resilience of the trade sector.

Examining the export component, the moving average of 62,726.34 USD denotes a steady increase in export values, reflecting a growing demand for the country's exports. This trend is further supported by the export growth rate, with a moving average of 113.98%, indicating consistent expansion in export activities and underscoring their positive economic impact. Conversely, the import analysis shows a moving average of 40,929.34 USD, illustrating an upward trend in import values and indicating rising domestic demand for foreign goods. The import growth rate, with a moving average of 111.50%, further demonstrates steady growth in import values, reflecting a healthy and sustained demand for imports.

The data points to a robust trade sector, with export and import activities showing positive trends. The consistent year-over-year growth in both components underscores the expanding nature of trade activities, contributing positively to the national economy. This comprehensive analysis clearly indicates the sustained growth and resilience of the foreign trade sector, which plays a critical role in the country's economic landscape.

The crop production (CP) exports and imports analysis reveals significant trends and potential underlying factors influencing these movements. The moving average of 9,002,070.2 tons for CP exports indicates a declining trend in export quantities, which may be attributed to changing agricultural practices or external market conditions. However, the

increasing trend in the monetary value of CP exports, with a moving average of 2,220,311.1 USD, suggests that the value per unit of crop exports is rising, potentially due to higher prices or improvements in product quality.

In Table 2, there is provided information export and import of agricultural products in Kazakhstan for the period 2018-2022.

TABLE 2. Export and Import of Agricultural Products

Indicator	2018	2019	2020	2021	2022	Moving Average
CP (tons) Export	10 003 657.5	9 358 408.1	8 322 216.4	8 098 601.7	9 227 470.4	9 002 070.2
CP (USD) Export	1 850 005.4	1 994 459.6	1 950 023.7	2 236 820.9	3 070 245.9	2 220 311.1
Crop Production (tons) Import	1 401 774.7	1 709 015.2	2 198 915.9	3 025 265.4	3 889 346.2	2 444 063.5
CP (USD) Import	10 003 657.5	9 358 408.1	8 322 216.4	8 098 601.7	9 22 ,470.4	9 002 070.2
CP (tons) Export	1 850 005.4	1 994 459.6	1 950 023.7	2 236 820.9	3 070 245.9	2 220 311.1
Export FP (tons)	4 555 476.8	4 085 734.0	4 321 570.9	3 612 020.7	5 172 506.1	4 349 461.7
Export FP (USD)	1 366 156.3	1 344 648.6	1 505 903.5	1 517 083.5	2 583 626.5	1 663 083.7
Import FP (tons)	7 386 370.9	7 585 738.5	6 874 347.3	7 588 514.8	7 616 558.7	7 410 706.0
Import FP (USD)	3 094 577.2	3 335 768.3	3 442 773.8	4 030 605.3	4 779 944.4	3 736 733.8
LP, Export (tons)	95 068.8	115 483.5	55 018.2	101 906.7	74 083.6	88 712.2
LP, Export (USD)	108 114.8	180 213.0	81 842.8	153 968.6	176 002.6	140 828.4
LP, Import (tons)	68 473.7	98 042.1	9 396.9	99 180.6	85 405.6	89 499.8
LP, Import (USD)	189 221.5	295 093.5	272 669.0	304 115.8	287 750.4	269 370.0

Note: compiled by authors based on Bureau of National Statistics (2022)

In contrast, the import side presents a different scenario. The moving average of 2,444,063.5 tons for CP imports reflects a significant increase in import quantities, indicating a growing domestic demand for foreign crops. This increase is mirrored in the monetary value of these imports, with a moving average of 1,084,758.6 USD, pointing to a steady rise in the economic value of crop imports and aligning with the increased quantities.

For food products (FP), the export data shows a moving average of 4,349,461.7 tons, indicating fluctuations in export quantities likely driven by varying market demands. Despite these fluctuations, the value of FP exports shows a rising trend, with a moving average of 1,663,083.7 USD, which may be driven by increased prices or the export of higher-value products. On the import side, the stable quantities of FP imports, with a moving average of 7,410,706.0 tons, suggest consistent demand. The upward trend in the value of these imports, reflected in a moving average of 3,736,733.8 USD, aligns with the stable quantities and potentially rising prices.

The analysis of livestock products (LP) reveals further complexities. The moving average of 88,712.2 tons for LP exports shows variability, indicating sensitivity to market conditions. Nonetheless, the increasing trend in export values, with a moving average of

140,828.4 USD, suggests that market demand and pricing drive these values upward. The moving average of 89,499.8 tons for LP imports indicates variability in import quantities, reflecting fluctuating demand. However, the steady increase in the monetary value of these imports, with a moving average of 269,370.0 USD, points to rising prices or increased demand.

In Table 3, there is provided information export and import of services in Kazakhstan for the period 2018-2022. The analysis of service exports and imports from 2018 to 2022 reveals significant insights into the stability and fluctuations within various service sectors.

TABLE 3. Export and Import of Services

Indicator	2018	2019	2020	2021	2022	Moving Average
Export (mln.USD)	7 319.9	7 745.3	5 032.0	5 886.9	7 922.7	6 781.36
Transport Services Export (mln. USD)	4 011.7	3 973.8	3 355.3	3 975.9	4 674.1	3 998.16
Passenger Services Export (mln. USD)	396.1	459.4	129.8	153.0	243.4	276.34
Cargo Services Export (mln. USD)	3 236.1	3 150.8	2 936.1	3 455.1	3 808.1	3 317.24
Other Services Export (mln. USD)	370.4	363.6	289.4	367.8	622.6	402.76
Telecommunication, Computer and Information Services Export (mln. USD)	122.5	129.9	143.4	175.8	470.3	208.38
Other Business Services Export (mln. USD)	461.9	512.3	422.2	422.0	570.0	477.68
Scientific and Technical Services Export (mln. USD)	5.5	7.0	21.3	13.3	11.8	11.78
Professional and Management Consulting Services Export (mln.USD)	118.0	144.7	124.0	135.4	175.0	139.42
Technical, Trade-related, and Other Business Services Export (mln. USD)	338.4	360.7	276.9	273.3	383.2	326.50
Import (mln.USD)	11 981.4	11 462.2	8 096.4	7 907.1	9 415.8	9 772.58
Transport Services Import (mln. USD)	2 103.2	2 502.0	2 138.9	1 967.7	2 705.3	2 283.42
Passenger Services Import (mln. USD)	165.3	192.2	35.4	56.5	87.3	107.34
Cargo Services Import (mln. USD)	1 552.5	1 867.8	1 851.1	1 679.3	2 297.2	1 849.58
Other Services Import (mln. USD)	375.0	442.0	252.4	231.8	320.7	324.38
Telecommunication, Computer and Information Services Import (mln. USD)	398.9	401.4	428.7	425.7	590.9	449.12
Other Business Services Import (mln. USD)	5 035.1	4 472.3	3 484.0	2 433.7	2 200.9	3 525.20
Scientific and Technical Services Import (mln. USD)	12.0	15.3	18.3	18.3	35.1	19.80
Professional and Management Consulting Services Import (mln. USD)	1 518.7	1 096.3	931.6	855.0	768.2	1 033.96
Technical, Trade-related, and Other Business Services Import (mln. USD)	3 504.3	3 360.7	2 534.1	1 560.5	1 397.7	2 471.46

Note: compiled by authors based on Bureau of National Statistics (2022)

The overall export value of services, with a moving average of 6,781.36 million USD, suggests a generally stable trend, albeit with slight fluctuations, indicating resilience in the service sector despite global challenges. Within this category, transport services show a consistent export value with a moving average of 3,998.16 million USD, reflecting steady demand in international logistics and transportation. Passenger services, however, displayed a sharp decline during 2020, with a moving average of 276.34 million USD, likely due to travel restrictions imposed during the COVID-19 pandemic. Still, a gradual recovery is evident after that. Cargo services maintain stable export values with a moving average of 3,317.24 million USD, indicating robustness in goods transportation.

The miscellaneous services, categorized as other services, show modest but stable growth, with a moving average of 402.76 million USD. Telecommunication, computer, and information services exports highlight growth in tech-related services, driven by increased digitalization, with an average of 208.38 million USD. Other business services, with a moving average of 477.68 million USD, demonstrate consistent export values, indicating steady demand for these services. Scientific and technical services, while low in volume with a moving average of 11.78 million USD, suggest niche but consistent activity. Professional and management consulting services maintain steady demand, reflected in a moving average of 139.42 million USD. Technical, trade-related, and other business services exhibit stable values with a moving average of 326.50 million USD, signifying consistent demand.

On the import side, the overall value of service imports, with a moving average of 9,772.58 million USD, suggests significant domestic demand for international services despite fluctuations. With a moving average of 2,283.42 million USD, transport services imports show variability but an overall high level of imports, indicating firm reliance on foreign transport services. Passenger services imports mirror global travel trends, with a significant drop in 2020 and a gradual recovery, reflected in a moving average of 107.34 million USD. Cargo services imports, maintaining stable values with a moving average of 1,849.58 million USD, indicate consistent demand for international cargo services.

Miscellaneous service imports, categorized as other services, show stable but modest growth with a moving average of 324.38 million USD. The telecommunication, computer, and information services sector shows growth in imports, driven by increasing reliance on digital services, with a moving average of 449.12 million USD. Other business services imports, with a high level of imports reflected in a moving average of 3,525.20 million USD, indicate domestic solid demand for these services. Scientific and technical services, while niche, show consistent imports with a moving average of 19.80 million USD. Professional and management consulting services imports maintain steady demand with an average of 1,033.96 million USD. Lastly, technical, trade-related, and other business services imports, with a moving average of 2,471.46 million USD, reflect consistent demand, signifying reliance on foreign expertise and services.

These observations highlight the service sector's resilience and dynamic nature in exports and imports, revealing underlying trends and economic factors that influence these trade activities. The stability in specific service categories and the fluctuations in others provide a comprehensive understanding of the service trade landscape over the analyzed period.

The actual versus fitted values for crop production, food products, and livestock production exports in USD are provided in Figure 2.

Crop Production Export: Actual vs Fitted. The regression plot for Crop Production Export shows a weak linear relationship, with the

actual values scattered around the fitted line. The regression line is nearly horizontal, indicating that changes in the quantity of crop exports (tons) do not significantly impact the USD value. The data points show considerable variability, suggesting that other factors, such as market prices, global demand, and possibly government policies, play a more substantial role in determining the export values. For instance, the data point at approximately 10 million tons corresponds to a higher USD value than expected, highlighting the influence of external factors.

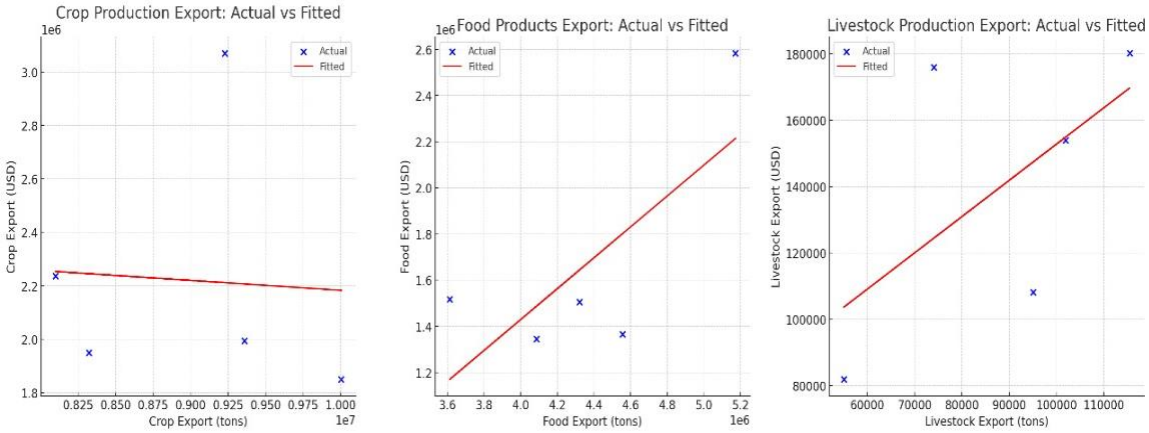

FIGURE 2. Regression Plots: Crop Production, Food Products and Livestock Production

Note: complied by authors based on calculations

Food Products Export: Actual vs Fitted. The regression plot for Food Products Export demonstrates a stronger linear relationship, with the actual values aligning more closely with the fitted line. The positive slope indicates that an increase in the quantity of food products exported (tons) is associated with an increase in the USD value. This relationship suggests that the export value of food products is more directly influenced by the quantity exported. For example, the highest data point at around 5.2 million tons corresponds to a high USD value, indicating that increased export volumes lead to higher export earnings.

Livestock Production Export: Actual vs Fitted. The regression plot for Livestock Production Export also shows a moderate linear relationship, with actual values closely following the fitted line. The positive slope indicates that an increase in the quantity of livestock exported (tons) results in a higher USD value. This suggests a strong dependency of livestock export values on the amount exported, with fewer external factors affecting this relationship. The data point at approximately 110,000 tons corresponds to the highest USD value, reinforcing the influence of export quantities on earnings.

The time series graphs in Figure 3 provide insights into trends and seasonal patterns for different categories.

Crop Production. The graph shows a declining trend in crop export quantities from approximately 10 million tons in 2018 to around 9 million tons in 2022, while the USD value of exports has steadily increased from about 1.85 million USD to over 3 million USD. This divergence suggests that the value per unit of crop exports has increased, possibly due to higher prices or improved quality. The import quantities and values show an upward trend, with imports rising from 1.4 million tons to nearly 4 million tons and the USD value increasing correspondingly, indicating growing domestic demand for foreign crops.

Food Products. The graph for food products shows fluctuating export quantities, with a peak in 2022 at around 5.2 million tons and a general upward trend in USD values from 1.36 million USD in 2018 to 2.58 million USD in 2022. This pattern suggests dynamic market conditions and changing consumer preferences. Import quantities remain relatively stable, around 7.4 to 7.6 million tons, while the USD value shows an upward trend, reflecting stable demand and possibly rising prices.

Livestock Production. The livestock production graph illustrates significant variability in export quantities and USD values, with a peak in 2019 at around 115,000 tons and corresponding fluctuations in USD values. This variability indicates sensitivity to market conditions and supply chain factors. Import quantities peak in 2020, followed by a decline, while the USD values remain relatively high, suggesting consistent demand despite quantity fluctuations.

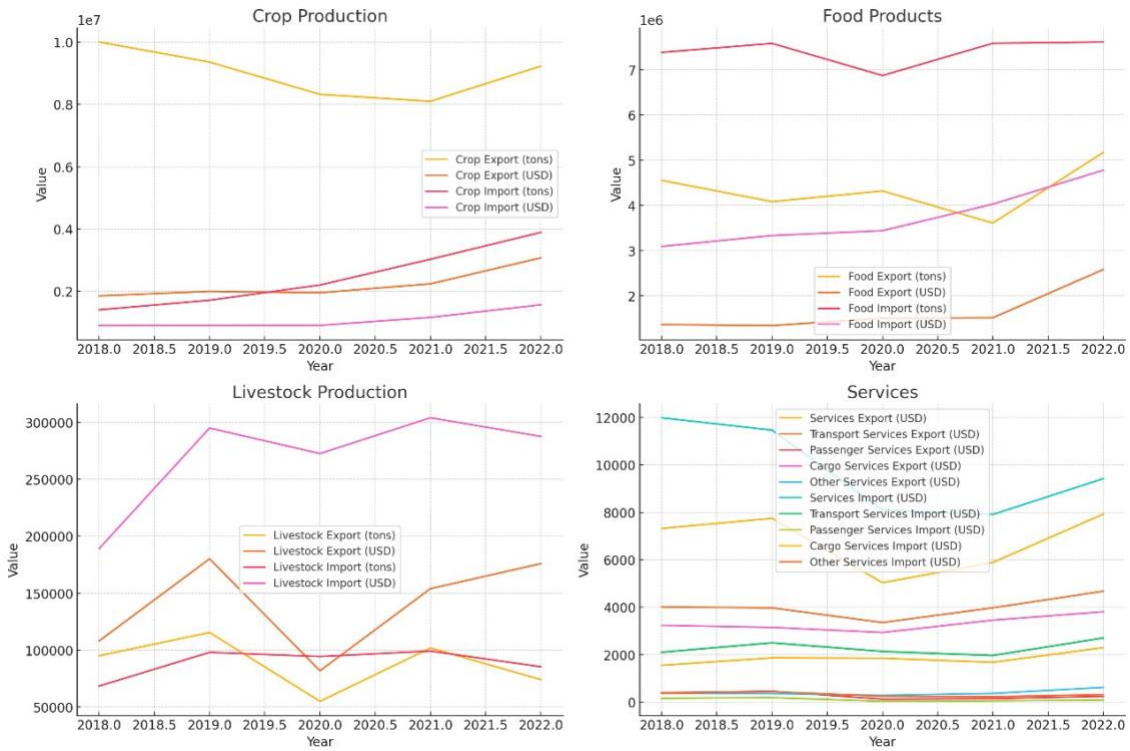

FIGURE 3. Time Series Trends: Crop Production, Food Products, Livestock Production, and Services

Note: complied by authors based on calculations

Services. The services graph shows a consistent increase in export values across different service categories, highlighting the growing importance of the service sector in the economy. For instance, the USD value of Transport Services Export remains around 4,000 to 4,600 million USD. At the same time, other services like Telecommunication and Computer Services show significant growth, with values rising from about 122 million USD in 2018 to 470 million USD in 2022. This trend underscores the increasing reliance on digital services and the global integration of the service economy. Import values also show an upward trend, particularly in Transport Services, reflecting strong domestic demand for international services.

The correlation matrix in Figure 4 provides insights into the relationships between various trade indicators. High correlations between

import and export values within the same category (e.g., Crop Import (tons) and Crop Import (USD)) indicate that the quantity of imports strongly influences the USD value. For instance, the correlation coefficient 0.95 between Crop Import (tons) and Crop Import (USD) suggests a nearly direct relationship, implying stable prices and demand. In contrast, weaker correlations between different categories (e.g., Crop Export (tons) and Food Export (USD)) suggest that other factors, such as market conditions and global demand, significantly influence trade values. The correlation of -0.06 between Crop Export (tons) and Crop Export (USD) highlights the weak relationship and the role of external factors. The strong positive correlations within the Services sector, such as 0.94 between Services Import (USD) and Transport Services Import (USD), emphasize the interconnectedness and consistent demand for these services.

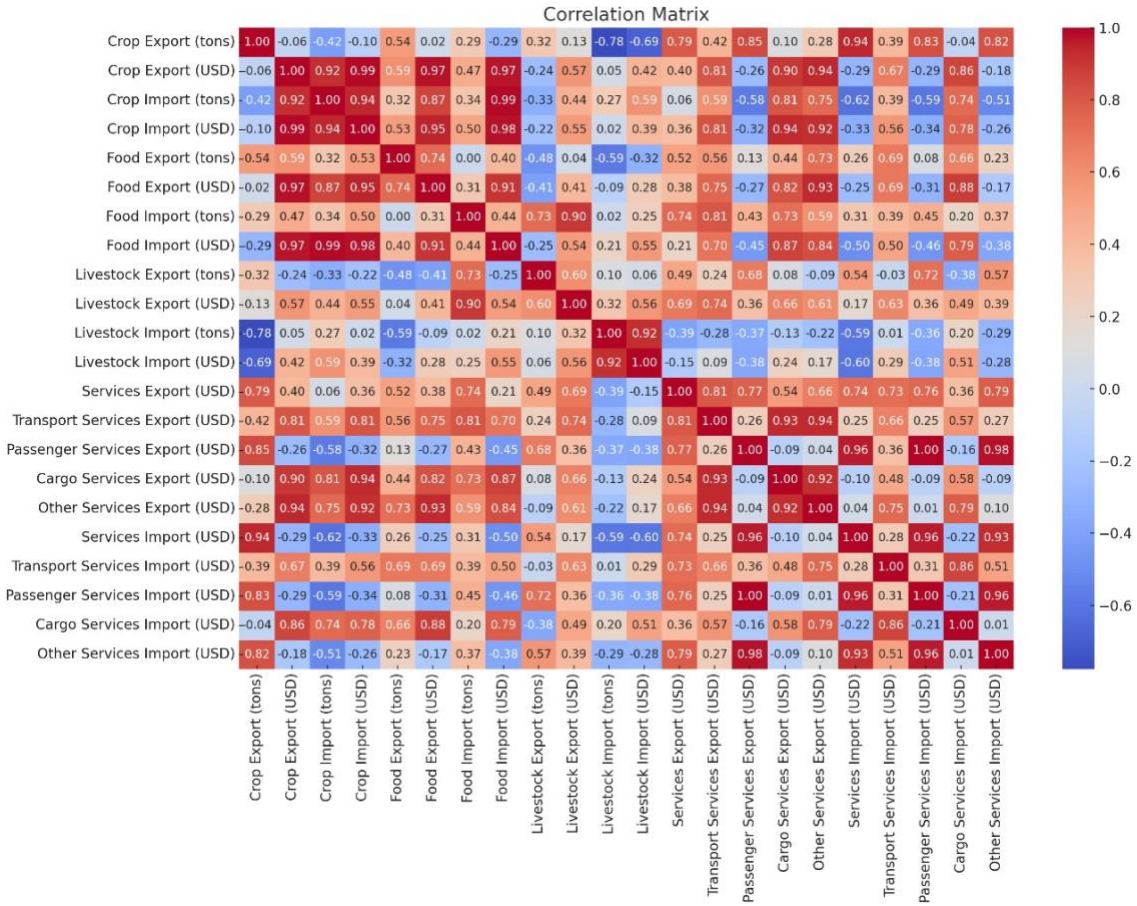

FIGURE 4. Correlation Matrix

Note: complied by authors based on calculations

The R-squared value of 0.003 indicates a fragile relationship for crop production, with only 0.3% of the variance in crop export value explained by the quantity exported. The adjusted R-squared of -0.329 and a p-value of 0.926 further confirm the model's poor fit and lack of statistical significance. The coefficient of -0.0176 suggests a negligible and insignificant decrease in USD value with an increase in tons. The intercept of 2,553,000

USD, representing the expected export value when quantity is zero, lacks practical significance.

The regression analysis of crop production, food products, and livestock production exports in Table 4 reveals critical insights into the relationships between the quantities exported and their respective USD values.

TABLE 4. Regression analysis of crop production, food products, and livestock production exports

Category	R-squared	Adjusted R-squared	P-value	Coefficient (tons)	Intercept
Crop Production	0.003	-0.329	0.926	-0.0176	2 553,000
Food Products	0.283	-0.009	0.395	0.1748	1 112,000
Livestock Production	0.363	0.150	0.283	1.0927	43 530

Note: complied by authors based on calculations

An R-squared value of 0.283 shows a moderate relationship for food products, with 28.3% of the variance in USD value explained by the quantity exported. However, the adjusted R-squared of -0.009 and a p-value of 0.395 indicate a poor fit and lack of statistical significance. The coefficient of 0.1748 suggests a slight increase in USD value per additional ton exported, though this relationship is not statistically significant. The intercept of 1,112,000 USD is not practically meaningful. In livestock production, the R-squared value of 0.363 indicates a stronger relationship, with 36.3% of the variance in USD value explained by the quantity exported. The adjusted R-squared of 0.150 suggests a reasonable fit but leaves significant unexplained variance. Despite a p-value of 0.283 indicating non-significance, the coefficient of 1.0927 suggests a meaningful increase in USD value per additional ton exported. The intercept of 43,530 USD is also not practically significant.

Overall, crop production shows a fragile and insignificant relationship between quantity and export value, suggesting other factors are more important. Food products exhibit a moderate but insignificant relationship. Livestock production shows a stronger relationship, implying that export quantities are more critical in determining USD values for this category. These results highlight the need to consider multiple factors in trade analysis to understand the economic dynamics accurately.

The regression analysis of crop production, food products, and livestock production imports in Table 5 reveals strong relationships between the quantities imported and their respective USD values.

TABLE 5. Regression analysis of crop production, food products, and livestock production imports

Category	R-squared	Adjusted R-squared	P-value	Coefficient (tons)	Intercept
Crop Production	0.888	0.850	0.016	0.348	56 377.68
Food Products	0.970	0.960	0.002	0.616	5 179.80
Livestock Production	0.954	0.938	0.003	2.592	-104 350.88

Note: complied by authors based on calculations

The R-squared value of 0.888 indicates a strong relationship for crop production imports, with 88.8% of the variance in crop import value explained by the quantity imported. The adjusted R-squared of 0.850 confirms a robust model fit, slightly adjusted for the number of

predictors. The low p-value of 0.016 suggests that the regression model is statistically significant. The coefficient of 0.348 indicates a positive relationship, where each additional ton imported increases the USD value by approximately 0.348 USD. The intercept of 56,377.68 USD represents the expected import value when the quantity is zero, though this figure may have limited practical significance.

An R-squared value of 0.970 demonstrates a strong relationship for food product imports, with 97.0% of the USD value variance explained by the imported quantity. The adjusted R-squared of 0.960 reflects a robust model fit even after accounting for the number of predictors. The very low p-value of 0.002 indicates that the regression model is highly statistically significant. The coefficient of 0.616 suggests a positive relationship, with each additional ton imported increasing the USD value by approximately 0.616 USD. The intercept of 5,179.80 USD is practically meaningful as a baseline value for food product imports when the quantity is zero.

The R-squared value of 0.954 shows a solid relationship for livestock production imports, with 95.4% of the variance in USD value explained by the quantity imported. The adjusted R-squared of 0.938 indicates a strong model fit after adjusting for the number of predictors. The low p-value of 0.003 signifies that the regression model is statistically significant. The coefficient of 2.592 implies a strong positive relationship, with each additional ton imported increasing the USD value by approximately 2.592 USD. The intercept of -104,350.88 USD might indicate baseline cost adjustments or initial fixed costs when the quantity imported is zero.

In conclusion, the regression analysis for imports demonstrates strong and statistically significant relationships across all categories. Crop production and food products imports show high R-squared values, indicating that the quantity imported significantly influences the USD value. Livestock production imports exhibit the highest coefficient, suggesting a substantial impact of quantity on the USD value. These insights underscore the critical role of import quantities in determining trade values and highlight the importance of understanding these dynamics for economic policy and trade strategy development.

Trade is vital to Kazakhstan's economy, significantly contributing to GDP, employment, and economic stability. Accurate forecasts are essential for strategic planning and policy formulation, helping to optimize resources and enhance trade infrastructure (Figure 5).

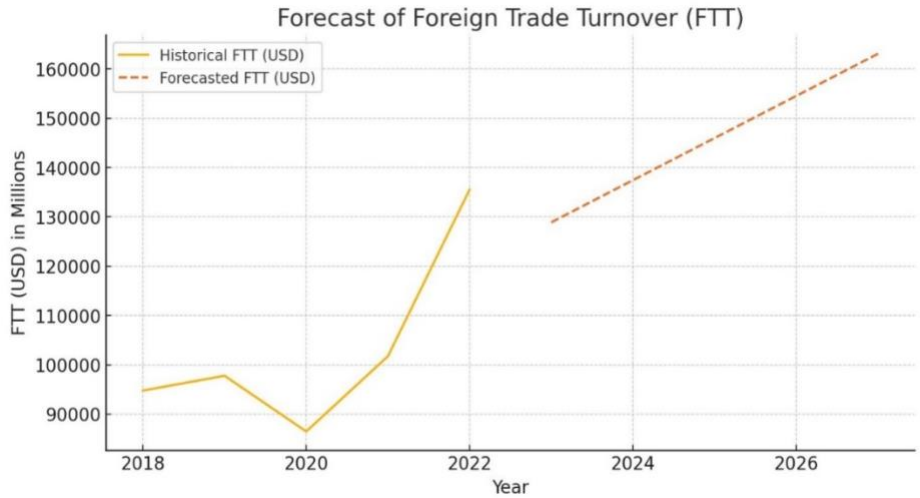

FIGURE 5. Forecast of foreign trade turnover

Note: complied by authors based on calculations

The linear regression model forecasts a steady increase in Kazakhstan's Foreign Trade Turnover over the next five years. This positive trend suggests a continued expansion of trade activities, which holds significant implications for the national economy.

The forecasted increase in FTT indicates that Kazakhstan's trade activities are expected to grow steadily. This growth is likely driven by rising export volumes and increasing import demands. Such an expansion can enhance Kazakhstan's position in global trade, particularly in the sectors with a competitive advantage, such as oil, metals, and agricultural products.

The projected growth in FTT is a positive signal for the national economy. Increased trade turnover can lead to higher export revenues, improving the trade balance and strengthening the national currency. Moreover, higher import values reflect a growing domestic market demand, which can stimulate local industries and consumer markets.

The forecasted data provide valuable insights for policymakers and economic planners. The anticipated growth in trade turnover suggests the need for strategic investments in trade infrastructure, such as ports, logistics, and transportation networks, to handle the increased volume efficiently. Additionally, there is a need to diversify the export base to reduce dependence on a few key sectors and to mitigate risks associated with global market fluctuations.

A growing FTT can contribute to a more favorable trade balance, provided that export growth outpaces import increases. This can enhance economic stability by reducing trade deficits and fostering a more resilient economy. Strategic efforts to promote value-added exports can further amplify these benefits, creating more jobs and boosting income levels within the country.

The optimistic forecast also indicates potential opportunities for both domestic and foreign investments. The growing trade volumes and the prospects of a thriving economy may attract investors. This can lead to new industries, technological advancements, and overall economic diversification, which are crucial for sustainable growth.

The forecasted increase in Kazakhstan's Foreign Trade Turnover from 2023 to 2027 underscores the importance of trade as a driver of economic growth. The steady upward trend suggests a robust and expanding trade sector, which can significantly contribute to the national economy. Policymakers and economic planners should leverage these insights to develop strategies that enhance trade infrastructure, diversify the export base, and attract investments. By doing so, Kazakhstan can maximize the benefits of increased trade turnover, leading to sustained economic development and improved living standards for its population.

5. CONCLUSIONS

The research aimed to evaluate the relationship between the quantities of exported and imported agricultural and livestock products and their respective USD values, with specific research hypotheses formulated to guide the analysis. The study achieved these aims and hypotheses, revealing significant insights into Kazakhstan's trade dynamics.

The findings indicate that while export volumes of agricultural products do not significantly influence their trade values, import volumes strongly correlate with USD values, especially in the food and livestock sectors. The forecasted growth in Foreign Trade Turnover (FTT) from 2023 to 2027 shows a steady increase, suggesting continued expansion in trade activities.

To accommodate the forecasted increase in trade activities, Kazakhstan should invest in upgrading its trade infrastructure, including ports, logistics, and transportation networks. Improved infrastructure will facilitate the efficient handling of higher trade volumes and support the seamless movement of goods.

Given the weak correlation between export volumes and trade values for agricultural products, there is a need to diversify the export base. Developing value-added products and

exploring new markets can reduce reliance on a few key sectors and enhance overall trade value.

The optimistic forecast for FTT suggests potential investment opportunities. Kazakhstan should create an attractive investment climate by offering incentives, reducing regulatory barriers, and ensuring political and economic stability to attract domestic and foreign investors.

Kazakhstan should promote environmentally sustainable trade practices to align with sustainable development goals. This includes encouraging the export of eco-friendly products, implementing green logistics solutions, and ensuring compliance with international environmental standards.

Investing in education and training programs to build a skilled workforce capable of supporting the expanding trade sector is essential. Enhanced human capital will improve productivity, innovation, and competitiveness in the global market.

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Software and supervisions: Berik Kadyrov.
Data collection, analysis and interpretation: Kadyrov Berik.
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