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ESTIMATION OF THE IMPACT OF MACROECONOMIC VARIABLES IN THE SHORT-TERM AND LONG-TERM ON THE VOLUME OF GOODS EXPORTS OF KAZAKHSTAN AND AZERBAIJAN

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A B S T R A C T

The author presents a study dedicated to a quantitative assessment of the influence of key macroeconomic factors on the dynamics of commodity export volumes in the Republic of Kazakhstan and the Republic of Azerbaijan. The article examines the problem of the high dependence of export earnings on commodity prices and external macroeconomic conditions, a topical issue for the national economy. The study aims to identify long-term and short-term relationships between commodity exports, total international reserves, the base rate, residents' income from foreign sources, and Brent crude oil prices. The article consistently presents methodological approaches to time series analysis, including stationarity testing, cointegration testing, evaluation of error correction models, and the construction of autoregressive moving average models of various orders. To analyze short-term reactions, an impulse response function is used to identify the nature of the reaction of commodity exports to macroeconomic shocks. The author finds that Brent crude oil prices are the most significant factor exerting a persistent influence on commodity exports in the long and short term for both countries. Total international reserves and the base rate exhibit a moderate impact, while the impact of residents' income from foreign sources is characterized by a short-term and statistically weak effect. The article concludes that commodity exports are highly sensitive to external shocks and confirms the feasibility of considering macroeconomic factors when formulating trade and currency policies. The results can be used to forecast export performance and assess the economy's resilience to fluctuations in the external environment.

Keywords: oil price; exports; total international reserves; income from foreign sources; interest rate; autoregressive integrated moving average; vector autoregression model; autoregressive distributed lag model.

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Introduction

The export dynamics of Kazakhstan and Azerbaijan are significantly dependent on fluctuations in global oil prices and other external macroeconomic factors, making their economies vulnerable to external shocks. Despite the availability of statistical data, descriptive analysis does not allow us to identify lag effects, the strength of the impact of macroeconomic variables, or the differences between short- and long-term relationships. The relevance of this study lies in the need to quantitatively assess these relationships using econometric models (ARIMA, VAR, ARDL). This provides a deeper understanding of the mechanisms by which oil prices, base rates, residents' income from foreign sources, and total international reserves influence the volume of Kazakhstan and Azerbaijan's exports, enabling more informed economic decisions to improve the resilience of the foreign trade sector.

Based on the identified relationship, key research questions were formulated to better understand the mechanisms by which various macroeconomic factors influence export performance:

1. What is the impact of macroeconomic factors (Brent crude oil price, residents' income from foreign sources, base rate, international reserves) on the export volumes of goods in Kazakhstan and Azerbaijan?
2. Are there differences between the short-term and long-term effects of macroeconomic shocks on the export volumes of goods in the countries under study?
3. To what extent are Kazakhstan's and Azerbaijan's goods exports dependent on fluctuations in the global price of Brent crude oil?
4. Are residents' income from foreign sources a stable long-term determinant of goods exports?

The study's hypotheses are as follows:

- rising Brent crude oil prices have a positive impact on the volume of goods exports in Kazakhstan and Azerbaijan in the long term;
- residents' income from foreign sources is a key long-term factor in the growth of goods exports in both countries;

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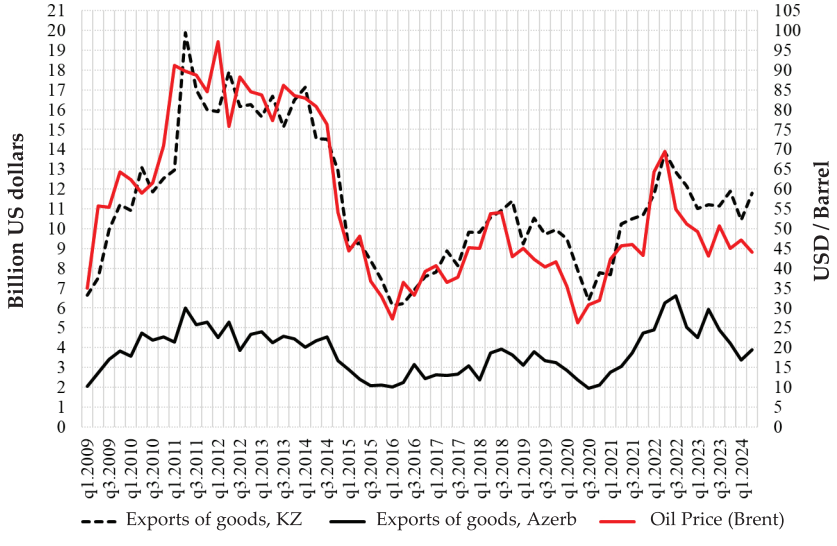
- total international reserves have a contrasting effect on goods exports in Kazakhstan and Azerbaijan in the short term;
- goods exports demonstrate a pronounced dependence on their lagged values.

Indeed, the fact that Kazakhstan and Azerbaijan's commodity exports are largely driven by raw materials is indirectly confirmed by both statistical data and the structure of their export revenues. However, simply stating this relationship does not capture the complexity of the processes that determine foreign trade dynamics. Therefore, the objectives of this study are not limited to confirming well-known facts, but rather to a more in-depth analysis of the mechanisms that determine the behavior of export indicators over time. The focus was on quantifying short-term and long-term relationships, identifying the strength and direction of the impact of various macroeconomic shocks, and establishing statistically significant cause-and-effect relationships. As is well known, such relationships cannot be determined using descriptive analysis or simple comparative statistics, as they require consideration of the time structure of the data and the dynamic nature of economic processes. For this reason, the use of ARDL, VAR, and ARIMA econometric models allowed us to: assess the contribution of individual factors to changes in export indicators over time, rather than merely record their statistical dynamics; verify the presence of lagged effects, such as the dependence of export volumes on values from previous periods; separate short-term and long-term influences, which is fundamental for formulating economic policy; test the robustness of the identified relationships across various model specifications and variable sets; and determine the direction of export responses to shocks, which is impossible using solely structural indicators of foreign trade. Thus, the use of econometric tools in this study is aimed not at confirming the well-known dependence of export structure on oil prices, but at obtaining empirical results that are more profound and formalized than those that can be obtained based on descriptive data.

Time series play an important role in economic and financial analysis, allowing us to forecast future values based on historical data. Among the most popular methods of time series forecasting are the ARIMA and VAR models. As is known, these models are widely used in macroeconomics, financial analysis, marketing and other fields where it is important to take into account the dynamics of time series. ARIMA is one of the most common forecasting models, based on a combination of autoregression, integration and moving average. This model is well suited for univariate time series, especially if the data exhibit trends and seasonal fluctuations. The main advantages of ARIMA are its flexibility, the ability to take seasonality into account and relative ease of interpretation. However, the model requires stationarity of the data, and the process of selecting parameters can be complex and time-consuming. According to studies by Nexbold [1], Fattah [2], Makridakis et al. [3], ARIMA is one of the most effective models for forecasting time series with the correct choice of parameters.

Unlike ARIMA, VAR is used for multivariate time series and allows for the analysis of relationships between multiple variables. This model is particularly useful in macroeconomic research, where the interaction of various economic indicators must be taken into account. The advantages of VAR is its ability to analyze dynamic relationships between variables and generate forecasts that take into account their mutual influence. However, one of its main drawbacks is the need for a large amount of data to obtain reliable parameter estimates, as well as the difficulty in interpreting the results. According to research by Abad et al. [4] and Sims [5], VAR models are an effective tool for analyzing macroeconomic relationships.

Figure 1 shows the dynamics of Kazakhstan and Azerbaijan's exports and Brent crude oil prices in 2009–2024. Kazakhstan's exports grew rapidly until 2013, then fell in 2014–2016 following the fall in oil prices. A partial recovery was observed in 2017–2019, but a further decline occurred in 2020, likely due to the pandemic. In 2021–2022, exports increased again amid rising oil prices, but began to decline in 2023. Azerbaijan's exports were significantly lower: relatively stable in 2009–2014, they declined in 2015, stabilized



Note: presented in prices of the first quarter of 2001
Source: compiled on the basis of IMF data

Fig. 1. Dynamics of the volume of exports of goods of Kazakhstan and Azerbaijan

in 2017–2019, fell in 2020, and increased in 2021–2022, reaching a peak before declining again. The dynamics of oil prices generally follow these fluctuations: growth until 2014, a sharp decline in 2015, a partial recovery in 2017–2019, a new collapse in 2020, and a rise in 2021–2022, after which the price will decline again from 2023. Thus, the exports of Kazakhstan and Azerbaijan demonstrate a pronounced dependence on global oil price dynamics, confirming the structure of their economies, which are focused on revenues from the commodity sector. This dependence is clearly evident during periods of price downturns: in 2015–2016 and in 2020, the decline in oil prices led to a significant reduction in export volumes for both countries. In subsequent years, when oil prices recovered and reached higher levels (2021–2022), export figures again demonstrated growth, reflecting a direct link between the external price environment and export revenues. However, in 2023, another drop in oil prices led to a further decline in exports, demonstrating that this factor continues to play a decisive role in shaping foreign trade dynamics. This cyclical dependence on volatile oil markets highlights the need for diversification of the economies of Kazakhstan and Azerbaijan to reduce the sensitivity of the export sector to external price shocks and ensure sustainable economic growth.

Literature review

Contemporary literature devotes considerable attention to the role of total international reserves, their adequacy, and their impact on macroeconomic stability. In the study by Jamalzade et al. [6], foreign exchange reserves are considered a key element of economic protection, as they comprise highly liquid assets that ensure the fulfillment of payment obligations and the stability of the national currency. The authors emphasize that central banks maintain sufficient reserves primarily to counter speculative attacks and smooth out fluctuations in the trade balance. On this basis, the researchers analyze the factors determining the adequacy of reserves in Azerbaijan and Turkey, comparing the activities of their central banks. Jamalzade's approach is continued in the work by Arize [7], which shifts the focus from the motives for reserve accumulation to their consequences, particularly in relation to import demand. The author demonstrates that the growth of reserves in a number of Asian countries is accompanied by an increase in imports, which is theoretically explained by the expansion of opportunities for financing external purchases. To test this relationship, Arize [7] uses a dynamic error correction model and cointegration analysis, estimating the impact of reserves, income, and relative prices on import demand in India, Japan, Korea, Singapore, and Thailand. This approach allows us to distinguish between long-term and short-term effects, demonstrating that foreign exchange reserves can be a significant factor in foreign trade activity. The problem of macroeconomic stability and the role of reserves in countering external shocks are examined in the work of J.-P. Allegret and A. Allegret [8]. Unlike Arize [7], which focuses on the trade channel of the influence of reserves, the authors examine their importance as a self-insurance instrument. They show that high foreign exchange reserves increase resilience to financial crises and capital flow volatility, and their accumulation in the pre-crisis period accelerates economic recovery. However, the study emphasizes the nonlinearity of the effect: as reserves increase, the marginal return decreases, indicating the limitations of a simple accumulation strategy. The analysis focuses on assessing the ability of reserves to cushion the impact of external shocks on output for nine emerging market countries. The relationship between central bank policy and macroeconomic stability is also explored in the study by Maslennikov et al. [9], although the focus is shifted from foreign exchange reserves to refinancing instruments. The authors analyze the impact of the refinancing rate on GDP and GNI in 13 countries with different banking systems, emphasizing that monetary instruments can have different impacts on the economy depending on the institutional context. The use of econometric apparatus allows us to take into account the qualitative characteristics of the impact of monetary decisions, which complements approaches based on cointegration models and error correction used in previous studies. The topic of foreign trade dynamics is developed in the studies of Yuliadi et al. [10] and Sudarusman et al. [11], who analyze the impact of domestic and external macroeconomic factors on exports. The work of Yuliadi et al. [10] studies the role of the exchange rate, inflation, interest rates, and imports in shaping exports in the Association of Southeast Asian Nations. Using a panel fixed effects model, the authors show that the exchange rate and imports have a significant positive impact on exports, which is consistent with the findings of Arize [7] on the relationship between reserves and trade activity. The study by Sudarusman et al. [11] complements this line of analysis by focusing on Indonesia, using an ARDL model and an error correction mechanism to estimate short-run and long-run effects. The results confirm the positive impact of the exchange rate, world income, and investment on exports, and also reveal a long-run relationship between key macroeconomic variables. These findings are consistent with the self-insurance concept of Allegret [8], as they indicate the importance of investment inflows and external income for exports and, consequently, for macroeconomic stability.

Recent studies published in SOCAR Proceedings further demonstrate the applicability of economic and mathematical methods for solving complex managerial and economic problems in the oil and gas industry. Mammadov, Yadigarov, Safarova et al. [12] developed an economic and mathematical model for assessing innovation-related risks at oil and gas enterprises and demonstrated that quantitative risk evaluation can improve decision-making under conditions of uncertainty. In a subsequent study, Safarova [13] investigated the assessment of synergistic effects in oil and gas industry enterprises using economic and mathematical approaches and confirmed the usefulness of quantitative models for evaluating the efficiency of integration processes and corporate interactions. These studies support the growing role of advanced econometric and mathematical methods in the analysis of economic processes in the energy sector and provide additional methodological justification for the application of ARDL, VAR and ARIMA models in the present research.

The choice of oil prices as the central element of the literature review is deliberate, as the oil and energy sectors play a dominant role in Kazakhstan and Azerbaijan, generating a significant portion of export earnings, government revenues, and international reserves. Therefore, the majority of empirical studies in the academic literature focus on the impact of oil prices on macroeconomic indicators, and this indicator is traditionally used as the main external factor affecting export fluctuations and the dynamics of other economic variables.

Furthermore, the available literature on the CIS countries is extremely unevenly distributed: there is a vast body of research on the impact of oil prices, while studies examining the role of other factors, such as residents' income from foreign sources, international reserves, or interest rates, are significantly fewer or fragmentary. Therefore, the literature review inevitably relies on areas where a sufficient number of empirical studies exist, which explains the concentration in table 1 on the analysis of oil shocks. Thus, table 1 presents the studies on the impact of oil prices on macroeconomic variables in developing countries and Norway. There are many works on this topic in the economic literature, but this section presents the most similar articles on the research topic. The impact of oil prices on macroeconomic indicators is a topical issue in economic research, especially for oil-producing countries. The following empirical studies analyze the effects of oil price fluctuations on the economies of Azerbaijan and Kazakhstan. The study by Mukhtarov et al. [14] considers the impact of oil prices on the economy of Azerbaijan from 2001 to 2018 using the Johansen cointegration and error

Table 1

A comparative review of empirical studies on the impact of oil prices on macroeconomic indicators

Authors	Country, time period	Research methods	The results obtained
Mukhtarov et al. [14]	Azerbaijan, quarterly, 2001-2018	Johansen cointegration and Vector Error Correction methods	The impact of oil price shocks on the economy of the country and other oil producing developing countries
Zulfigarov, Neuenkirch [15]	Azerbaijan, quarterly, 2002-2018	Vector autoregression model	The decline in GDP follows fluctuations in oil prices, also the interest rate and exchange rate predominantly decline in response to rising oil prices
Moldabekova et al. [16]	Kazakhstan, quarterly, 2009-2021	A system of five regression equations and two identities	In the long term, the domestic currency remains risky, with Kazakhstan's consolidated budget revenues and GDP dependent on commodity price fluctuations
Czech, Niftiyev [17]	Kazakhstan, Azerbaijan, monthly, 2000-2020	Structural vector autoregressive model	In the short term, the growth of oil prices is accompanied by a decrease in exchange rates, which leads to the strengthening of the Azerbaijani manat and Kazakh tenge against the U.S. dollar, the increase in international reserves of Azerbaijan is due to the growth of oil prices
Faria et al. [18]	China, monthly, 1992-2005	Autoregressive distributed lag model, a stylized macro model of China's open economy (labor market, goods market, money market, international oil market and exports)	In the long run, we find a small positive impact of oil prices and export competitiveness elasticity coefficients, as well as the expected negative elasticity of the real exchange rate in response to an increase in the first difference of export volume
Iwayemi, Fowowe [19]	Nigeria, quarterly, 1985-2007	An unrestricted vector autoregression model	Oil price shocks do not significantly affect most of Nigeria's macroeconomic variables. In the short run, positive oil shocks do not affect output, government expenditure, inflation and real exchange rate, while negative oil shocks significantly affect output and real exchange rate
Muhammad [20]	Pakistan, annual, 1975-2008	Vector Error Correction model	There is a significant correlation between export revenues and key macroeconomic indicators (GDP, living standards, trade balance, oil prices, money supply M2)
Al-Maamary et al. [21]	Gulf countries, annuals, 90s, 00s, 10-20s	Analysis of oil and gas industry data	The increase in oil and shale gas production has had an impact on the Gulf countries, especially Saudi Arabia. Over the past decades, these countries have failed to decouple economic development from energy demand, making them economically inefficient. Energy consumption in the region is growing faster than the economy
Solheim [22]	Norway, annual, 1987-2007	Vector autoregression model	In the short run, the revenue effect is limited because fiscal policy follows a «fiscal rule» that limits government spending of oil revenues to an expected real return of 4% of the Fund. In the long run, rising wealth expands the room for maneuvering within this rule, which may increase the non-oil fiscal deficit. High oil prices shorten the life of real capital, which slows down productivity growth

Source: compiled by the author

correction methods. The results confirm that oil shocks have a significant impact not only on the country's economy but also on other oil-producing developing countries. The study by Zulfigarov and Neuenkirch [15] analyzes the economic situation in Azerbaijan from 2002 to 2018 using the vector autoregressive model. The findings show that oil price fluctuations are followed by a decline in GDP. Interest rates and the exchange rate generally decrease in response to rising oil prices. The study by Moldabekova et al. [16] focuses on Kazakhstan for the period 2009–2021. Using a system of five regression equations and two identities, the authors find that, in the long run, Kazakhstan's national currency remains vulnerable, and government budget revenues and GDP are closely related to changes in commodity prices. The study by Czech and Niftiyev [17] examines data for Kazakhstan and Azerbaijan for the period 2000–2020, applying a structural vector autoregressive model. The study shows that a short-term increase in oil prices is accompanied by a depreciation of exchange rates, which leads to the appreciation of the Azerbaijani manat and the Kazakhstani tenge against the US dollar. In addition, an increase in oil prices contributes to the growth of Azerbaijan's international reserves. The study by Faria et al. [18] examines the Chinese economy over the period 1992–2005 using the autoregressive distributed lag methodology and a stylized open economy macromodel. They found a small positive impact of oil prices, the elasticity of export competitiveness, and a negative elasticity of the real exchange rate on the increase in China's export margin. The study by Iwayemi and Fowowe [19] analyzes the impact of short-run oil price shocks on Nigeria's macroeconomic variables over the period 1985–2007 using the first-differenced vector autoregressive model. The study found that oil shocks do not have a significant impact on most of the country's macroeconomic indicators. In the short run, positive oil shocks do not affect output, government spending, inflation, and the real exchange rate, while negative shocks affect output and the exchange rate. A study by Muhammad [20] analyzed data for Pakistan from 1975 to 2008 using an error correction model. The author found a significant correlation between export revenues and the country's key macroeconomic indicators. A subsequent article by Al-Maamary et al. [21] analyzed the dynamics of oil and shale gas production in the Persian Gulf countries. The results showed that increased production led to economic development due to increased energy demand, but made these economies less efficient.

Finally, Solheim's study [22] examined the impact of oil revenues on the Norwegian economy over the period 1987-2007 using a vector autoregressive model. In the short term, the effect of oil revenues was limited by the fiscal rule that governs government spending. However, in the long term, rising wealth expanded the scope for maneuver within this rule, ultimately leading to an increase in the non-oil budget deficit. High oil prices also shortened the lifespan of real capital, reducing productivity growth. Consequently, empirical studies have confirmed the significant impact of oil prices on macroeconomic indicators across various countries, although the extent of this impact depends on the structural features of their economies. Thus, the selection of sources for table 1 was based on several criteria: relevance of country specifics (including Kazakhstan, Azerbaijan, and other oil-producing developing economies), comparability of the methods used (VAR, VECM, ARDL, and other time series models), the focus of the studies on assessing the impact of external shocks and macroeconomic factors, and the availability of published empirical results in peer-reviewed scientific journals. Based on the above, the presented studies were not selected randomly, but based on the principle of substantive and methodological comparability for the purpose of this study. It follows from the above that the choice of oil prices as a benchmark for the literature review is due not only to their high significance for the economies of the studied countries, but also to the objective availability and development of the existing scientific base. Against this background, the conducted study expands the literature by addressing factors that have been significantly less studied, in particular, the influence of residents' income from foreign sources on export dynamics, which forms the key scientific contribution of the work.

Methodology

The export of goods plays a key role in the economy of the Republic of Azerbaijan, as they provide a significant portion of foreign exchange earnings and affect the country's macroeconomic stability. As noted in the works of Jwair et al. [23], Domashchenko [24], Broni-Bediako et al. [25], the importance of exports is due to its close relationship with residents' foreign- sources income, interest rate fluctuations, the level of international reserves, and global oil prices. Given the dominant role of the oil and gas sector in the economy of Azerbaijan, the impact of these factors on export indicators requires detailed analysis. To study these relationships, ARIMA and VAR models were used, allowing the identification of both short-term dynamic effects and long-term dependencies between variables.

It should also be noted that the conclusion on the importance of exports for the economies of the countries under consideration was based on official statistics and the results of previous studies. As is known, commodity exports occupy a dominant position in the structure of GDP and foreign trade turnover of Kazakhstan and Azerbaijan, which has been repeatedly confirmed in previously published works mentioned in the literature review. Therefore, the emphasis on the importance of the export sector is a consequence of the generally recognized macroeconomic specifics of these countries, and not a separate assumption of the author. It is appropriate to emphasize that the choice of specific macroeconomic indicators - residents' income from foreign sources, interest rates, international reserves and oil prices - was based on theoretical assumptions and empirical results obtained in previous studies. On this basis, an understanding of the mechanisms of transmission of external and internal shocks to commodity exports was formed. For example, oil prices are a key external factor for commodity-exporting economies; residents' foreign -sources income reflects the channels of cash flows influencing consumption, investment and the balance of payments; interest rates shape the cost of financing; international reserves reflect the stability of the external sector. Thus, the selection of variables was not arbitrary, but based on the well-documented relationship between these indicators and foreign trade dynamics. Finally, the key motivation for choosing these variables was the desire not only to confirm known patterns (for example, the impact of oil prices) but also to identify less-studied factors, such as the impact of residents' foreign-source income on exports. It is this aspect that has been underrepresented in existing research, which underlies

the originality and scientific contribution of this work.

The presented study was based on quarterly data for 2001-2024, given in prices of the first quarter of 2001. Statistical data were collected from the website of the International Monetary Fund. The following independent variables were considered: LNINC – the natural logarithm of the residents income from foreign sources in Azerbaijan , LNIR – the natural logarithm of the base rate of the Republic of Azerbaijan, LNRES – the natural logarithm of total international reserves excluding gold, LNPB – the natural logarithm of BRENT crude oil prices. The ARIMA model was used to forecast the time series, combining autoregression (AR), integrated order (I), and moving average (MA). This approach made it possible to identify the structure of the time series and predict its future values based on past data. For this sample, the best model was ARIMA (3,1,3), which has the following form:

$$(1-\phi_1 B-\phi_2 B^2-\phi_3 B^3)\,\Delta LNEXP_t=(1-\theta_1 B-\theta_2 B^2-\theta_3 B^3)\,\varepsilon_t \quad (1)$$

or in expanded form:

$$\Delta LNEXP_t=\phi_1\Delta LNEXP_{t\text{-}1}+\phi_2\Delta LNEXP_{t\text{-}2}+\phi_3\Delta LNEXP_{t\text{-}3}+ \\ +\theta_1\varepsilon_{t-1}+\theta_2\varepsilon_{t-2}+\theta_3\varepsilon_{t-3}+\varepsilon_t \quad (2)$$

where $LNEXP_t$ – the natural logarithm of the volume of goods exported by Azerbaijan, B – is the shift operator ($BLNEXP_t = LNEXP_{t-1}$), Δ – is the first difference operator, ϕ_i – and θ_j are the coefficients of the model, ε_t is white noise.

To estimate the ARIMA model parameters, we used stationarity tests (ADF tests), correlogram analysis, and selection of the best specification using the Akaike criteria and the Bayesian information criterion. Unlike ARIMA, which focuses on analyzing a single variable, the VAR model is used to study the relationships between multiple time series. The VAR model accounts for the interdependence of commodity export volumes and independent variables by considering them as a system of equations in which each variable is explained by its lags and the lags of other variables. If cointegration existed between the variables, the VECM model was employed, which takes into account long-run equilibrium relationships between variables and corrects for short-run deviations from this equilibrium. The Johansen test was used to identify long-run relationships between variables. Cointegration is known to indicate the existence of a stable long-run relationship between variables, confirming their economic connection. After cointegrating relationships were identified, Johansen normalization was used to correctly interpret the coefficients of the cointegrating vectors. This method helps identify which variables have a consistent impact on export volumes over the long term and avoid the problem of spurious regression in modeling. The results of the eigenvalue stability test confirmed the validity of the VECM specification: four eigenvalues equal one, corresponding to the number of cointegrating relationships in the model. The remaining eigenvalues are less than one, indicating model stability and the absence of explosive behavior in the time series.

It should also be noted that the autoregressive distributed lag model is a powerful tool for time series analysis, especially in the presence of mixed stationarity of variables. This model allows for the assessment of both short-term and long-term relationships between economic indicators. This section examines the specification of the ARDL model for commodity exports in Kazakhstan and Azerbaijan and defines its significance in economic analysis. The ARDL model is written as follows:

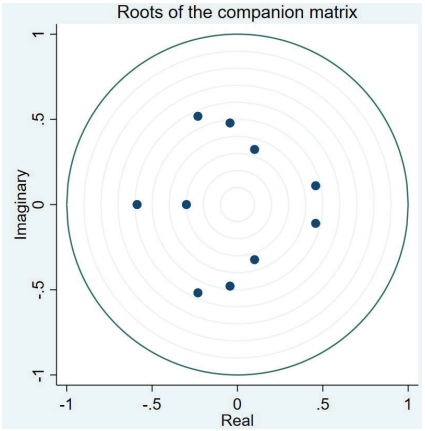
$$LNEXP_t=\alpha+\sum_{i=1}^{p}\beta_i LNEXP_{t-i}+\sum_{j=0}^{q_1}\gamma_j LNINC_{t-j}+ \\ +\sum_{k=0}^{q_2}\delta_k LNIR_{t-k}+\sum_{m=0}^{q_3}\theta_m LNPB_{t-m}+\sum_{n=0}^{q_4}\varphi_n LNRES_{t-n}+\varepsilon_t \quad (3)$$

where $LNEXP_{t-1}$ – is the natural logarithm of exports of goods of Kazakhstan and Azerbaijan, $LNINC_{t-j}$ – is the natural logarithm of residents foreign-source income in Kazakhstan and Azerbaijan, $LNIR_{t-k}$ – natural logarithm of the refinancing rate of Kazakhstan and Azerbaijan, $LNPB_{t-m}$ – natural logarithm of Brent crude oil prices. $LNRES_{t-n}$ – natural logarithm of the total international reserves of Kazakhstan and Azerbaijan, α – free member model, β_i, γ_j, δ_k, θ_m, φ_n – coefficients of lagged values of the corresponding variables, ε_t random error. The parameter p, q_1, q_2, q_3, q_4 denote the number of lags for the dependent and independent variables. The choice of the number of lags plays an important role, as it determines how accurately the model accounts for the temporal dependencies between variables. Nkoro [26] and Ghouse et al. [27] note that before constructing an ARDL model, it is necessary to check the properties of the time series to avoid incorrect conclusions. First, the stationarity of the variables was determined using the ADF, KPSS, and PP tests.

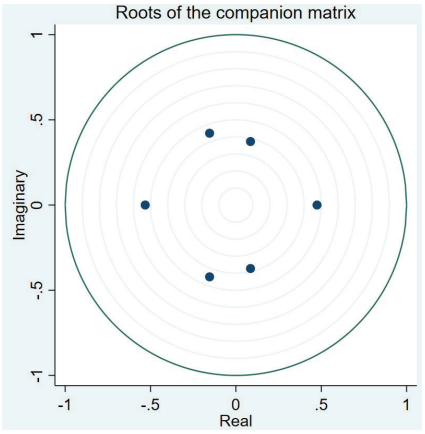
It should be noted that the use of the ADF [28], KPSS [29], and PP [30] tests is associated with the requirement for the correct construction of the ARDL model, since, according to the works of Nkoro [26], Ghouse et al. [27], before its application it is necessary to establish the order of integration of the variables and make sure that none of them is integrated of the second order. In this regard, the three most common tests for time series stationarity were applied. As is known, the ADF (Augmented Dickey–Fuller) test checks for the presence of a unit root and allows us to determine whether the series is stationary or contains a trend, while adjusting the model for possible autocorrelation of the residuals. The KPSS (Kwiatkowski–Phillips–Schmidt–Shin) test performs the opposite function, since its null hypothesis assumes the stationarity of the series, which makes it a useful tool for cross-validating the ADF results. The Phillips–Perron (PP) test accounts for potential heteroscedasticity and autocorrelation of the error bars without introducing additional lags into the model, making it an alternative method for testing stationarity. The simultaneous use of these three tests is common practice in time series studies based on the ARDL methodology, as it improves the robustness of inferences by testing stationarity under various assumptions regarding the error structure.

The ARDL model is applicable if the variables have an integration order of I(0) or I(1), but not I(2). A cointegration test was then conducted to identify the existence of a long-run relationship between the variables. The optimal number of lags was determined using the Akaike criterion and the Bayesian information criterion. The robustness of the model was tested using tests for autocorrelation, heteroscedasticity, and residual normality. Thus, the tests conducted ensured that the model adequately describes the data and does not contain systematic errors. It should be noted that when interpreting the coefficients in the ARDL model, it is important to consider their economic meaning and statistical significance. In the short run, the lag coefficients reflect the temporary impact of changes in independent variables on the volume of goods exported by Kazakhstan and Azerbaijan. In the long run, if cointegration is detected, the coefficients demonstrate

a) Kazakhstan



b) Azerbaijan



Source: calculated in STATA program

Fig. 2. Analysis of the stability of the VAR model using the roots of the companion matrix

stable relationships between the variables. It should be noted that a direct interpretation of the coefficients requires caution, since the presence of lags and the interaction of factors can lead to complex dynamic effects. To ensure a proper analysis, elasticities and an error correction mechanism were used, reflecting the speed of return to equilibrium after shocks. If the coefficients of the independent variables in the long-run equilibrium equation are statistically significant, then changes in residents' income from foreign sources, the refinancing rate, oil prices, and international reserves have a persistent impact on the exports of Kazakhstan and Azerbaijan. The coefficients of the lagged variables in the short-run dynamics allow us to determine how past changes in the explanatory factors influence current commodity export volumes in Kazakhstan and Azerbaijan.

Research results

The results of the augmented Dickey-Fuller test, presented in table 2, show that merchandise exports and residents' income from foreign sources have test statistics within the 5% critical value, indicating their stationarity. Also, the first difference of total international reserves, Brent crude oil prices, and the refinancing rate have statistics exceeding the 1% critical value, confirming their stationarity. This fact indicates that the analyzed variables become stationary after first differencing. Figure 2 illustrates the stability analysis of the VAR model, performed using the roots of the companion matrix. All roots are within the unit circle, indicating model stability. Thus, the VAR model is appropriate for studying the dynamic relationships between the variables under consideration.

The test statistic values in table 3 are compared with the critical values at the 1, 5, and 10 % significance levels, allowing

Table 2

Results of the augmented Dickey-Fuller test for the studied variables of Kazakhstan (n=72)

Augmented Dickey-Fuller Unit Root Test				
Variable	**Test statistics**	**Interpolated Dickey-Fuller**		
		1% critical value	**5% critical value**	**10% critical value**
Export of goods	-2.96**	-3.55	-2.91	-2.60
Residents' income from foreign sources	-3.93***			
First difference of total international reserves	-3.44***			
First price difference for Brent crude oil	-4.57***			
First difference of the base rate	-3.83***			

*Note: ***p<0.01; **p<0.05; * p<0.1, all cost indicators are presented in prices of the first quarter of 2001, variables were logarithmized*
Source: calculated in STATA program

Table 3

Results of the augmented Dickey-Fuller test for the studied variables of Azerbaijan (n=87)

Augmented Dickey-Fuller Unit Root Test				
Variable	Test statistics	Interpolated Dickey-Fuller		
		1% critical value	1% critical value	1% critical value
Export of goods	-3/08**	-3.53	-2.90	-2.60
Residents' income from foreign sources	-2.80*			
First difference of total international reserves	-2.95**			
First price difference for Brent crude oil	-4.81***			
Base rate	-3.26**			

*Note: ***p<0.01; **p<0.05; * p<0.1, all cost indicators are presented in prices of the first quarter of 2001, variables were logarithmized*
Source: calculated in STATA program

us to assess the stationarity of Azerbaijan's variables. The test showed that goods exports have a test statistic of -3.082, which is within the critical value of 5%, meaning that the unit root hypothesis is rejected. Residents' income from foreign sources showed a value of -2.799, indicating weak signs of stationarity. The first difference in total international reserves has a test statistic of -2.952, which does not exceed the 5% level, indicating stationarity. The first difference in Brent crude oil prices has a test statistic of -4.814, indicating a high degree of stationarity. Similarly, the refinancing rate has a value of -3.256, confirming its stationarity at the 5% significance level.

Thus, we can conclude that the first-order difference of Brent crude oil prices and total international reserves, the base rate, and commodity exports are stationary at the 5% significance level or higher. However, Azerbaijani resident incomes exhibit weak signs of stationarity only at the 10% level, which may indicate the need for additional data transformations, such as first-order differencing, to achieve full stationarity.

Figure 2 demonstrates the stability analysis of the VAR model for Kazakhstan and Azerbaijan using the roots of the companion matrix. Each panel (a and b) plots the roots of the matrix in the complex plane, where the x-axis represents the real part of the roots, and the y-axis represents the imaginary part. A circle of radius 1 denotes the stability boundary of the model: if all roots lie within this circle, the VAR model is considered stable, meaning that the time series returns to equilibrium after the shock. The results in figure 2 show that, in all cases, the roots of the companion matrix lie within the unit circle for both Kazakhstan and Azerbaijan. This fact indicates that the VAR models used for the analysis are stable. Therefore, we can conclude that the resulting models are correctly specified and suitable for further analysis of the dynamic relationships between variables. The absence of roots outside the unit circle indicates the absence of explosive processes, which confirms the stability of time series after shock impacts.

Table 4 presents the results of White's test for the statistical data of Kazakhstan and Azerbaijan. For Kazakhstan, the chi-square χ^2 statistic is 86.69 with 87 degrees of freedom, yielding a probability of 0.49. Similarly, for Azerbaijan, the χ^2 statistic is 71.68 with 64 degrees of freedom, with a corresponding probability of 0.24. Since the probability values in both cases are significantly higher than the conventional significance threshold (e.g., 0.05), the null hypothesis of homoscedasticity cannot be rejected. This indicates the absence of heteroscedasticity in the data for both Kazakhstan and Azerbaijan. Consequently, the results confirm the uniformity of error variance across the models, ensuring the reliability of statistical inferences drawn from the analysis.

Analyzing the results of the ARIMA model estimates for the volume of exports of goods and services in the Republic of Azerbaijan (see table 5) allows for several key conclusions. First, the ARIMA (3,1,2) and ARIMA (3,1,3) models exhibit the highest likelihood function values (31.97 and 34.94, respectively), indicating the best fit to the data. Additionally, these

Table 4
White test results according to statistical data of Kazakhstan and Azerbaijan

Kazakhstan		
Chi-square	df	Probability
86.69	87	0.49
Azerbaijan		
71.68	64	0.24

Source: calculated in STATA program

Table 5
Estimates results of ARIMA models for the volume of goods and services exports in the Republic of Azerbaijan

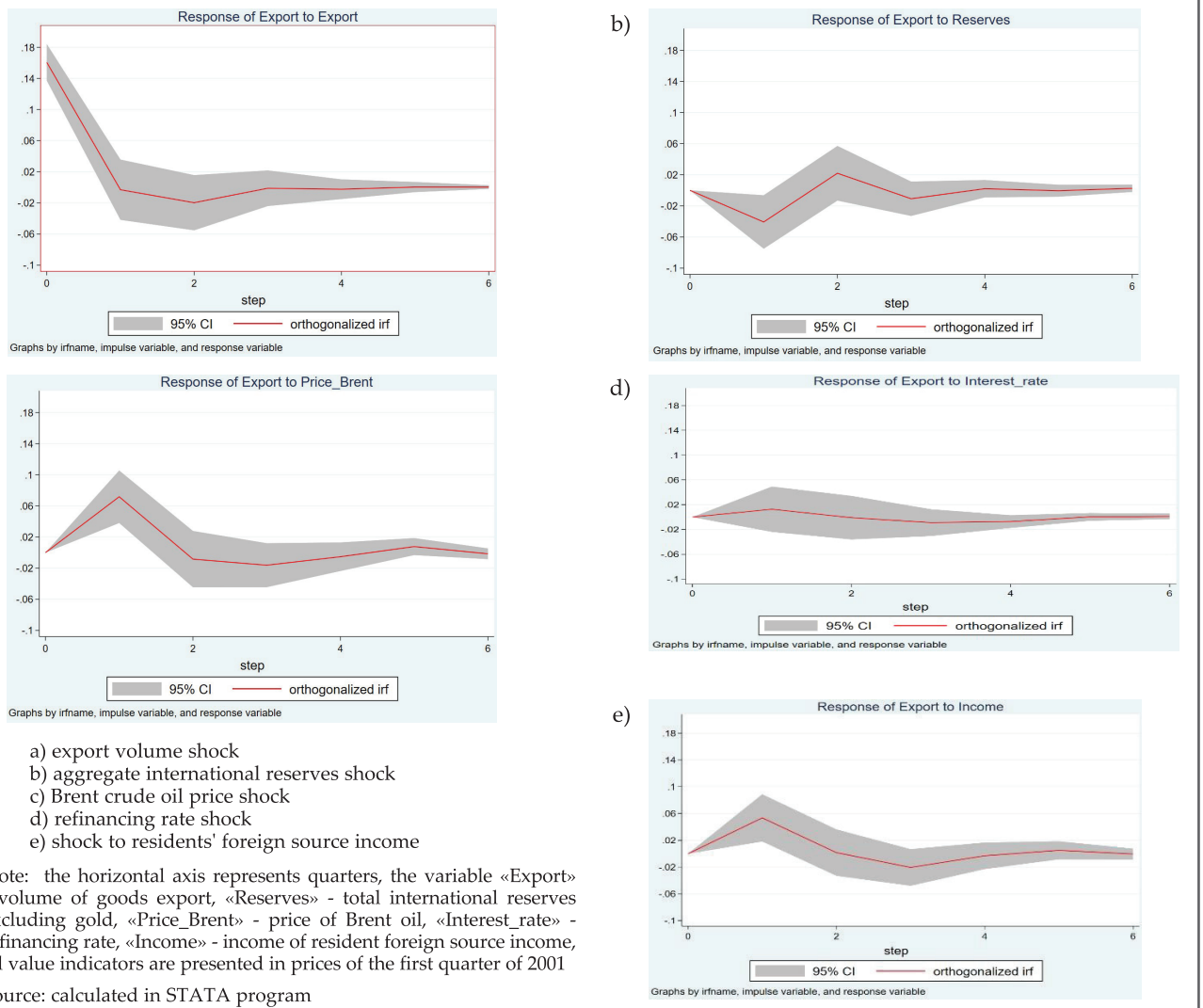
	ARIMA (1,1,1)	ARIMA (1,1,2)	ARIMA (1,1,3)
Dependent variable: volume of exports of goods			
Number of statistically significant coefficients	2	0	1
Sigma (volatility)	0.19	0.19	0.18
Likelihood function	22.23	22.35	27.83
Akaike's criterion	-36.47	-34.69	-43.66
Bayesian information criterion	-26.38	-22.09	-28.53
	ARIMA (2,1,1)	ARIMA (2,1,2)	ARIMA (2,1,3)
Number of statistically significant coefficients	0	3	2
Sigma (volatility)	0.19	0.18	0.17
Likelihood function	22.62	24.33	29.67
Akaike's criterion	-35.23	-38.66	-45.34
Bayesian information criterion	-22.62	-26.05	-27.68
	ARIMA (3,1,1)	ARIMA (3.1,2)	ARIMA (3,1,3)
Number of statistically significant coefficients	1	5	6
Sigma (volatility)	0.18	0.17	0.16
Likelihood function	28.28	31.97	34.94
Akaike's criterion	61.13	63.13	64.73
Bayesian information criterion	76.26	80.78	84.91

Note: cost indicators are presented in prices of the 1st quarter of 2001, the dependent variable was prologarized
Source: calculated in STATA program

models contain a greater number of statistically significant coefficients (five and six, respectively), which, while potentially improving explanatory power, may also suggest the risk of overfitting. Second, the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) serve as crucial metrics for selecting the optimal model. Among all estimated models, the lowest AIC and BIC values are observed for ARIMA (1,1,3) (-43.66 and -28.53, respectively) and ARIMA (2,1,3) (-45.33 and -27.68, respectively), suggesting that these models may be preferable in terms of information efficiency and predictive capability. Third, while the ARIMA (3,1,1), ARIMA (3,1,2), and ARIMA (3,1,3) models demonstrate higher likelihood function values (28.28, 31.97, and 34.94, respectively), they also exhibit significantly larger AIC (61.13, 63.18, and 64.73) and BIC values (76.26, 80.78, and 84.91). This indicates that their increased complexity does not necessarily yield substantial gains in forecasting accuracy, making them less preferable for selection. Thus, considering the trade-off between model accuracy and simplicity, the ARIMA (1,1,1) model emerges as the most balanced choice due to its minimal information criteria values. However, if maximizing the likelihood function is prioritized, the ARIMA (3,1,3) model could be considered a potentially optimal alternative.

Based on the presented estimates of the coefficients of the ARIMA models for the volume of goods exported by the Republic of Kazakhstan, the following conclusions can be drawn (see table 6). Among the three models (ARIMA (1,1,1), ARIMA (2,1,2), and ARIMA (3,1,1)), the ARIMA (3,1,1) model is the best in terms of the Akaike criterion and the Bayesian information criterion, since this model has the lowest values of these criteria (see table 6), indicating its better explanatory power and adequacy compared to the other models. At the same time, the number of statistically significant coefficients varies: the ARIMA (1,1,1) and ARIMA (3,1,1) models each have one statistically significant coefficient, while no significant coefficients were found in the ARIMA (2,1,2) model. Volatility values vary slightly across the models, with the lowest value in the ARIMA (3,1,1) model, which also indicates its preference. Thus, based on information efficiency criteria and the presence of significant coefficients, the ARIMA (3,1,1) model appears to be the most suitable for analyzing the volume of goods exports of the Republic of Kazakhstan.

Figure 3 illustrates the impact of short-term shocks in Brent crude oil prices, residents' foreign -source income, base rates, and total international reserves on the volume of goods exports of the Republic of Azerbaijan. Figure 3a shows the response of exports to their own shocks. A sharp decline is



a) export volume shock
b) aggregate international reserves shock
c) Brent crude oil price shock
d) refinancing rate shock
e) shock to residents' foreign source income

Note: the horizontal axis represents quarters, the variable «Export» - volume of goods export, «Reserves» - total international reserves excluding gold, «Price_Brent» - price of Brent oil, «Interest_rate» - refinancing rate, «Income» - income of resident foreign source income, all value indicators are presented in prices of the first quarter of 2001

Source: calculated in STATA program

Fig. 3. Impact of short-term shocks of macroeconomic factors on goods export volumes in the Republic of Azerbaijan

observed in the first quarters, after which the effect gradually stabilizes. Figure 3b demonstrates the impact of export shocks on total international reserves. Initially, the effect is negative, but over time it weakens and approaches a steady state. Figure 3c shows the response of exports to changes in Brent crude oil prices. It is clear that exports grow in the first quarter, reaching a maximum in the second quarter, and then gradually decline. Figure 3d reflects the impact of the base rate on goods exports. A moderate positive effect was observed in the first quarters, which leveled out over time. Finally, figure 3e demonstrates the response of goods exports to changes in residents' foreign -source income. Exports decline in the first quarters, then the effect gradually weakens but remains negative. The note indicates that the horizontal axis represents quarters, and all indicators are given in first-quarter 2001 prices. Gray areas in the graphs indicate 95% confidence intervals. All calculations were performed in STATA.

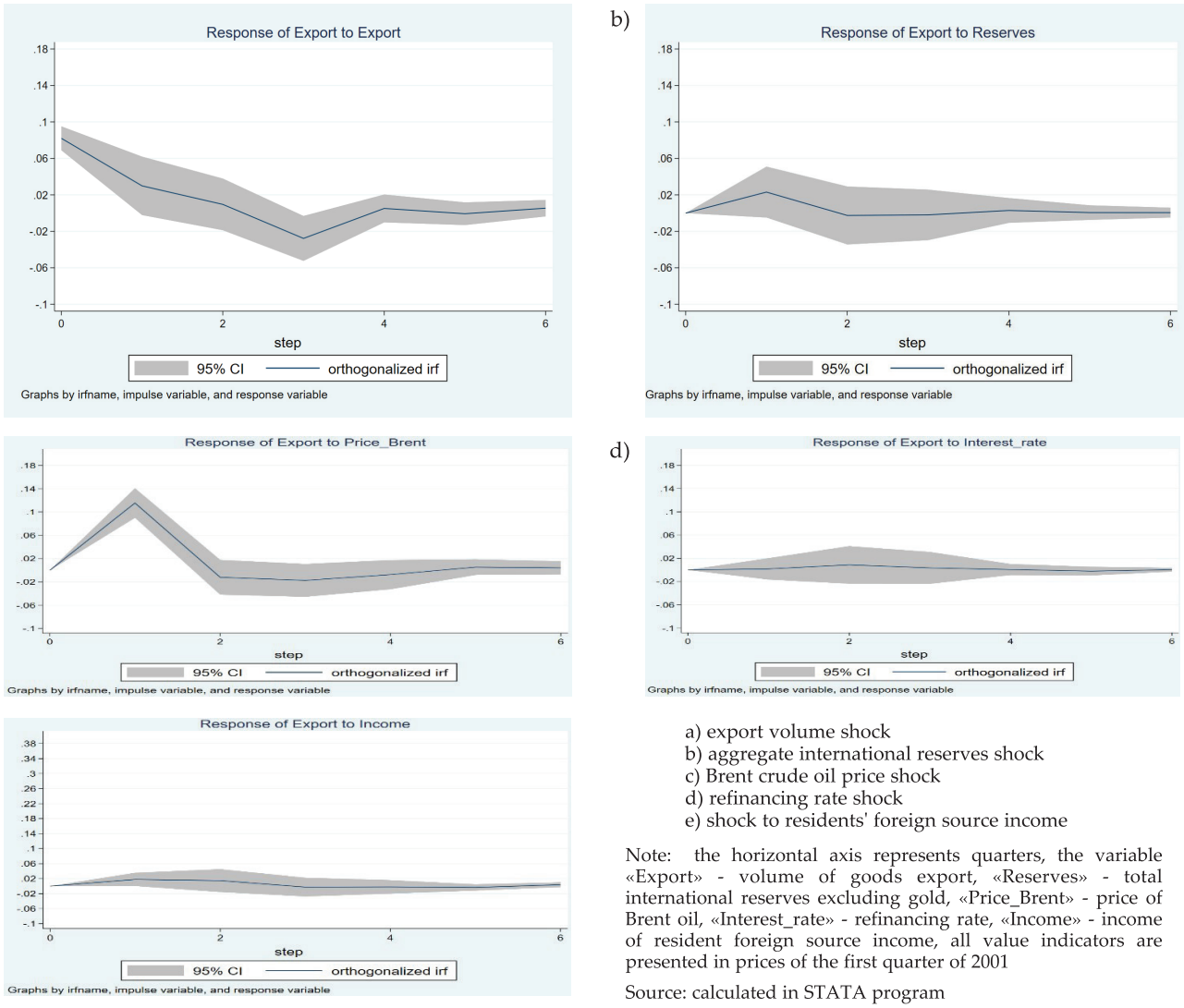
Figure 4 also demonstrates the impact of short-term

Table 6

Estimates results of ARIMA model for the volume of goods exports in the Republic of Kazakhstan

	ARIMA (1,1,1)	ARIMA (2,1,2)	ARIMA (3,1,1)
Dependent variable: volume of exports of goods			
Number of statistically significant coefficients	1	0	1
Sigma (volatility)	0.15	0.15	0.15
Likelihood function	34.87	35.27	41.44
Akaike's criterion	-61.74	-58.55	-70.88
Bayesian information criterion	-52.36	-44.48	-56.81

Note: cost indicators are presented in prices of the 1st quarter of 2001, the dependent variable was prologarized



a) export volume shock
b) aggregate international reserves shock
c) Brent crude oil price shock
d) refinancing rate shock
e) shock to residents' foreign source income

Note: the horizontal axis represents quarters, the variable «Export» - volume of goods export, «Reserves» - total international reserves excluding gold, «Price_Brent» - price of Brent oil, «Interest_rate» - refinancing rate, «Income» - income of resident foreign source income, all value indicators are presented in prices of the first quarter of 2001

Source: calculated in STATA program

Fig. 4. Impact of short-term shocks of macroeconomic factors goods export volumes Kazakhstan

macroeconomic shocks on Kazakhstan's goods exports using an impulse response function. An initial positive shock to exports is followed by a subsequent decline, suggesting a transitory effect, whereby an increase in exports in one period is partially offset in subsequent periods (see fig. 4a). A slight decline in exports following a shock to total international reserves may indicate a relationship between reserve accumulation and foreign trade dynamics. An increase in oil prices leads to short term rise in exports, confirming Kazakhstan's economy's dependence on oil prices. However, this effect quickly weakens. An increase in the base rate leads to a slight decline in exports, which may be attributed to higher borrowing costs and reduced investment activity. The impact of a short-term shock to residents' income from foreign sources has a weak effect on goods exports, suggesting a weak dependence of goods exports on foreign earnings. Based on the results presented in figure 3, the following conclusions can be drawn: Brent crude oil prices have the most significant impact on goods exports, confirming the high dependence of Kazakhstan's economy on the oil sector. Furthermore, increases in total international reserves and in the base rate may slightly reduce goods exports. The impact of residents' foreign-source income on goods exports is insignificant. Furthermore, goods exports showed a short-term upward trend following a positive shock, but subsequently corrected. Thus, the results highlight the importance of oil prices for Kazakhstan's goods exports and the need to consider monetary factors when forecasting foreign trade dynamics.

Table 7 presents the estimated coefficients of the impact of Brent crude oil price dynamics and total international reserves on the volume of goods exports in the Republic of Azerbaijan. Data analysis revealed a number of significant patterns. First of all, the coefficient of the first lag of goods exports (-0.309) indicates negative autocorrelation, suggesting a slowdown in export growth despite high value in the previous period. Residents' income from foreign sources has a significant impact on goods exports. The corresponding coefficient (0.651) demonstrated a positive and statistically significant ($p<0.01$) relationship, indicating an increase in export activity as external income increases. The dynamics of total international reserves also plays an important role. The lagged first difference of this indicator (-0.382) had a negative effect, significant at the 5% level. This fact indicates that the short-term decline in export activity in response to the growth of total international reserves is due to sterilization effects or inefficient resource reallocation. Brent crude oil price dynamics also influence goods exports. The lagged first difference in Brent crude oil prices (0.317) demonstrated a positive and statistically significant ($p<0.01$) effect, confirming the relationship between the growth of Brent crude oil prices in the previous period and the increase in goods exports in the current one. The model constant (0.861) is positive and statistically significant, indicating the presence of a stable baseline level of goods exports independent of the factors under consideration. Thus, in the long term, the key determinant of the volume of goods exports remains the income of residents from foreign sources, while Brent crude oil prices and total international reserves do not have a statistically significant effect. In the short term, changes in international reserves have a negative impact on commodity exports, which, in our opinion, is related to liquidity management measures. The impact of changes in Brent crude oil prices manifests itself with a time lag, confirming the strategic importance of oil revenues for Azerbaijan's economy. Overall, the country's commodity exports remain sensitive to fluctuations in oil prices in the short term, and to changes in residents' external income from foreign sources in the long term.

Table 8 presents the estimated coefficients of the autoregressive distributed lag (ARDL) model, offering insights into the key determinants of Kazakhstan's export volume. The results reveal a negative and statistically significant coefficient for the first lag of exports, indicating negative

Table 7

Empirical assessment of the impact of changes in macroeconomic variables on the volume of goods exports in the Republic of Azerbaijan (n=91)

First difference of goods export volume	Estimation of coefficients (standard errors)	95% confidence Interval	
First lag: volume of exports of goods	-0.31*** (0.08)	-0.47	-0.14
Long-term Effect:			
Income of residents from foreign sources	0.65*** (0.17)	0.32	0.98
Base rate	0.16 (0.12)	-0.07	0.40
Total international reserves	0.09 (0.12)	-0.15	0.33
Brent crude oil price	-0.03 (0.28)	-0.59	0.53
Short-term effect:			
Total international reserves			
First difference	0.00 (0.15)	-0.29	0.29
Delayed first difference	-0.38** (0.15)	-0.68	-0.08
Brent crude oil price			
First difference	0.13 (0.10)	-0.75	0.34
Delayed first difference	0.32*** (0.11)	-0.75	0.34
Constant	0.86*** (0.32)	0.22	1.49

*Note: ***p<0.01; **p<0.05; * p<0.1, all value indicators are presented in prices of the first quarter of 2001, the variables were prologarithized.*
Source: calculated in the STATA program

Empirical assessment of the impact of changes in macroeconomic variables on the volume of goods exports in the Republic of Kazakhstan (n=76) **Table 8**

First difference of goods export volume	Estimation of coefficients (standard errors)	95% confidence interval	
First lag: volume of exports of goods	-0.98*** (0.12)	-1.21	-0.74
Long-term effect:			
Income of residents from foreign sources	0.56*** (0.03)	0.49	0.63
Base rate	-0.00 (0.03)	-0.06	0.06
Total international reserves	-0.06* (0.03)	-0.12	0.00
Brent crude oil price	0.50*** (0.03)	0.43	0.56
Short-term effect:			
Income of residents from foreign sources			
First difference	-0.27*** (0.08)	-0.44	-0.11
Delayed first difference	-0.15** (0.06)	-0.26	-0.04
Total international reserves			
First difference	0.05 (0.06)	-0.08	0.18
Delayed first difference	0.12* (0.06)	-0.00	0.24
Brent crude oil price			
First difference	-0.36*** (0.08)	-0.53	-0.19
Delayed first difference	0.12 (0.08)	-0.03	0.27
Constant	3.18*** (0.50)	2.15	4.22

*Note: ***p<0.01; **p<0.05; * p<0.1, all value indicators are presented in prices of the first quarter of 2001, the variables were prologarithized.*
Source: calculated in the STATA program

autocorrelation. This suggests that a rise in exports in one period is followed by a decline in the next, reflecting a self-correcting mechanism in export dynamics. A key factor influencing exports is residents' income from foreign sources, which has a positive and significant effect. This implies that as foreign income increases, export activity strengthens, likely due to enhanced production capacity or improved trade conditions. In contrast, the refinancing rate has an insignificant coefficient (-0.004), suggesting that borrowing costs exert little direct influence on export volumes. The role of total international reserves appears more complex. The negative coefficient suggests that reserve accumulation may dampen export activity, possibly due to liquidity absorption measures or shifts in trade policy. At the same time, Brent crude oil prices exhibit a positive and significant relationship with exports, confirming that higher oil prices contribute to increased trade flows, reinforcing Kazakhstan's dependence on global energy markets. Short-term dynamics reveal additional nuances. A sudden increase in residents' foreign income leads to a temporary decline in exports, as indicated by the negative coefficient. This effect is further reinforced by the first-differenced lag of foreign income, suggesting that short-term fluctuations in external earnings can introduce volatility into export performance. Conversely, total international reserves exert a positive short-term influence on exports, although only the first-differenced lag is statistically significant. This indicates that reserve accumulation in the previous period may support export growth, potentially through improved trade financing or currency stability. However, Brent crude oil prices demonstrate a short-term negative effect on exports, suggesting a temporary adjustment period following oil price shocks. Notably, the lagged effect of oil prices is not statistically significant, highlighting the transient nature of this relationship. Finally, the model's constant term (3.18) reflects the baseline level of exports in the absence of fluctuations in the explanatory variables. Taken together, these findings underscore the interplay between short-term and long-term factors shaping Kazakhstan's export dynamics, emphasizing the dominant role of oil prices, foreign income, and reserve management in influencing trade performance.

The estimation results highlight that Kazakhstan's exports are significantly affected by oil prices, residents' income from foreign sources, and international reserves. Over the long term, exports tend to increase with rising oil prices and higher income from foreign sources, while they decrease as reserves grow. However, in the short term, the effects of these factors are more complex: an increase in income can temporarily reduce exports, while an increase in reserves in the previous period can stimulate export growth. This complexity suggests that Kazakhstan's export policy must carefully consider the impact of international factors, especially oil prices and income from external economic activities. Additionally, it should account for potential delays in the export response to changes in the broader macroeconomic environment.

Conclusion

Based on the results obtained in the previous section, the following conclusions can be drawn:

1. The results of the impulse response analysis indicate that short-term macroeconomic shocks exert heterogeneous effects on the export volume of the Republic of Azerbaijan. The most pronounced response is observed to an export's own shock: following a brief increase, the indicator rapidly declines and stabilizes at a low level, implying short-term inertia. The shock of total international reserves produces a weak and short-lived positive effect, which subsequently fades, suggesting that reserve policy exerts only a limited influence on export activity. Changes in Brent crude oil prices generate a significant positive response of exports in the first quarter, confirming the dependence of export revenues on oil market dynamics. The response to the base interest rate shock appears insignificant, indicating a weak relationship between monetary conditions and export performance. The impact of shocks to residents' income from foreign sources is moderate: a temporary increase is followed by stabilization, reflecting the adjustment of external economic activity to income fluctuations. Overall, the findings highlight the high sensitivity of Azerbaijan's exports to oil price shocks and the limited role of domestic financial factors.
2. The analysis of Kazakhstan's export dynamics reveals a similar pattern of short-term responses to macroeconomic shocks. The most notable reaction occurs in response to an export's own shock: an initial surge is followed by a gradual decline and stabilization, demonstrating short-term inertia. The shock of total international reserves has a mild and temporary positive impact that quickly dissipates. Variations in Brent crude oil prices elicit a marked positive response in exports during the first period, underscoring Kazakhstan's dependence on global oil price fluctuations. The response to the base interest rate shock remains weak, implying a limited transmission of monetary factors to export performance. Shocks to residents' foreign income generate a moderate effect, with a brief increase followed by a decline, which reflects the economy's adaptation to changes in external income. Overall, the short-term export dynamics of Kazakhstan are primarily driven by external economic conditions—particularly oil prices—while domestic financial factors have only marginal significance.
3. The results of the ARDL model reflect the impact of Brent crude oil price dynamics and total international reserves on Azerbaijan's goods exports. The results show that the negative coefficient of lagged goods exports (-0.31) indicates a slowdown in its growth despite high values in the previous period. The main factor remains residents' income from foreign sources (0.65; $p<0.01$), which has a positive effect on goods exports. The lagged dynamics of total international reserves (-0.38; $p<0.05$) have a negative short-term impact, probably due to sterilization effects. Changes in Brent crude oil prices (0.32; $p<0.01$) have a positive effect with a time lag, reflecting the dependence of goods exports on oil revenues. The model constant (0.86) confirms the presence of a stable baseline level of goods exports. Thus, in the long term, the export of goods is determined by residents income from foreign sources, while in the short term they are sensitive to fluctuations in oil prices and changes in total international reserves.
4. The results of the ARDL model also show that the dynamics of Kazakhstan's goods exports significantly depends on external economic factors. The negative coefficient of the first lag (-0.98; $p<0.01$) reflects the presence of inertia and a tendency for exports to decline after high values in the previous period. In the long term, the greatest influence is exerted by residents' income from foreign sources (0.56; $p<0.01$) and Brent crude oil prices (0.50; $p<0.01$), which confirms the dependence of export earnings on the external environment. Total international reserves have a moderate negative impact (-0.06; $p<0.1$), while the base rate is statistically insignificant. In the short term, a negative impact of changes in residents' income from foreign sources and current oil prices is noted, which may indicate temporary fluctuations in export activity. The model constant (3.18; $p<0.01$) indicates the presence of a stable level of goods exports that does not depend on the studied variables.

Based on the obtained results, it follows that the combination of impulse analysis and ARDL modeling made it possible to identify differences between short-term adaptation reactions and long-term factors in the formation of goods exports, which confirms the feasibility of using a combined econometric approach.

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