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Article

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The Relationship between the Return of Energy Companies Listed on the Kazakhstan Stock Exchange and the Exchange Rate, KASE Index, and Gold Return: ARDL Bounds Value Approach

Baltaim Sabenova[1], Lyazat Talimova[2], Meruert Kanabekova[3], Dilyara S. Zhakipbekova[4], Gulnara Seitova[5], Gulbana Erzhigitovna Maulenkulova[4]*, Artur Bolganbayev[6]

[1]Peoples' Friendship University Named after Academician A. Kuatbekov, Shymkent, Kazakhstan, [2]Karaganda University of Kazpotrebsoyuz, Karaganda, Kazakhstan, [3]Abai Kazakh National Pedagogical University, Almaty, Kazakhstan, [4]Mukhtar Auezov South Kazakhstan University, Shymkent, Kazakhstan, [5]A. Baitursynov Kostanay Regional University, Kostanay, Kazakhstan, [6]Khoja Akhmet Yassawi International Kazakh-Turkish University, Turkestan, Kazakhstan. *Email: maulenkulovagulbana@gmail.com

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ABSTRACT

In a free market economy, stock market indices are influenced not only by national economic developments, but also by economic indicators such as gold, exchange rates, and oil. It is important to consider these indicators when analyzing the returns of companies traded on the stock exchange. Internal factors that impact stock market returns include the company's estimated earnings and changes in the company's financial structure. External factors include macroeconomic variables such as exchange rates, interest rates, gold prices, and Gross Domestic Product (GDP). A study analyzed the relationship between the returns of energy companies traded on KASE and the KASE index, exchange rate, and gold return during the period of January 01, 2023- April 01, 2024 (328 trading days) using the ARDL Bounds Value Approach. The research findings indicate that the stock market composite index, foreign exchange, and gold returns have a long-term effect on the returns of energy companies. Particularly, the long-term effect of the stock market composite index return is found to be significant and positive for all three assets. Additionally, the effect of companies' past values has been observed as negative. According to the error correction model analysis, a key finding is that shocks to company returns will reach equilibrium in a short time, approximately one trading day. These results can provide decision support, especially for investors, when investing in energy companies.

Keywords: Kazakhstan, Kazakhstan Stock Exchange, Exchange Rate, Stock, Gold Yield, Energy Companies, Autoregressive Distributed Lag
JEL Classifications: C13, C20, C22

1. INTRODUCTION

Kazakhstan declared independence on December 16, 1991, following the collapse of the Soviet Union. To overcome the economic challenges experienced after independence, Kazakhstan has implemented significant structural reforms to transition to a free market economy (Bekzhanova et al., 2023; Yesbolova et al., 2024; Niyetalina et al., 2023). These reforms included introducing the national currency Tenge, launched on November 15, 1993, maintaining price stability in the market, controlling inflation during the transition period, accelerating privatizations to promote free entrepreneurship, and implementing new fiscal and monetary policies. This rapid transformation in the economic field has been a long and challenging process for Kazakhstan (Sultanova et al., 2024). By the 2000s, the issues stemming from economic reforms began to decrease, and Kazakhstan's economy started to grow, drawing attention from other former Soviet states (Dyussembekova et al., 2023; Ibyzhanova et al., 2024).

After gaining independence, the Kazakhstan economy faced four significant crises: The dissolution of the USSR, the Asian crisis in 1998, the crisis caused by Western countries in 2007-2008, and the COVID-19 crisis (Sartbayeva et al., 2023). Kazakhstan, having implemented radical structural reforms in the economy after gaining independence, successfully navigated these global crises, leveraging its abundant natural resources, including approximately 3% of the world's total oil reserves, around 1.1% of natural gas reserves, and roughly 3.3% of coal reserves (Mudarissov and Lee, 2014; Xiong et al., 2015; Mashirova et al., 2023; Issayeva et al., 2023).

On November 17, 1993, Kazakhstan established the Kazakhstan Interbank Currency Exchange to facilitate the transition to a free market economy. This exchange, later renamed the Kazakhstan Stock Exchange (KASE) in 1996, is overseen by the National Bank of the Republic of Kazakhstan and comprises 23 leading Kazakh banks. KASE is responsible for organizing the national money market and is the primary trading platform for stocks, foreign exchange, and money markets in Kazakhstan (Gnahe, 2021; https://kase.kz/en/history/). Stock markets play a key role in collecting savings from various sources and directing them towards productive investments, thus supporting economic activities by facilitating transactions between savers and those in need of financing. Furthermore, stock exchanges foster economic growth by enabling the allocation of funds to different sectors, contributing to a country's economic stability. Various macroeconomic variables influence investors' preferences and stock choices. Policymakers develop policies by considering these macroeconomic factors, which are crucial as they affect stock returns and serve as leading indicators of economic activities. A stock market crash often signals challenging economic conditions and can result in an overall decline in a country's economic activity. Particularly in developing countries, macroeconomic variables significantly impact stock markets, influenced by global policies and events (Gnahe, 2021; Tiwari and Gupta, 2015; Attari and Safdar, 2013).

Gold has held significant importance among people since ancient times due to its unique properties (Toraman et al., 2011; Bilal et al., 2013). Initially used for jewelry, gold later became a standard for the monetary system when it began to be used as coins. This led to the emergence of the gold standard in the 19th century, with countries using gold for invoices and gold certificates. After World War II, the Bretton Woods System was established, where the USA and many other countries fixed their currencies to the value of gold. According to this system, 1 Dollar was equivalent to 1 Ounce, that is, 31.1 g of gold. However, due to economic changes and system difficulties, the Bretton Woods System officially ended in 1971 (Bhunia and Mukhuti, 2013). Since then, gold has been utilized as a commodity in the global market, particularly as a safe haven in times of war or crisis to minimize high risks. This has attracted the attention of researchers to explore the relationship between gold, exchange rates, stock market indices, and other economic variables (Arouri et al., 2012).

The exchange rate is an important macroeconomic variable that affects stock values and is defined as the equivalency of a foreign currency to a local currency. The demand for deposits in foreign currency is one of the factors affecting the demand for other financial assets. The main factor determining this demand is the future value of the deposit, and nominal interest rates provide important information in this regard. The future value of a deposit in a foreign currency generally depends on two factors: (1) the nominal interest rate offered by the deposit and (2) the change in the expected value of the relevant currency against the other currency. Profit opportunities arising from the transition between currencies can also be observed among investment instruments. Therefore, there is a relationship between exchange rates and stock values (Isard, 1995).

In a free market economy, stock market indices interact not only with national economic developments but also with economic indicators such as gold, exchange rates, and oil. It is important to consider these indicators when analyzing the performance of companies traded on the stock exchange. Internal factors that influence stock market returns include the company's estimated earnings and changes in the company's financial structure. External factors can be listed as macroeconomic variables such as exchange rates, interest rates, gold prices, and Gross Domestic Product (GDP). So, in this study, the relationship between the returns of energy companies (KZAP, KZTO, and KEGC) traded on KASE and the exchange rate, KASE index, and gold return in the period of January 01, 2023- April 01, 2024 (328 trading days) was analyzed using the ARDL Bounds Value Approach. Research data was obtained from https://www.investing.com/.

2. LITERATURE REVIEW

The number of publications on the Kazakhstan economy and KASE, which holds a significant position among the economies of developing countries in academic literature, is increasing. This overview provides information about the main publications related to the subject and the research methods involved.

Basit's study (2013) examined the impact of the KSE-100 Index on oil and gold prices in the Pakistani market. The researcher used available secondary data for the KSE-100 Index, oil prices, and gold prices from 2005 to 2011. In the study, the KSE-100 Index was considered the independent variable, while oil prices and gold prices were the dependent variables. The researcher conducted separate simple regression models for both dependent variables and concluded that there was no significant relationship between these variables.

Bhunia's study (2013) analyzed the cointegration relationships between crude oil price, domestic gold price, and selected financial variables (exchange rates and stock price indices) in India. The study data were obtained from BSE, NSE, and World Gold Council databases and the data period was between January 2, 1991, and October 31, 2012. The analysis included the ADF unit root test, Johansen cointegration test analysis, and Granger causality test. The results of the analysis identified causality from the exchange rate to gold prices, but no causality between oil prices and the exchange rate.

In a study by Monjazeb and Shakerian (2014), the reaction of bank stock returns to world oil and gold prices for seven banks in Iran was analyzed using data from the 2008 to 2012 period. The panel data method was employed in the analysis. The research found that world oil prices had a significant positive effect with a lag on stock returns, while gold prices had a significant negative effect. Additionally, it was observed that exchange rate and interest rate had a negative effect, while inflation and gross domestic product (GDP) had a positive effect on bank stock returns.

Bouri et al. (2017) conducted a study on the impact of gold prices on the stock market prices of India and South Africa. They used monthly data from 1997 to 2017 and found that the variables used contained unit roots. They applied an asymmetric ARDL model to analyze the data and rejected the null hypothesis that there is no asymmetric effect of gold prices on both South African and Indian stock markets in the short and long term.

Another study by Delgado et al. (2018) focused on the analysis of oil price, exchange rate, and stock market index variables in Mexico from January 1992 to June 2017. The Vector Autoregressive Model (VAR) was used. The research revealed a negative and statistically significant effect of the exchange rate on the stock market index. It was observed that an appreciation in the exchange rate corresponded with an increase in the stock market index. The study also found that the consumer price index had a positive effect on the exchange rate and a negative effect on the stock market index.

Tursoy and Faisal (2018) examined the interactions between stock prices, gold prices, and crude oil prices in Turkey using monthly data from January 1986 to November 2016. They used the autoregressive distributed lag (ARDL) model to estimate cointegration and short-term relationships. The study also validated the robustness of the ARDL bounds test using a joint cointegration method, which supported a strong long-run relationship. Additionally, FMOLS, DOLS, and CCR cointegration equations were used to examine the long-run coefficients between variables. The findings indicated a negative relationship between gold prices and stock prices and a positive relationship between crude oil prices and stock prices in both short-term and long-term results. Additionally, the Granger causality test detected a unidirectional causality from gold prices to stock prices, both in the short-term and long-term.

In a study conducted by Syzdykova et al. (2019), the authors aimed to analyze the impact of exports and imports on national income using quarterly data from Kazakhstan for the period 2000-2017. They utilized the autoregressive distributed lag (ARDL) model in their analysis. The research findings indicated that both an increase in exports and imports in Kazakhstan led to a rise in the country's gross domestic product (GDP). Specifically, a 1% increase in exports resulted in a 0.38% increase in GDP in the long run, whereas a 1% increase in imports led to a 0.42% increase in GDP. Additionally, the study revealed that the long-term effect of exports was more substantial than the short-term effect, while imports initially had a negative impact on economic growth, but a positive impact in the long term. The researchers also established that the income elasticity of imports was statistically significant and positive, showing that a 1% increase in economic growth increased imports by 0.60%.

In another study conducted by Shabbir et al. (2020), the researchers examined the influence of gold and oil prices on the stock market in Pakistan for the period 1991-2016. They analyzed the research data using descriptive statistics, augmented Dickey-Fuller test, correlation, and autoregressive distributed lag test. Their findings indicated that gold and oil prices had a significant impact on the stock market.

The study by Stoian and Iorgulescu (2020) explored the semi-strong market efficiency hypothesis concerning fiscal policy information in the Bucharest Stock Exchange. They utilized the ARDL Bounds testing approach to analyze the research data. Their findings revealed that in the long term, stock prices fully reflected past fiscal policy information, while in the short term, there was a lagged relationship with expected fiscal policy information, and the Romanian stock market reacted to unexpected fiscal policy news. Furthermore, the study found that monetary policy information was not effectively integrated into stock prices, and its impact on stock returns was greater than that of fiscal policy.

In a recent study, Baimaganbetov et al. (2021) conducted an empirical analysis of the impact of real oil price shocks on food inflation in Kazakhstan. They utilized a VAR model and examined monthly data from 2004 to 2019. Due to potential breaks in the data, the researchers used the Zivot and Andrews (2002) unit root test, which showed that food prices were I(1), while the ADF test indicated I(0). Additionally, they investigated the causal relationship between the variables, determined bidirectional causality between oil and food prices, and analyzed the short-term effects of variables using the VAR model. They found that crude oil prices indirectly influence food prices.

In their study, Omar et al. (2022) empirically analyzed the macroeconomic factors influencing the development of Pakistan's stock market from 1980 to 2019. They employed Ng-Perron and Zivot-Andrews unit root tests and applied the Autoregressive Distributed Lag (ARDL) bounds test to ascertain the integrated orders of the variables. The findings confirmed cointegration among the variables. The study revealed that economic growth and the development of the banking sector had positive effects on the stock market, while inflation, foreign direct investment, and trade openness had negative effects in the long term. The short-term analysis showed that economic growth, inflation, and foreign direct investment have significant relationships with the development of the stock market.

Bin Amin and Rehman (2022) analyzed the asymmetric effects of oil prices, money supply, and the Tadawul All Share Index (TASI) on sectoral stock prices in Saudi Arabia. They used the NARDL (Nonlinear Auto-Regressive Distributive Lag) approach to examine monthly data from January 2007 to December 2016. The research findings indicated that positive oil price shocks had a stronger impact than negative shocks on certain sectors like construction, energy utilities, and petrochemical sectors, and high oil prices negatively affected the stock prices of the banking and financial services sectors. In addition, research has shown that the Saudi stock market's development exhibits both long-term and short-term asymmetric relationships with the stock prices of banking and financial services, energy and utilities, and petrochemical sectors. However, there is only a long-term asymmetric relationship with the construction sector. It has been concluded that money supply does not have a long-term and short-term asymmetric effect on the construction, energy public services, and petrochemical sectors, but it does have a long-term asymmetric relationship with the banking and financial services sectors.

In his study, Jindal (2023) analyzed the relationship between the Indian stock market and commodities such as oil, gold, silver, and exchange rates. The Nifty index is used to represent the Indian stock market. The analysis applied ARDL and VAR methods. The research findings indicate that the exchange rate and crude oil have a significant relationship with the stock market, whereas other variables such as gold and silver have an insignificant relationship. This suggests that gold and silver do not have any impact on the stock market in the long run.

3. METHODS

Cointegration analysis is a widely used method to analyze the relationship between two or more variables in econometric time series analysis. However, cointegration tests have limitations such as requiring the variables in the model to be stationary at the same level and needing large samples. The ARDL (Autoregressive Distributed Lag) boundary test addresses these limitations by allowing flexibility in including variables that are stationary at level I(0) or I(1) at the first difference. But, as mentioned above, there are criticisms that cointegration methods are not reliable for small sample sizes (Narayan and Narayan, 2005). Moreover, the ARDL method can be applied to data sets with small sample sizes, which is crucial considering that data are often published in annual periods (Pesaran et al., 2001). Considering that national macro indicators are predominantly published in annuals, this advantage is of critical importance.

The ARDL model with two independent variables has the following mathematical structure:

$$\Delta Y_t = a_0 + \sum_{i=0}^{m} a_{1i}\Delta Y_{t-i} + \sum_{i=0}^{m} a_{2i}\Delta M_{t-i} + \sum_{i=0}^{m} a_{3i} EY_{t-i} + a_{4i}\Delta Y_{t-1} + a_{5i}\Delta M_{t-1} + a_{6i}\Delta E_{t-1} + u_t \quad (1)$$

ARDL is a two-stage method. In the first stage, it tests whether there is a long-term relationship between the variables. If a long-term relationship is confirmed, the second step involves estimating and testing the short and long-term coefficients (Narayan and Smyth, 2006). If there is no long-term relationship, ARDL regression coefficients are estimated. The determination of a long-term relationship is examined using the boundary test based on the F statistic.

The results of the ARDL bounds test are evaluated as follows:

- If F statistics < I(0) Limit, there is no cointegration relationship
- If F statistics > I(1) Limit, there is a cointegration relationship
- If I(0) Limit < F statistics < I(1) Limit, the cointegration relationship cannot be evaluated (Pesaran et al., 2001).

ARDL analysis involves two preparation steps. The first step is to check the stationarity of the series. This study used the ADF unit root test for this. The second step is to determine the delay length, which commonly uses criteria such as the Akaike Information Criterion (AIC), Schwartz Information Criterion (SIC), Log-maximum likelihood (LogL), Bayesian information criterion (BIC), and the Hannan-Quinn information criterion (HQ).

After obtaining the model, it's important to test the compatibility and goodness of the model. This study used the Breusch-Godfrey-LM test to detect autocorrelation, the White Test and Breusch-Pagan-Godfrey test to identify heteroscedasticity, and the Ramsey Reset test as a functional form test (Austine et al., 2022). The CUSUM and CUSUMSQ tests developed by Brown et al. (1975) are also used to examine for a structural break in the estimated model, and the results are presented graphically.

The first step in time series analysis is to check the stationarity of the series. Common tests used for this purpose include ADF (Augmented Dickey-Fuller), Phillips-Perron (PP), and Kwiatkowsky-Philips-Schmidt-Shin (KPSS). In this study, the ADF (Augmented Dickey-Fuller) test was utilized to examine the series' stationarity. Test statistics are as follows:

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

If the ADF test rejects the null hypothesis for the values, then the series is stationary at the relevant level (Ng and Perron, 2001).

4. DATA AND FINDINGS

For energy companies traded on the Kazakhstan stock exchange, it is expected that the stock market composite index to have an impact on the companies' stock returns. Furthermore, as a result of the financial markets and the economic environment of Kazakhstan, it is expected that the gold and foreign exchange returns, which are important parameters, to have an impact on the returns of the mentioned companies. This study aims to investigate the effect of these factors using the ARDL bounds test method. The research data consists of daily return data from 328 trading days between January 01, 2023 and April 01, 2024. The data was sourced from www.investing.com (Access date: May 01, 2024).

The descriptive statistical information of the research series will be presented first in this section. Unit root test findings, which are essential for econometric analyses, will be examined next. The results will be interpreted by applying ARDL bounds value analysis for the series made stationary according to the unit root test findings. An ARDL model was created separately for each of the three energy companies traded on the stock exchange: Model 1 for KEGC, Model 2 for KZAP, and Model 3 for KZTO. In all three models, the independent variables are stock market composite index return, exchange rate return (USD), and gold price return.

Table 1 presents descriptive statistics findings for the variables. The table shows that the average value of GOLD, KASE, KZAP, and KZTO assets is positive, while the return of KEGC and USD is negative in the research period. Additionally, the skewness values indicate that only KEGC has a skewed return distribution, while the other assets have a symmetrical (normal distribution-like) return structure.

Table 2 displays ADF unit root test findings for the variables. The findings show that all research variables are stationary at the 5% significance level. Based on this finding, the current values of the variables were used in the ARDL models.

In the ARDL models, determining the number of lags is an important step. In this study, the possible models were assessed according to LogL, AIC, BIC, and HQ criteria, and the adjusted R-square value of each ARDL regression model was calculated. Table 3 presents the criterion values for three ARDL models that best fit the research model. Based on these values, we decided to use the ARDL model with lag (2, 0, 0, 0) for KEGC, ARDL (1, 0, 1, 0) for KZAP, and ARDL (2, 0, 2, 0) for KZTO.

The ARDL bounds test results, which determine if there is a long-term relationship according to the ARDL model, are provided in Table 4. The F values calculated for all three models exceeded the critical I(1) value recommended by Pesaran et al. (2001) at the 5% significance level. As a result, it was concluded that there exists a long-term relationship between the variables. Consequently, the ARDL long-term form and error correction regression model are used.

Diagnostic test values play a crucial role in assessing the compatibility of the ARDL regression model. Table 5 indicates that all three models exhibit no autocorrelation issues based on the Breusch-Godfrey test, no heteroscedasticity problems according to the Breusch-Pagan-Godfrey test, normally distributed residuals as per the Jarque-Bera test and no model specification errors based on the Ramsey RESET test.

Another criterion showing the compatibility of the ARDL regression model is diagnostic test values. Table 5 includes the CUSUM and CUSUMSQ tests (Brown et al., 1975). The findings of the three analysis models are given in Graph 1. Tests show that the models show no structural breaks and provide stable results.

Table 6 presents the ARDL model findings and long-term prediction values for KEGC. The model predicts that the lagged values of KEGC, stock exchange composite index, and gold return have a significant effect at the 10% significance level, while the dollar return is statistically insignificant. Additionally, the lagged values of KEGC are shown to have a negative effect. Consistent with the model's predictions, the stock exchange composite index and gold return are predicted to have a positive and significant long-term effect.

After establishing the presence of cointegration based on the bounds test and long-term prediction results, the ARDL error correction model findings are presented in Table 7. The impact of the error correction term and the lagged value of KEGC were found to be statistically significant. The error correction term falling between −1 and 0 (−0.83) indicates a convergence toward the equilibrium value (Alam and Quazi, 2003). This means that with a correction term of −0.83, approximately 83% of the shocks to KEGC can be eliminated within one trading day, estimating the time to reach equilibrium at 1.21 trading days. The corrected R-square value of the model was calculated as 0.51, indicating that 51% of the variability in KEGC is explained by the Stock Exchange composite index, gold, and dollar returns through the model.

Table 8 presents the ARDL model findings and long-term prediction values for KZAP. According to the model prediction, it is evident that the lagged values of KZAP, the value of the Stock Exchange composite index, and the impact of gold and dollar return values are significant at the 10% significance level, while the difference in the dollar return is statistically insignificant. Moreover, it is observed that the lagged values of KZAP have a negative effect. The findings are consistent with the model prediction, indicating that the stock market composite index, dollar, and gold returns have a significant effect on long-term predictions, with the effect of gold returns being negative.

Following the determination of cointegration via the bounds test and long-term estimation findings, the ARDL error correction model findings are presented in Table 9. The findings indicate that the error correction term has a statistically significant effect. With the error correction term at −0.83, there is convergence towards the equilibrium value, signifying that approximately 83% of the shocks to KEGC can be rectified within one trading day, estimating the time

Table 1: Descriptive statistics findings for the variables

Statistics		KEGC	KASE	KZAP	KZTO	USD
Mean	0.000637	−0.00019	0.001434	0.001060	0.000383	−0.00018
Median	0.000200	0.000000	0.001233	0.000100	−0.00068	−0.00065
Maximum	0.031100	0.019300	0.021800	0.039900	0.110600	0.017700
Minimum	−0.0279	−0.048	−0.0187	−0.0368	−0.0921	−0.018
SD	0.008089	0.006135	0.004847	0.011419	0.016798	0.005164
Skewness	0.192885	−2.87145	−0.07179	0.488728	0.669233	0.279073
Kurtosis	4.356353	23.14222	5.040911	4.794950	16.02308	4.104021
Observations	328	328	328	328	328	328

SD: Standard deviation

Table 2: ADF unit root test findings for the variables

Variable	T-statistics	P*
Gold	−17.9509	0.0000
KEGC	−9.91198	0.0000
KASE	−10.7111	0.0000
KZAP	−14.8193	0.0000
KZTO	−17.1207	0.0000
USD	−18.0799	0.0000
Test critical values		
1% level	−2.57205	
5% level	−1.9418	
10% level	−1.61605	

ADF: Augmented Dickey-Fuller

Table 3: Autoregressive distributed lag model selection criteria values

Model specification	LogL	AIC	BIC	HQ	Adjusted R^2
KEGC					
ARDL (2, 0, 0, 0)	1197.018362	−7.35197	−7.28195	−7.32402	0.030871
ARDL (2, 1, 0, 0)	1197.465699	−7.34855	−7.26687	−7.31595	0.030494
ARDL (2, 4, 0, 0)	1200.326592	−7.3477	−7.23101	−7.30112	0.038365
KZAP					
ARDL (1, 0, 1, 0)	1023.598965	−6.28148	−6.21146	−6.25353	0.178468
ARDL (1, 0, 0, 0)	1022.518610	−6.28098	−6.22263	−6.25769	0.175564
ARDL (4, 0, 0, 0)	1025.408774	−6.2803	−6.18695	−6.24304	0.182453
KZTO					
ARDL (2, 0, 2, 0)	874.808530	−5.35067	−5.25732	−5.31341	0.048436
ARDL (2, 0, 0, 0)	872.593072	−5.34934	−5.27933	−5.32139	0.041401
ARDL (2, 0, 2, 1)	875.432842	−5.34835	−5.24333	−5.30643	0.049087

AIC: Akaike ınformation criterion, BIC: Bayesian information criterion, HQ: Hannan-Quinn, ARDL: Autoregressive distributed lag

Table 4: Autoregressive distributed lag bounds test findings

Test statistic	Value	Significant (%)	I (0)	I (1)
KEGC				
F-statistic	24.55104	10	2.37	3.2
k	3	5	2.79	3.67
-		2.5	3.15	4.08
-		1	3.65	4.66
KZAP				
F-statistic	64.15110	10	2.37	3.2
k	3	5	2.79	3.67
-		2.5	3.15	4.08
-		1	3.65	4.66
KZTO				
F-statistic	40.87839	10	2.37	3.2
k	3	5	2.79	3.67
-		2.5	3.15	4.08
-		1	3.65	4.66

Table 5: Autoregressive distributed lag diagnostic test findings

Variables/Tests	Statistics	P
KEGC		
Breusch-godfrey serial correlation LM test	F-statistic: 0.187976	Prob. F (2.318): 0.8287
Heteroskedasticity test: Breusch-pagan-godfrey	F-statistic: 1.35689	Prob. F (5.320): 0.24016
Ramsey reset test	F-statistic: 0.763533	Prob. F (1.319): 0.3829
Test of normality	Jarque-Bera: 1.66569	Prob. 0.4348
KZAP		
Breusch-godfrey serial correlation LM test	F-statistic: 0.267337	Prob. F (2.319): 0.7656
Heteroskedasticity test: Breusch-Pagan-Godfrey	F-statistic: 0.633111	Prob. F (5.321): 0.6746
Ramsey reset test	F-statistic: 0.319266	Prob. F (1.320): 0.5724
Test of normality	Jarque-Bera: 1.09043	Prob. 0.5797
KZTO		
Breusch-godfrey serial correlation LM test	F-statistic: 0.201261	Prob. F (2.316): 0.8178
Heteroskedasticity test: breusch-pagan-godfrey	F-statistic: 1.056284	Prob. F (7.318): 0.3048
Ramsey reset test	F-statistic: 1.615329	Prob. F (1.317): 0.2047
Test of normality	Jarque-Bera: 2.87802	Prob. 0.2372

Graph 1: 95% confidence interval for CUSUM and CUSUMSQ test

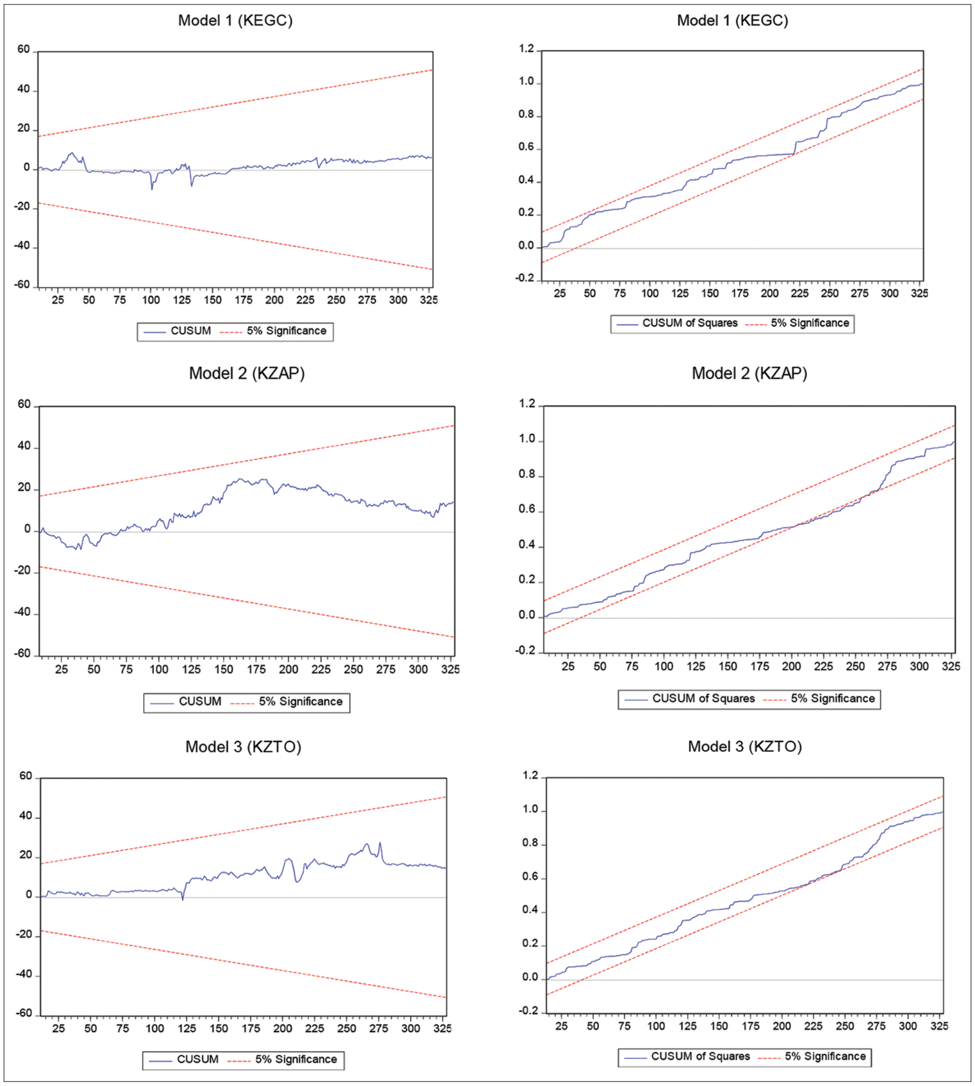

Table 6: Autoregressive distributed lag model and long-term prediction findings for KEGC

Variable	Coefficient	SE	T-statistic	P
Prediction findings for the model (KEGC)				
C	−0.00038	0.00035	−1.08009	0.28090
KEGC (−1)	−0.83200	0.07690	−10.81982	0.00000
KASE	0.11851	0.06922	1.71211	0.08780
Gold	0.08161	0.04167	1.95841	0.05110
USD	−0.00321	0.06542	−0.04902	0.96090
D (KEGC[−1])	−0.15098	0.05499	−2.74578	0.00640
Long-term prediction findings				
KASE	0.14244	0.08423	1.69109	0.09180
Gold	0.09809	0.05038	1.94682	0.05240
USD	−0.00385	0.07859	−0.04904	0.96090
C	−0.00046	0.00042	−1.08003	0.28090

EC=KEGC − (0.1424 × KASE+0.0981 × GOLD−0.0039 × USD−0.0005). SE: Standard error

to reach equilibrium at 1.21 trading days. The corrected R-square value of the model was calculated as 0.499, indicating that 49.9% of the variability in KZAP is explained by the Stock Exchange composite index, gold, and dollar returns through the model.

Table 7: Autoregressive distributed lag error correction regression model findings for KEGC

Variable	Coefficient	SE	T-statistic	P
D (KEGC[−1])	−0.15098	0.05399	−2.79664	0.00550
CointEq(−1)	−0.83200	0.07463	−11.14853	0.00000
R^2	0.51138	Mean dependent variable		0.00000
Adjusted R^2	0.50988	SD, dependent variable		0.00860
SE of regression	0.00602	Akaike info criterion		−7.38147
Sum squared resid	0.01174	Schwarz criterion		−7.35824
Log likelihood	1205.179	Hannan−Quinn criter		−7.37220
Durbin-Watson statistics	2.01429			

SE: Standard error, SD: Standard deviation

Table 10 shows the findings of the ARDL model and long-term predictions for KZTO. According to the model, the lagged values of KZAP, the Stock Exchange composite index, the lagged value of gold return, and the dollar return have a significant effect at a 10% significance level. Additionally, it was found that the lagged values of KZTO have a negative effect. Consistent with the model's predictions, the stock market composite index, dollar, and gold returns have a significant

Table 8: Autoregressive distributed lag model and long-term prediction findings for KZAP

Variable	Coefficient	SE	T-statistic	P
Prediction findings for the model (KZAP)				
C	−0.00020	0.00060	−0.32759	0.74340
KZAP (−1)	−0.83408	0.05040	−16.54962	0.00000
KASE	0.85441	0.11901	7.17903	0.00000
Gold (−1)	−0.16709	0.10085	−1.65687	0.09850
USD	0.23234	0.11164	2.08112	0.03820
D (Gold)	−0.04878	0.07108	−0.68624	0.49310
Long-term prediction findings				
KASE	1.02437	0.15241	6.72122	0.00000
Gold	−0.20033	0.12120	−1.65289	0.09930
USD	0.27856	0.13518	2.06067	0.04010
C	−0.00024	0.00073	−0.32704	0.74390

EC=KZAP − (1.0244 × KASE−0.2003 × GOLD + 0.2786 × USD − 0.0002).
SE: Standard error

Table 9: Autoregressive distributed lag error correction regression model findings for KZAP

Variable	Coefficient	SE	T-statistic	P
D (Gold)	−0.04878	0.05013	−0.97317	0.33120
CointEq(−1)	−0.83408	0.04628	−18.02089	0.00000
R^2	0.50010	Mean dependent variable		−0.00001
Adjusted R^2	0.49856	SD, dependent variable		0.01457
SE, of regression	0.01032	Akaike info criterion		−6.30382
Sum squared resid	0.03460	Schwarz criterion		−6.28064
Log likelihood	1032.675	Hannan−Quinn criterion		−6.29458
Durbin-Watson statatistics	2.02242			

SE: Standard error, SD: Standard deviation

Table 10: Autoregressive distributed lag model and long-term prediction findings for KZTO

Variable	Coefficient	SE	T-statistic	P
Prediction findings for the model (KZTO)				
C	−0.00068	0.00096	−0.70979	0.47840
KZTO(−1)	−1.03970	0.07523	−13.82040	0.00000
KASE	0.69515	0.18963	3.66581	0.00030
Gold (−1)	0.13655	0.19602	0.69663	0.48650
USD	−0.33776	0.17879	−1.88914	0.05980
D (KZTO[−1])	0.10929	0.05496	1.98858	0.04760
D (Gold)	0.02899	0.11338	0.25566	0.79840
D (Gold [−1])	−0.21251	0.11417	−1.86139	0.06360
Long-term prediction findings				
KASE	0.66861	0.18571	3.60028	0.00040
Gold	0.13134	0.18965	0.69253	0.48910
USD	−0.32486	0.17290	−1.87889	0.06120
C	−0.00065	0.00093	−0.70785	0.47960

EC=KZTO − (0.6686 × KASE + 0.1313 × GOLD − 0.3249 × USD−0.0007).
SE: Standard error

effect on long-term predictions, with the effect of dollar returns being negative.

Table 11 presents the findings of the ARDL Error Correction Regression model for KZTO. After establishing the existence of cointegration via the bounds test and long-term estimation findings, the model showed that the error correction term and the lagged values of KZTO and gold were statistically significant. The error correction term value of −1.04 indicates that shocks on KZTO can be eliminated in <1 trading day, and the time to reach equilibrium may be shorter than one trading day. The corrected R-square value of the model was calculated as 0.504, indicating that 50.4% of the variability in KZTO is explained by the Stock Exchange composite index and gold and dollar returns through the model.

Table 11: Autoregressive distributed lag error correction regression model findings for KZTO

Variable	Coefficient	SE	T-statistic	P
D (KZTO[−1])	0.10929	0.05429	2.01312	0.04490
D (Gold)	0.02899	0.09175	0.31594	0.75230
D (Gold [−1])	−0.21251	0.09223	−2.30399	0.02190
CointEq (−1)	−1.03970	0.07227	−14.38621	0.00000
R^2	0.50809	Mean dependent variable		−0.00003
Adjusted R^2	0.50350	SD, dependent variable		0.02316
SE of regression	0.01632	Akaike info criterion		−5.38044
Sum squared resid	0.08578	Schwarz criterion		−5.33397
Log likelihood	881.011	Hannan−Quinn criterion		−5.36189
Durbin-Watson statistics	2.00452			

SE: Standard error, SD: Standard deviation

5. CONCLUSION AND RECOMMENDATIONS

The returns of companies traded on the stock exchange are influenced by the returns of other companies. The simplest way to analyze this connection is by comparing the returns of the relevant company with the returns of the stock market composite index. It is also a well-known fact that the company's return is influenced by domestic and international economic indicators. This study focused on analyzing the impact of the stock market composite index, gold, and foreign exchange returns on the returns of energy companies traded on the stock exchange. The most important finding is that the stock market composite index, foreign currency, and gold returns have a long-term effect on the returns of energy companies. The study found that the stock market composite index, foreign currency, and gold returns have a long-term effect on the returns of energy companies. Additionally, it was observed that the companies' past values have a negative effect. According to the error correction model analysis, shocks to the company's returns reach equilibrium in a short time, typically within one trading day. These findings are valuable for investors, providing decision-support information when investing in energy companies. Furthermore, the corrected r-square value of around 50% indicates that there may be significant effects of variables not included in the model. Therefore, it is suggested that incorporating assets or funds traded in international markets into the model could enhance its descriptive power.

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