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Predicting Stock Market Indicators by Utilizing a Hybrid ARIMA-GARCH Model

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Abstract:
The research aims to compare the results of forecasting financial market indicators in the Arabian Gulf using the hybrid ARIMA-GARCH model. The study assumes the efficiency of the hybrid ARIMA-GARCH model for predicting financial indicators. The hybridization technique starts by picking the best autoregressive integrated moving average model for predictions, which is found using an automatic selection function that identifies the models with the best statistical fit. The models chosen in the previous step serve as inputs to use the (1,1,1) GARCH model for the prediction. Both models predict financial market indicators from outside the sample for 12 months. Finally, we compared the actual closing points of the market indicators with the prediction results of the two models. The research concludes that ARIMA models are practical and efficient in predicting the indices of the Kuwait Stock Exchange and the Manama Stock Exchange. By contrast, the GARCH model outperformed the ARIMA model in predicting the Saudi Stock Exchange index and achieved excellent results. The prediction results for the Iraqi stock exchange markets were unsatisfactory; however, comparing average square error calculations indicates that ARIMA models are superior. This study argues for the possibility of traditional standard models predicting financial market indicators for relatively long periods, which is not provided by previous literature that argues for the efficiency of artificial intelligence models. It also confirms that standard models can predict short periods.
Keywords: Hybrid Model, Prediction, Financial Markets, ARIMA, GARCH.

1. Introduction:

The market's indicators, investments, and economic activity reflect the increasing activity of companies listed on financial markets. There is a growing need to develop more accurate and effective methods for forecasting, which is a field of interest to investors and joint-stock companies alike. This reduces uncertainty and investment risks in these financial markets. The market index provides a comprehensive picture of the activity of companies listed on the financial market and reflects the extent of investor interest in trading.

Risk and price volatility are the real problems facing investors, as are those interested in investing in financial markets and their indices. We must develop the best methods and models to accurately predict financial investment indicators and reduce risk. Forecasting is a major area of interest for researchers, businesses, and investors. Researchers resort to using various quantitative and qualitative models to achieve the best forecasting results, which can provide more accurate and objective evidence. Numerous studies and research have been conducted on the use of hybrid forecasting models, represented by the ARIMA model and the GARCH model, to forecast financial and economic data. Many researchers have proved the effectiveness of the adopted models for prediction.

Many researchers present various models for forecasting financial data and indicators. Some choose artificial intelligence, machine learning, and deep learning, while others use econometric and econometric models. All these methods can be used for forecasting, but the key is to choose the forecasting model that best achieves the results that best suit the research purpose. The selection process often involves a careful analysis of the data characteristics and the specific objectives of the study. The most appropriate model can significantly enhance the accuracy of predictions and inform better decision-making in the financial sector. By aligning the chosen model with the unique aspects of the data, researchers can uncover insights that may otherwise remain hidden.

The current research focuses on the use of a hybrid model to quantitatively forecast financial indicators and discusses its effectiveness. The study includes several chapters: Chapter 2 reviews literature; Chapter 3 presents the theoretical framework; Chapter 4 presents the research methodology; Chapter 5 discusses the forecasting results using the hybrid model (ARIMA-GARSH) versus the actual indicators; Chapter 6 discusses the results; and Chapter 7 includes the research conclusions and proposals.

2. Literature review:

Researchers use various prediction models to achieve the best results that suit the research objectives. In our research, we focus on the literature that used the ARIMA model, the literature that used the GARCH model, and previous literature that used a hybrid technique between the two models. The ARIMA model has been widely used for forecasting, with studies using the model presented by Afeef et al. (2018), Assous et al. (2020), Dhyani et al. (2020), Meher et al. (2021), and Mashadihasanli, (2022). Ahmed Hamel & Ismael Abdulwahhab (2022), Al-samarra (2024), and Tuama Kudair * & Zaid Ibrahim (2024).

Many researchers have used the GARCH model as an important tool to predict various types of financial data. For example, (Alam et al., 2013) examined how the Autoregressive conditional heteroskedasticity model could be used to predict the volatility of the DSE20 and DSE general indices using daily data. The researchers used the GARCH and EGARCH models. Sharma and Vipul (2015), Ismail et al. (2016a), Ismail et al. (2016b), Naik et al. (2020), Afzal et al. (2021) (Sahiner, 2022), (H. Yıldırım & F.V. Bekun, 2023), Lu et al. (2023), Tayyab Raza Fraz (2024). This study focuses on the use of ARCH, GARCH, and EGARCH models.

With the complexity of financial forecasting and big data concepts, hybrid techniques using dual forecasting models have emerged. For example, Long et al. (2024) study a hybrid model for stock price forecasting based on heterogeneous data from multiple perspectives. Hybrid techniques have been widely used in literature. For example, Miswan N, Ngatiman N, and Hamzah K (2014) investigated the volatility of the Malaysian stock and real estate market using ARIMA and GARCH models. They found that the Box-Jenkins ARIMA model performs better than the GARCH model in modeling and forecasting the Malaysian stock and real estate markets. Babu and Reddy (2015) presented their research on forecasting selected Indian stocks using the ARIMA-GARCH model based on partitioning and interpolation.

Grachev (2017) compared the application of time-series models (ARIMA, GARCH, and ARMA-GARCH) for stock market forecasting. Guiao (2019) studied the forecasting of Philippine stock market prices using ARIMA-GARCH models. Nargunam et al. used a hybrid approach that combines ARIMA and GARCH models to examine how gold futures prices are likely to perform. They used a model with the standard variance stabilization transform and the ARIMA/GARCH modeling method. The standard variance transform method may give them better forecast values, whereas the ARIMA/GARCH modeling method gives them much shorter forecast periods (Nargunam et al., 2021), (Li, 2024)

Cao and Zhao (2022) investigated the prediction of stock indices based on ARIMA-GARCH and hybrid SVM models. Park et al. (2023) argue for the prediction of the Chicago Stock Exchange's volatility index under the COVID-19 pandemic: the integrated BiLSTM-ARIMA-GARCH model. The results show that the integrated model is better at predicting the volatility index in time-series regression and trend prediction than other existing models. This demonstrates the effectiveness of the model even during the pandemic.

The hybrid models (ARIMA-GARCH) were used by Arashi and Rounaghi used the ARIMA-GARCH model to examine stock indices, which are random, non-linear systems that are affected by political, economic, and psychological factors. They also modeled the daily NASDAQ stock index using the ARIMA-GARCH model. The ARIMA-GARCH model proved to be the most effective time-series model for predicting the out-of-sample stock indices. The results also demonstrate the cross-time correlation of stock price indices and the efficiency of the NASDAQ market (Arashi & Rounaghi, 2022).

Kolte et al. used a generalized autoregressive conditional heteroscedastic GARCH model to analyze the impact of updates from the United States on the returns of the S&P 500 index. In global capital markets, there is a large uncertainty gap in stock returns. Such findings have important implications for investors looking to diversify their portfolios (Kolte et al., 2023).

Rubio (2023) argues that ARIMA is the best alternative for predicting low-volatility signals using linear models. In contrast, algorithms that can capture strong non-linear patterns, such as the GARCH model, can predict high-volatility signals. For example, (Alaminos et al., 2024) study how global geopolitical events can affect the US stock market prices of the Dow Jones Aerospace and Defense Index and movements of highly volatile foreign exchange (Forex) markets. They used machine learning techniques and more sophisticated network models to make predictions. Machine learning methods have proven the effectiveness of the hybrid ARMA-GARCH model, with the ARMA-GARCH-Quantum Recurrent Neural Network technique achieving the highest accuracy in results. Xing et al. (2024) studied the prediction of NVIDIA stock prices on the following day through a comparative analysis of LSTM, MLP, ARIMA, and ARIMA-GARCH models. Burhan & Mohammed (2024) use a wavelet transform along with a combination method to create a hybrid model that merges modular discrete maximum overlap wavelet transform (MODWT), autoregressive integrated moving average (ARIMA), and the GJR-GARCH model.

Zhang and Zhou compared the performance of the hybrid model with three other models: ARIMA-EGARCH, ARIMA-SVR, and ARIMA-EGARCH-POT. The results show that the hybrid ARIMA-SVR-POT model provides accurate forecasts of returns and volatility (Zhang & Zhou, 2024). Manish Adhikari researched forecasting stock index closing points using ARIMA-GARCH within a rolling data window. The autoregressive integrated moving average (ARIMA) model finds linear trends and temporal dependencies in the time-series data. The GARCH model examines volatility clustering, which is part of the whole financial time series. Together, these models provide a complete way to make predictions (Manish Adhikari, 2024). This finding is consistent with that of Rubio (2023). Suitability of ARIMA-GARCH models for financial forecasting.

When reviewing the previous literature on forecasting models, I was unable to find any study that specifically addressed the indicators of Arab financial markets, which are considered emerging markets. Previous research has not shown a way to automatically choose highly efficient ARIMA models that do not depend on the researcher's opinion when comparing them. After selecting the most efficient ARIMA model, researchers developed a hybridization technique using the GARCH model. The research aims to answer an important question, which is: "**Does the ARIMA model provide better actual forecasting accuracy than the GARCH model? Or vice versa?". The** research is based on one main hypothesis: "**The ARIMA-GARCH hybrid model provides an efficient possibility for predicting financial indicators**."

This study is the first to predict the closing indicators of Arab financial markets for an entire year and then compare the results with real data to determine the accuracy of the prediction process. This has not been performed before. Short prediction periods are often made using the ARIMA model, not exceeding days, hours, or minutes. However, the current research attempts to study the possibility of standard prediction models (ARIMA-GARCH) for a longer period using a simple hybrid technique and testing the possibility of the models used to achieve the appropriate accuracy. The complexities that accompany the financial and investment fields include the complexity of the techniques used for prediction, the difficulty of the prediction process, and big data. There is no longer sufficient time to build algorithms that deal with financial data.

In fact, some studies have found the superiority and efficiency of prediction using standard techniques over artificial intelligence tools. A study (M. Mallikarjuna & Rao, 2019) argued that traditional models are superior to AI models. Considering the huge amount of research that uses artificial intelligence methods for prediction, this study is based on standard economic prediction methods and argues that these tools cannot be dispensed, even with the widespread use of artificial intelligence methods for prediction.

We chose the ARIMA model because it can predict market indicators with little volatility. On the other hand, the GARCH model focuses on the variance-conditional time series, which is a beneficial way to deal with high volatility. Rubio (2023) and Manish Adhikari (2024) have confirmed this. Therefore, this study proposes the use of a hybrid model (ARIMA-GARCH) to leverage the advantages of both models, thereby improving forecasting accuracy.

3.Research Methodology:

3.1. ARIMA model:

Box and Jenkins (Dinardi, 2020) present one of the main forecasting approaches to address the time-series forecasting problem, primarily through the autoregressive moving average (ARIMA) model (Xu et al., 2024). The model is an important technique for forecasting upcoming events in a time-series analysis. This model is particularly suitable for short-term forecasting(Yasmin & Moniruzzaman, 2024). The ARIMA model contains three components: (p, d, q), where p and q represent the orders of the moving average and autoregressive parts, respectively, and d represents the level of variation in the time series that achieves a suitable range of Stationary. The ARIMA model is expressed in Equation (1)(Yamacli & Yamacli, 2023).

$y_t = c + \sum_{i=1}^{p} \varphi_i x_{t-i} + \sum_{j=1}^{q} \theta_j \varepsilon_{t-1} + \varepsilon_t \ldots$. (1)

y_t represents the data on which the ARIMA model was applied and x_t is the degree of difference., φ_i represents the autoregressive coefficient, θ_j represents the parameters of the moving average, and finally ε_t shows the amount of error.

3.2. GARCH Model:

Engle (1982) first studied autoregressive conditional heteroscedasticity (ARCH) models, which have since gained widespread use for predicting extreme volatility. These models do a decent job of explaining the heteroscedasticity, which is the variance that changes over time. They do this using deterministic mapping based on past errors (Rubio et al., 2023). This model can be used to examine time-series volatility and eliminate too many data volatility peaks (Lu et al., 2023) because it also models the variance in the random error term. For the residual series from the ARIMA model, Equation (2) (Wang et al., 2023) shows the standard GARCH model.

$\sigma_t^2 = \omega + \sum_{i=1}^{p} \varphi_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \theta_j \sigma_{t-j}^2 \ldots\ldots$ (2)

σ_t^2 :conditional variance of the residual series, where ω is a constant. GARCH model with (p, q). The sum of parameters $\sum_{i=1}^{p} \varphi_i \quad and \quad \sum_{j=1}^{q} \theta_j$ for the GARCH model is less than 1.

3.3. Methodology:

This research method is different from how forecasting models and their hybridization (ARIMA-GARCH) have been used in the past. Choosing the appropriate ARIMA model for forecasting from many proposed models is one of the problems facing the use of the model for forecasting. This is because parameter estimation is sometimes subject to personal judgment. Additionally, the trial-and-error method does not consistently produce the most efficient ARIMA model. Among the many proposed forecasting models, the most efficient model must be chosen. The study found that the ARIMA auto-forecasting function was the best method for automatically selecting the best ARIMA models for forecasting each time series.

Using EViews 10, we started working on the autoregressive moving average (ARIMA) model and assessed the Stationary of the time series of the research sample. We identified the differences that ensured Stationary. The next step included estimating the autoregressive and partial autoregressive models. Subsequently, we estimated the model parameters and evaluated the proposed models by using the ARIMA automatic prediction function. We left the program to choose the model with the highest accuracy based on statistical comparison criteria.

Finding suitable GARCH models for forecasting that meet the statistical conditions for comparison poses another challenge. We use the GARCH model to forecast the financial market indicators for the research sample through hybridization, taking advantage of the outputs of the ARIMA model as inputs to the GARCH (1, 1) equation, which shows the optimal statistical conditions for forecasting. The goal of the hybridization method is to obtain the best possible results for forecasting the closing indicators of financial markets in the Arabian Gulf region.

Finally, we compared the results of both models' predictions (ARIMA-GARCH) and chose a more accurate model for the 12 months from January to December 2023. This model was based on the actual closing indicators of the financial markets in the same year.

This study utilizes data from seven financial markets. The research sample was chosen from four of these markets: the Iraq Stock Exchange Index, the Saudi Stock Exchange Index, the Kuwait First Market Index, and the Manama Stock Exchange Index. These financial markets belong to Arab countries with advanced economic capabilities in addition to the Iraq Stock Exchange Index, which is considered a country with a developing economy. These financial markets belong to Arab countries with advanced economic capabilities in addition to the Iraq Stock Exchange Index, which is considered a country with a developing economy.

The research data used the closing point of the financial market indices, which we obtained from https://sa.investing.com/markets/middle-east, which is an economic platform that covers Arab and international stock markets and features stock forums. We also obtained data from www.isx-iq.net.

The research data consists of a monthly time series spanning nine years, from January 2015 to December 2023, with 108 observations for each indicator. The research data were divided into two parts. The first part contains 96 observations for each time series and is the test data for the hybrid model (ARIMA-GARCH). The second part includes 12 observations to ensure that the forecast results are correct. The hybrid model compares the actual data from the second part, which consists of 12 observations, to the forecast results. We evaluated the best model using the mean square error.

4. Results:

Before selecting the appropriate ARIMA forecasting model, we tested the stationarity of the time series of the closing points of the financial market index in the research sample using a unit root test. We conducted this study according to the formulas used to test and select the appropriate forecasting model for each time series and financial market index in the research sample. Table (1) presents the results of the unit root test for closing points.

Table 1: Unit root test for the Stationary of time series of indicators

Market indicator	*Iraq*	*Saudi*	*Kuwait*	*Manama*
Level	0.0104	0.7138	0.8530	0.7934
1st difference	---	0.0000	0.0000	0.0000

Source: The output of the Eviews10 program**.**

Based on the unit root test, the financial market indicator series are unstable at this level. However, the Iraq Stock Exchange had a significance level of 0.0104. This meant that the first difference in the unstable financial market indicator data had to be considered.

We processed the data for the non-stationary time series using the first-difference method. Autocorrelation and partial autocorrelation tests were then performed to determine the parameters of the proposed models. This study used Arima's auto predict function to select the best ARIMA model to forecast financial market indices for the research sample. This allowed EViews 10 to select the best model for each series based on the statistical criteria. EViews 10 selected the models listed in Table (2).

Table 2: Selected ARMA models

Market indicator	*Iraq*	*Saudi*	*Kuwait*	*Manama*
Number of estimated models	25	72	80	36
Selected ARMA model:	(3,0,2)	(1,1,1)	(2,1,2)	(2,1,2)
Prob. (AR)	0.0000	0.0000	0.0000	0.0000
Prob. (MA)	0.9911	0.0000	0.0000	0.0000
R-squared	0.940522	0.045682	0.185318	0.218046
Adjusted R-squared	0.936512	0.014221	0.139549	0.174116
Prob(F-statistic)	0.000000	0.232953	0.002339	0.000469

Source: The output of the Eviews10 program**.**

Table (2) presents the statistical results of the automatic selection of the ARIMA models. Based on the models selected in the previous step, we forecast the closing points of the financial market indices using ARIMA models for the 12-month period of 2023.

Table (3) displays the GARCH models selected for the financial market indicator forecasting. The ARIMA automatic forecasting function provides the best model to choose from. We hybridized previously selected ARIMA models as inputs for testing GARCH models. This was followed by evaluating the ARCH-GARCH effects models to determine whether the proposed models were successful at predicting the research indicators. We tested the GARCH models (0,1), (1,0), and (1,1) and then applied the models that met the statistical conditions for prediction. We also tested the homogeneity of variance in the proposed models to forecast the financial market indicators. We adopted the F and (Obs*R-squared) statistics for forecasting purposes using GARCH models because their results are greater than 0.05.

Table 3: Selected GARCH models.

Market indicator		***Iraq***	***Saudi***	***Kuwait***	***Manama***
Selected GARCH model		(1,1,1)	(1,1,1)	(1,1,1)	(1,1,1)
Heteroskedas tic-city: Arch	F-statistic	0.6996	0.7345	0.4626	0.7709
	Obs*R-squared	0.6958	0.7312	0.4572	0.7680

Source: The output of the Eviews10 program**.**

This study seeks to verify the forecasting results of a hybrid model (ARIMA-GARCH) by comparing the results and preferring the most effective model for forecasting. We graphically display the forecasting results for the period from January to December 2023, compare the forecasting results with the actual results for the same period, and use the mean squared error to determine the most appropriate model.

4.1 Iraq market indicator:

The ARIMA-GARCH hybrid model did not match the actual results for the Iraq Stock Exchange index, although the Stationary of the initial data series was checked in earlier steps. This means that the forecast results using ARIMA-GARCH were inaccurate, as they showed a trend toward Stationary, in contrast to the actual results, which tended toward an increase.

To determine the accuracy of the prediction models used in this study, we used Equation (3) (Ismail et al., 2016b) to calculate the mean square error (MSE):

$$MSE = \frac{\sum_{i=1}^{n}(F_t - A_t)^2}{n} \quad \ldots\ldots (3)$$

where F_t represents the forecast value, A_t represents the actual value, and represents the number of forecast periods.

Table (4) shows the deviation of the prediction results using the GARCH model, which has an average squared error of 36272.5. Using ARIMA, the same indicator achieved an average square error of 12277.6. These results confirmed the advantage of using the ARIMA model to obtain more accurate results.

Table 4: Mean square error of prediction results.

Market indicators	***Iraq***		***Saudi***		***Kuwait***		***Manama***	
Model	**Arima F**	**Garch F**	**Arima F**	**Garch F**	**Arima F**	**Garch F**	**Arima F**	**Garch F**
MSE	12277.6	36272.5	247551	239434	117534	2205825	867.151	214695

Source: The output of the Microsoft Excel 10 program.

As can be seen in Charts (1, 2, 3, and 4), the predicted values from the ARIMA-GARCH models changed over time compared to the actual values of the Arab financial markets closing index, which were based on the Eviews10 program and cover the months from January to December 2023.

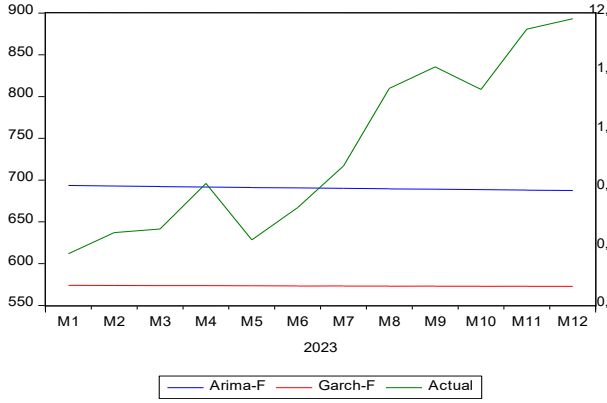

Figure 1: Comparison of forecast results for the Iraq Stock Exchange Index with actual results for 2023

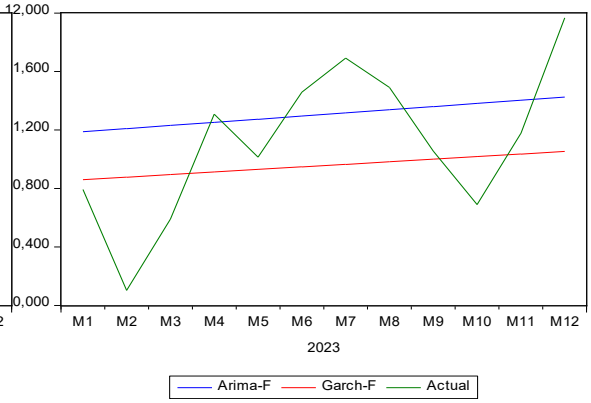

Figure 2: Comparison of the forecasting results for the Saudi market index with the actual results for 2023

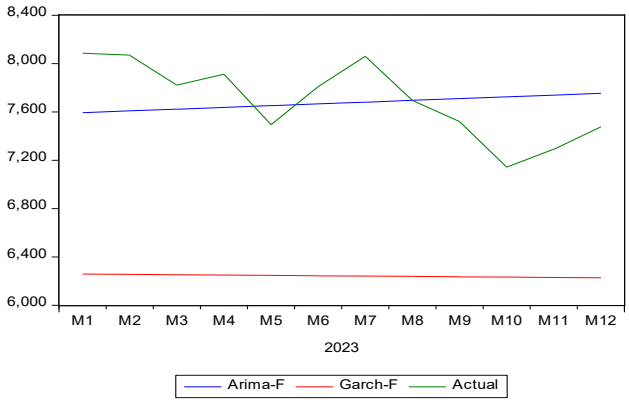

Figure 3: Comparison of forecast results for the Kuwait Stock Exchange Index with actual results for 2023

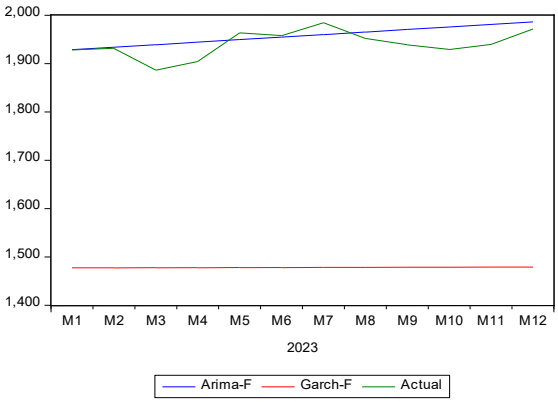

Figure 4: Comparison of forecast results for the Manama Market Index with actual results for 2023

***Source*:** Prepared by the researcher using EViews program

4.2 Saudi market indicator:

Figure (2) shows the effectiveness of the ARIMA-GARCH model in predicting the Saudi Stock Market Index when comparing the prediction results with the actual results for the year 2023. The expected results clearly mimic the actual results.

The results in Table (4) indicate that the MSE coefficient of the (GARCH) model reached 239434, better than the (ARIMA) model by a coefficient of 247551. This implies that the efficiency of the GARCH model in predicting the Saudi Stock Market Index is better than that of the ARIMA model.

4.3 Kuwait market indicator:

Figure (3) shows the efficiency of the ARIMA model in predicting the Kuwait Stock Exchange Index for 2023. The results of the prediction model are like the actual results for the Kuwait Stock Exchange Index. However, the prediction results using the GARCH model differ slightly from the actual results of the Kuwait Stock Exchange Index for the same period. This is evidence that using a single model may not achieve the required prediction efficiency. Therefore, it is necessary to rely on hybrid models to obtain the best prediction results.

The actual results show a decline in the market index; however, the efficiency of the ARIMA model stems from its ability to predict a linear relationship. Simultaneously, the GARCH model manages large fluctuations in the time series, a feature that is not present in the time series of the Kuwait Stock Exchange index.

Table (4) shows that the ARIMA model's prediction of the Kuwait Stock Exchange Index is accurate. The MSE calculation yields a lower result (117534) than the GARCH result (2205825), which proves the model's superiority.

4.4 Manama market indicator:

Figure (4) shows the effectiveness of the ARIMA model in predicting the Manama Financial Market Index for the year 2023 because the prediction results are very close to the actual results of the Manama Financial Market Index using the ARIMA model. In contrast, the prediction results using the GARCH model are less efficient than the actual results for the same period. We note that as the exact data of the market index approaches Stationary, the ability of the GARCH model to predict decreases accurately.

When calculating the MSE in Table (4) to compare the two models, it became clear that the mean square error of the ARIMA prediction model was 867.151. In contrast, the error coefficient was (214695) using the GARCH model. This proves the advantage of using the ARIMA model to predict the Panamanian market index.

5. Discussion of Results:

Miswan N., Ngatiman N., and Hamzah K. (2014) investigated the volatility of the Malaysian stock and real estate market using ARIMA and GARCH models. They found that the Box-Jenkins ARIMA model performs better than the GARCH model in modeling and forecasting the Malaysian stock and real estate markets. These results are in complete agreement with the results of current research on the superiority of ARIMA models in out-of-sample forecasting of Arab stock market indices. Except for the forecasting results of the Saudi Stock Market Index, the GARCH model is superior.

Yenice and Tekindal (2015) conducted a study to forecast the expected daily closing values of stock indices in Turkey, Brazil, Indonesia, South Africa, and India. This study also compared the expected and actual results of the index. The study found that the ARIMA models created for all countries were significant and had very low error margins. This is consistent with the results of the current research for the indices of the Kuwait and Manama markets. Even the prediction results of the Saudi market index are excellent when using ARIMA models. Yenice and Tekindal did not present a hybrid ARIMA-GARCH model, which sets the current research apart.

Grachev (2017) conducted a study on forecasting stock market returns using the ARMA-GARCH model. The research discovered that ARMA (1,0) + GARCH (1,1) consistently provides the best in-sample results for the same period across both datasets. However, this is not suitable for out-of-sample forecasting. These results match the current study's findings that the GARCH (1,1) model is ineffective for out-of-sample forecasting.

The study by Naik, Mohan, and Jha (2020) backs up what another research has said about how well the standard GARCH model (1,1) works. It also shows that the GARCH model can be used to predict crises using changes in stock prices as inputs. The model reduced the error in predicting stock crisis events. This study revealed a preference for higher-order GARCH models and larger sample sizes. Although the current study used the GARCH (1,1) model, it did not provide satisfactory results.

A study by (Challa et al., 2020) predicts the dynamics of returns and volatility. The study finds that the ARIMA model can forecast medium- to long-term horizons using the historical values of the S&P BSE Sensex and S&P BSE IT. This supports the findings of the current study on the ability of the ARIMA model to forecast financial market indices over relatively long periods.

Nargunam et al. (2021) use a hybrid approach that combines ARIMA and GARCH models to examine the performance of gold futures prices. They used a model with a standard variance stabilization transformation and ARIMA/GARCH modeling method. The standard variance transformation method may give them better forecast values, whereas the ARIMA/GARCH modeling method gives them much shorter forecast periods. The current research methodology differs in that it uses the hybrid ARIMA-GARCH model for longer periods

and out-of-sample forecasting, and this study demonstrates the ability of the ARIMA model to forecast relatively long periods.

Cao and Zhao (2022) compared traditional time-series analysis with machine-learning methods. They found that the prediction advantage is that the conventional ARIMA-GARCH model can only manage linear information and not non-linear information. However, the SVM model can handle non-linear data better. The current study argues that time series can be forecast for a longer period using traditional models, which is a different approach from what researchers are discussing regarding the superiority of artificial intelligence and machine learning models.

In 2022, Sahiner examined how well the GARCH, GARCH-M, EGARCH, TGARCH, and PGARCH models could predict things that were not in the sample for ten Asian markets. The research showed that GARCH models can adapt well to the volatile nature of Asian stock indices and make accurate predictions across all given times. This demonstrates the effectiveness of the model for time series and high-volatility indices. These results are not consistent with the results of the current study. Gulf markets may be less volatile than Asian markets.

Arashi and Rounaghi (2022) present the forecasted daily return series of the NASDAQ stock index using the ARMA-GARCH hybrid model. Our results show that the ARMA-GARCH model can predict very well at the 1% error level. These results were not achieved in the current research because out-of-sample forecasting for a relatively long period of one year cannot achieve highly accurate results. In particular, the description of financial data aligns with the random walk theory.

Researchers (Rubio et al., 2023) indicated that the best alternative for predicting low-volatility signals using linear models is to use ARIMA. In terms of the goodness of fitness and accuracy measures, ARIMA models are more accurate than GARCH models when used with the wavelet transform to predict realized volatility. This is consistent with the results of the current study, although the current study did not use the wavelet transform. Most of the prediction results for research using ARIMA-GARCH agree that ARIMA models provide better prediction efficiency than GARCH models. This conclusion differs from much of the previous literature and may reconsider the use of machine learning and artificial intelligence results for prediction, especially when predicting financial market indicators.

On the other hand, Yıldırım, and Bekun (2023) presented effective results for the appropriate modeling of price information in the Bitcoin market using the GARCH model. The effectiveness of the GARCH model in this study is due to its ability to capture high-volatile signals. This is why the results of the current research differ from those of many previous studies regarding the effectiveness of the ARIMA model, which is more efficient than the GARCH model. The level of volatility in the Bitcoin market cannot be compared with the indicators in Arab financial markets, as digital currencies are among the most volatile economic indicators.

Zhang and Zhou (2024) studied forecasting using a combination of autoregressive integrated moving averages (ARIMA), support vector regression (SVR), and peak-on-threshold (POT) methods from the extreme value theory for crude oil futures. The hybrid ARIMA-SVR-POT model provides accurate returns and volatility forecasts. Hybrid models offer a better picture of the forecasting results. The current research approach agrees with the idea of hybridization, and the basic model for most forecasting models is the ARIMA model, which has been widely used in various fields and multiple hybridization techniques.

Adhikari (2024) investigated the application of advanced forecasting methods to emerging markets, financial instruments, and indices. The hybrid ARIMA-GARCH model can adaptively respond to dynamic market conditions and adapt to forecasts in parallel with the latest market trends and fluctuations of the basic time-series data. The results of the current research present a hybrid ARIMA-GARCH model for forecasting Arab financial market indices. The efficiency of the models is not absolute, as they are affected by the nature of the data and the degree of volatility at the financial market level, which is affected by many economic and social variables.

The results of this study provide experimental evidence confirming the efficiency of standard ARIMA models in out-of-sample forecasting of financial market indicators. This research answers the question that was initially posed about whether the ARIMA model provides better actual forecasting efficiency than the GARCH model. Research and studies continue to provide evidence of the use of artificial intelligence tools to forecast financial indicators. However, the current research provides evidence that traditional models are indispensable for predicting financial indicators.

However, we used the standard (1,1) GARCH model. The GARCH model did not achieve satisfactory results in the current research in terms of its efficiency in predicting financial market indicators. The prediction results using the GARCH model deviated from the actual results by a larger MSE coefficient than those using the ARIMA model.

Financial variables fluctuate randomly, which poses a major challenge to the efficiency of financial value forecasting. This explains the conflicting results between different studies that used various models to forecast economic indicators.

6. Conclusion:

This study presents an analytical comparison of the ARIMA-GARCH hybrid model. This comparison adds strong scientific support to what has already been written. It shows how useful it is to use standard forecasting models, especially the very good ARIMA models that meet the statistical requirements. These studies show that the use of traditional models is necessary for predicting the time series. They support their claims with cognitive arguments and analytical evidence. Forecasting models provide the possibility of obtaining satisfactory results if used correctly and do not require programming complexity. Therefore, they save considerable effort and time compared to machine learning, deep learning, and artificial intelligence models.

When using ARIMA models in forecasting, choosing the appropriate model is very important as it is subject to several criteria. The more models proposed, the longer the process of comparing and selecting the proper model, which increases the possibility of errors and inefficiency. The economic program E-Views 10 provides the possibility of choosing an appropriate model from many proposed models. ARIMA, an automatic forecasting function, achieved the goal of prediction and accuracy for the models used in the current research.

The GARCH model provides forecasting capability for a heterogeneous time series with high volatility. Its use in Arab financial market indices has not achieved satisfactory results. The GARCH model predicts the Saudi market index, which is more volatile than the financial market indices in the research sample. This confirms that using the model on a stable financial index does not yield satisfactory forecasting results.

GARCH models used to forecast financial market indicators need to improve model-testing techniques and build more efficient models. The hybrid model (ARIMA GARCH) offers better forecasting ability than the individual models. The current research suggests using GARCH models to predict highly volatile indicators such as cryptocurrency prices or forex volatility.

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We Hereby Confirm That All the Figures and Tables in The Manuscript Are Mine and Ours. Besides, The Figures and Images, which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

Authors Declaration:

Conflicts of Interest: None

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- Ethical Clearance: The Research Was Approved by The Local Ethical Committee in The University.

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