Journal of Economics, Finance and Management Studies

ISSN (print): 2644-0490, ISSN (online): 2644-0504

Volume 08 Issue 09 September 2025

Article DOI: 10.47191/jefms/v8-i9-45, Impact Factor: 8.317

Page No: 6334-6339

Forecasting Gold Price Trends in Vietnam in the Fourth Quarter of 2025 Using the Arima Model

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ABSTRACT: In the context of geopolitical instability taking place in the world, leading to the outbreak of global financial crisis. Financial investors tend to invest in gold as a safe "haven" channel with high profitability (DUNG, 2004) . However, gold prices fluctuate in a complex, random, nonlinear manner and are strongly affected by interest rates, inflation, geopolitics, and USD fluctuations (Kristjanpoller & Minutolo, 2015) . This makes forecasting difficult and poses risks for investors and managers. Therefore, scientific and objective tools are needed instead of emotional forecasting. The ARIMA (Autoregressive Integrated Moving Average) model was developed by two authors (Box & Jenkins, 1976) to forecast time series to analyze the relationship between past and present data to forecast future trends. In this study, ARIMA is applied to forecast gold prices in Vietnam in the fourth quarter of 2025. Based on the data analyzed, the ARIMA(3,2,1) model is the most optimal model to forecast gold prices in Vietnam. The research results are a scientifically based reference source for investors and organizations in making decisions related to gold to minimize risks and maximize profits.

KEYWORDS: ARIMA, Gold price forecasting, Time series, Vietnam, Quarter IV.

1. PROBLEM STATEMENT

In the global financial system, gold is not only a precious metal but also a financial asset with an important role, especially as a “safe haven asset” in the context of volatile markets and unstable macroeconomics (Baur & McDermott, 2010) . The International Monetary Fund (IMF)'s regular report Fund **)** also pointed out that gold is often put into reserves by central banks to prevent risks and strengthen confidence in the monetary system. However, gold price fluctuations show randomness, nonlinearity and sensitivity to many macro factors such as interest rates, inflation, geopolitics and USD fluctuations (Kristjanpoller & Minutolo, 2015) . This makes it difficult to forecast, posing risks for both investors and managers. Therefore, to grasp the fluctuations of gold prices to help master the decisions of investors and make plans and policies of government organizations is necessary. Therefore, it is necessary to use a scientific forecasting tool to help produce reliable forecast results instead of subjective, emotional forecasts, or "FOMO" psychological forecasts that can easily cause psychological effects and financial losses for investors and managers.

Faced with this situation, the application of a quantitative model in gold price forecasting is necessary. Especially, in the context of the global economic and political fluctuations, the more accurate the gold price forecast, the more effective it is for implementing plans and policies of organizations and individuals. Therefore, managers and investors all want to have more information that is analyzed logically and scientifically about gold price fluctuations to make the best decisions for each stage of their management and investment. Faced with the challenge of needing a quantitative model to analyze time series, the ARIMA autoregressive moving average model developed by two authors Box & Jenkins in 1976 is a typical tool and is trusted and applied by many studies. Because the fundamental theory of this model is to analyze the relationship between past and present values to extrapolate future trends. Therefore, in this study, the authors apply this model to forecast gold prices in Vietnam in the fourth quarter of 2025.

2. RESEARCH OVERVIEW

Time series forecasting models are based on the assumption that past data can be used to forecast the future. Many domestic and foreign studies have applied different models to forecast gold prices, each with its own advantages and disadvantages. According to (Tuan et al., 2024), ARIMA is most effective in short-term forecasting, VARMA is suitable for the

medium term, and VECM is optimal for the long term. Other studies (Abdullah, 2012) ; (Sharma, 2016) ; (Yang, 2019) all confirm the suitability of ARIMA in forecasting gold prices, especially with detailed monthly statistical data (Brockwell & Davis, 2002) . In addition, some studies propose combining ARIMA with other models to improve accuracy.

According to (Bunnag, 2024) shows that ARIMA–GARCH gives feasible results, while (Mombeini & Yazdani-Chamzini, 2015) proves that the combination of ARIMA and artificial neural network (ANN) gives better performance. From the overview of research works, it shows that ARIMA is often evaluated as the most effective in the short term. Therefore, this study chooses the ARIMA model to forecast gold prices in Vietnam in the fourth quarter of 2025, expecting to bring reliable forecast results to serve investors and managers.

3. RESEARCH METHODS

In 1976, George Box and Gwilym Jenkins developed the Box-Jenkins method, which includes a set of time series analysis and forecasting techniques based on the construction of the ARIMA model. This model shows the relationship between the future value of data and the current value and the past value. Therefore, this is a model that is often applied in the process of forecasting future indicators in the short term and is commonly used in the fields of economics, engineering, etc. The components of the ARIMA model include: AR (autoregression); I (stationarity of the time series); MA (moving average component). To apply the ARIMA model in forecasting, it is necessary to go through 04 steps, (Gujarati & Porter, 2004) and (Adkins & Hill, 2011) .

Step 1: Define the model

To apply the ARIMA (p,d,q) model in forecasting, it is necessary to determine three components: AR(p), I(d) and MA(q). In which, component (d) is determined by checking the stationarity of the time series. If the series is stationary at order 0, then I(d=0); if the difference is order 1, then I(d=1), if the difference is order 2, then I(d=2). Normally, the series will be stationary at order 0 or 1, in few cases, up to order 2. When performing stationarity testing, the Dickey-Fuller (ADF) method is often used.

After determining the degree (d) and the values (p), (q) are determined respectively through analyzing the autocorrelation diagram ACF and partial autocorrelation PACF.

The AR(p) structure represents the relationship between the present and past values of the series Y_t represented by the following equation:

$$Y_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \ldots + \alpha_p x_{tp} \quad (1)$$

In which: Y_t is the series to be forecasted, x_t is the model error.

The value (p) is determined through the ACF and PACF charts. If the series is in the form of AR(p), the PACF chart has statistically significant partial correlation coefficients from 1 to (p), the following values will decrease rapidly to 0, and at the same time the ACF chart will show the correlation coefficients decreasing to 0.

The structure MA(q), of the series x_t is represented by the following equation:

$$Y_t = \mu + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \ldots + \beta_q x_{tq} \quad (2)$$

If the series is of the form MA(q) then the ACF plot will show statistically significant correlation coefficients from lag 1 to q, the values then rapidly approaching zero, whereas the PACF plot will show partial correlation coefficients gradually approaching zero.

Combining equations (1) and (2) we have the ARMA (p,q) model:

$$Y_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \ldots + \alpha_p x_{tp} + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \ldots + \beta_q x_{tq} \quad (3)$$

Step 2: Parameter estimation

Using Eviews 12 software to estimate the model parameters. The model is selected by comparing criteria such as adjusted R^2, AIC (Akaike info criterion), Log likelihood, Schwarz, performed many times until the optimal model is determined.

Step 3: Model validation

The model achieves a good fit when the errors are white noise. The ACF autocorrelation plot or Breusch-Godfrey test can be used to check for autocorrelation of the errors. In case, there is heteroscedasticity of the errors, the White or ARCH test is used.

Step 4: Conduct forecasting

After verification, if the model meets the requirements, it will be used to conduct forecasting. The forecasting process is performed with in-sample forecasts and out-of-sample forecasts. ACF and PACF charts can be used to evaluate the suitability of the model, if at the lags the values are all within the limit line (confidence interval).

4. RESEARCH RESULTS

The data used in this study is the gold price of Vietnam collected and compiled by the Authors from the Internet, the gold price data is taken monthly, from January 2015 to the end of August 2025, then the data is averaged monthly to take quarterly.

The results entered into EViews 12 software include a total of 44 observations, these observations are used for model determination.

Identify the model

The ARIMA model is built if the time series is stationary. Conducting ADF testing of the gold price series with zero-degree differences, the t-Statistic values obtained are all greater than the critical values and the Prob. * = 1.0000 > 0.05 value, so it is concluded that the gold price series is non-stationary. The results are shown in Table 1.

Table 1: ADF test with zero-order difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.882178	1.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Source: Analysis results of the Author group on EViews 12 software

Since the gold price series with zero-order difference is non-stationary, continue to perform the ADF test with first-order difference. The results in Table 2 show that the t-Statistic values are consistently greater than the critical values and the Prob. * value = 0.1920 > 0.05, so it can be concluded that the gold price series is non-stationary, so it is necessary to continue with second-order difference.

Table 2: ADF test with first-order difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.841393	0.1920
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Source: Analysis results of the Author group on EViews 12 software

Continuing to perform ADF test of the gold price series with 2nd difference, the obtained t-Statistic values are all smaller than the critical values and the Prob. * value = 0.0021 < 0.05. Therefore, it can be concluded that the gold price series has stopped at 2nd difference. The results are shown in Table 3.

Table 3: ADF test with second-order difference

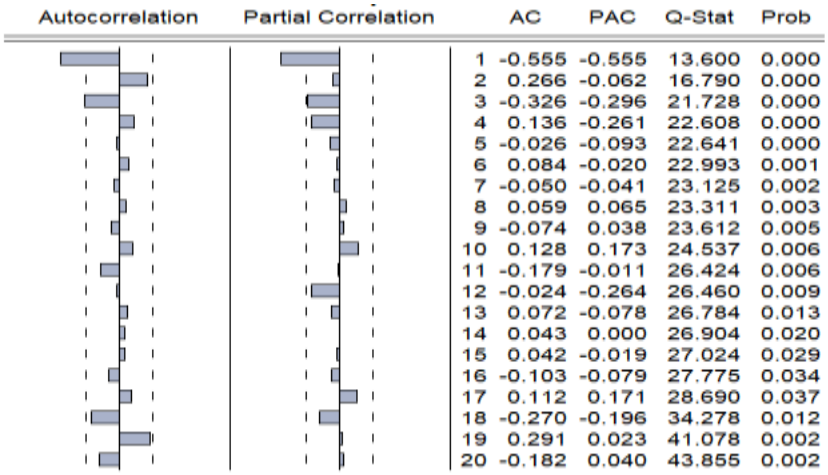
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.816677	0.0021
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Source: Analysis results of the Author group on EViews 12 software

Construct the ARIMA model by determining the values of p and q. These two values are determined based on the autocorrelation and partial autocorrelation diagrams, ACF and PACF. Conduct correlation analysis with the first difference (d=2), and obtain the results as shown in Table 4 below:

Table 4: ACF and PACF charts of gold price



	AC	PAC	Q-Stat	Prob
1	-0.555	-0.555	13.600	0.000
2	0.266	-0.062	16.790	0.000
3	-0.326	-0.296	21.728	0.000
4	0.136	-0.261	22.608	0.000
5	-0.026	-0.093	22.641	0.000
6	0.084	-0.020	22.993	0.001
7	-0.050	-0.041	23.125	0.002
8	0.059	0.065	23.311	0.003
9	-0.074	0.038	23.612	0.005
10	0.128	0.173	24.537	0.006
11	-0.179	-0.011	26.424	0.006
12	-0.024	-0.264	26.460	0.009
13	0.072	-0.078	26.784	0.013
14	0.043	0.000	26.904	0.020
15	0.042	-0.019	27.024	0.029
16	-0.103	-0.079	27.775	0.034
17	0.112	0.171	28.690	0.037
18	-0.270	-0.196	34.278	0.012
19	0.291	0.023	41.078	0.002
20	-0.182	0.040	43.855	0.002

Source: Analysis results of the Author group on EViews 12 software

From the results obtained in Table 4, based on the ACF column, the value (q) can be determined and the PACF column can be determined, the value (p) of the ARIMA model can be determined. The results show that in the PACF column, lags 1, 3, 4, 12 give non-zero partial autocorrelation coefficients, similarly in the ACF column, the correlation coefficients are non-zero at lags 1, 2, 3, 18, 19.

Parameter estimation

With the components (p,d,q) determined as above, the ARIMA model of the topic can be one of the following models: ARIMA(1,2,1); ARIMA(1,2,2); ARIMA(1,2,3); ARIMA(1,2,18); ARIMA(1,2,19); ARIMA(3,2,1); ARIMA(3,2,2); ARIMA(3,2,3); ARIMA(3,2,18); ARIMA(3,2,19); ARIMA(4,2,1); ARIMA(4,2,2); ARIMA(4,2,3); ARIMA(4,2,18); ARIMA(4,2,19); ARIMA(12,2,1); ARIMA(12,2,2); ARIMA(12,2,3); ARIMA(12,2,18); ARIMA(12,2,19). Test the adjusted R^2, AIC, Log likelihood, Schwarz values to determine the optimal model. The results are presented in Table 5 below.

Table 5: Comparing the Adjusted R^2, AIC, Log likelihood, Schwarz indices

Model	R^2 Adjusted	Log likelihood	AIC	Schwarz
ARIMA(1,2,1)	0.332199	-119.1757	6.008573	6.175750
ARIMA(1,2,2)	0.333061	-119.0849	6.004142	6.171320
ARIMA(1,2,3)	0.386221	-117.5071	5.927176	6.094354
ARIMA(1,2,18)	0.395073	-118.4490	5.973122	6.140300
ARIMA(1,2,19)	0.356936	-119.0326	6.001589	6.168767
ARIMA(3,2,1)*	0.430144	-116.4149	5.873895	6.041073
ARIMA(3,2,2)	0.175202	-123.5584	6.222363	6.389541
ARIMA(3,2,3)	0.159011	-124.1334	6.250409	6.417586
ARIMA(3,2,18)	0.454126	-121.4776	6.120861	6.288039
ARIMA(3,2,19)	0.357060	-121.8032	6.136743	6.303921
ARIMA(4,2,1)	0.350658	-120.0130	6.049413	6.216591
ARIMA(4,2,2)	0.090268	-125.4295	6.313635	6.480813
ARIMA(4,2,3)	0.118108	-124.8489	6.285313	6.452491
ARIMA(4,2,18)	0.356346	-124.5959	6.272970	6.440148
ARIMA(4,2,19)	0.286546	-124.9175	6.288661	6.455838
ARIMA(12,2,1)	0.340586	-119.2962	6.014448	6.181626
ARIMA(12,2,2)	0.027494	-126.6179	6.371604	6.538781
ARIMA(12,2,3)	0.121005	-124.8537	6.285546	6.452724
ARIMA(12,2,18)	0.455078	-125.1978	6.302331	6.469508
ARIMA(12,2,19)	0.354317	-124.8769	6.286679	6.347556

*Optimal value selected

Source: Analysis results of the Author group on EViews 12 software

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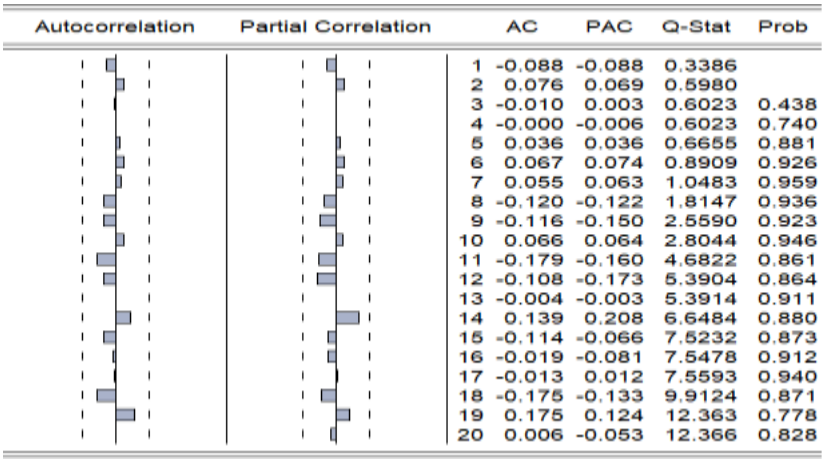
Based on the results of Table 5, among the 20 selected models, the ARIMA(3,2,1)* model is considered to be the optimal model selected. This model has 2 variables AR(3), MA(1) which are both statistically significant at the 5% significance level. In addition, this is also the model with a relatively high R2 coefficient [and] the smallest AIC, Log likelihood, and Schwarz values. However, to confirm the suitability of this model in gold price forecasting, the author continues to test the autocorrelation of this model. The results are shown in Table 6.

Table 6: ACF and PACF charts of gold price according to ARIMA(3,2,1) model



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.088	-0.088	0.3386	
		2	0.076	0.069	0.5980	
		3	-0.010	0.003	0.6023	0.438
		4	-0.000	-0.006	0.6023	0.740
		5	0.036	0.036	0.6655	0.881
		6	0.067	0.074	0.8909	0.926
		7	0.055	0.063	1.0483	0.959
		8	-0.120	-0.122	1.8147	0.936
		9	-0.116	-0.150	2.5590	0.923
		10	0.066	0.064	2.8044	0.946
		11	-0.179	-0.160	4.6822	0.861
		12	-0.108	-0.173	5.3904	0.864
		13	-0.004	-0.003	5.3914	0.911
		14	0.139	0.208	6.6484	0.880
		15	-0.114	-0.066	7.5232	0.873
		16	-0.019	-0.081	7.5478	0.912
		17	-0.013	0.012	7.5593	0.940
		18	-0.175	-0.133	9.9124	0.871
		19	0.175	0.124	12.363	0.778
		20	0.006	-0.053	12.366	0.828

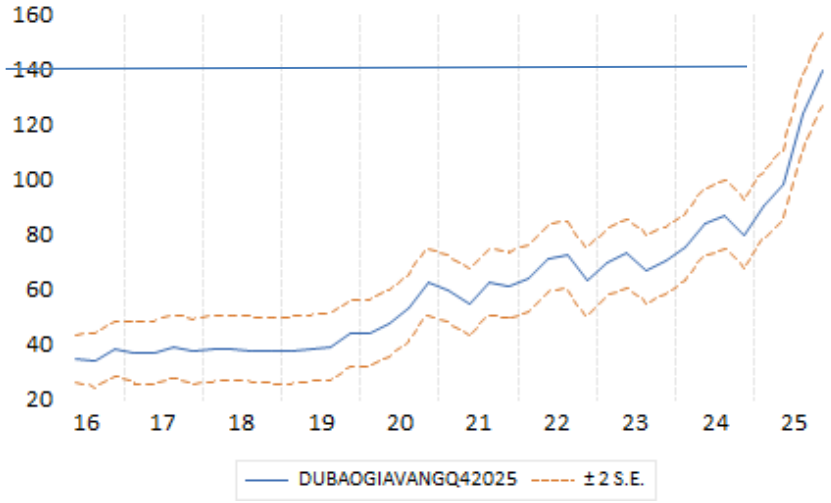
Source: Analysis results of the Author group on EViews 12 software

Based on the graph in Table 6, no lag value is found to be outside the confidence interval. Therefore, this is the optimal model for forecasting gold prices chosen by this study.

Conduct forecasting

Based on the Vietnam gold price quote for the fourth quarter of 2025 with the ARIMA(3,2,1) model, the forecast results are shown in the chart below:

Chart 1: Gold price forecast for the fourth quarter of 2025



Source: Analysis results of the Author group on EViews 12 software

Thus, from chart 1 showing the forecast results of gold prices in the fourth quarter of 2025 in Vietnam, it can be seen that in the fourth quarter of 2025, gold prices will continue to increase. According to the forecast results, the average SJC gold price is expected to reach about 140 million VND/tael, specifically fluctuating between 127 million VND/tael and 153 million VND/tael.

5. CONCLUSION

Through the process of determining and estimating parameters, the ARIMA(3,2,1) model was selected as the optimal model among the 20 identified models. The use of the ARIMA(3,2,1) model in gold price forecasting shows that gold prices are not only affected by immediate "shocks" such as changes in the Government's gold price management policy, interest rate fluctuations of the US Federal Reserve (FED), or President Trump's tax policy, but also have a "cyclical sliding" nature with a significant influence

of 3 consecutive quarters. The model used for forecasting with the second-order difference value shows that the time series of gold prices tends to fluctuate strongly, making it difficult to predict with historical values, and gold prices are greatly affected by changes in macroeconomic factors such as "inflation, political instability, etc.", causing gold prices to change without a linear trend.

From this forecast result, the study helps investors have a proactive vision to have a personal financial risk management strategy to make the right investment decisions, avoiding turning to gold when they need a "safe haven". In addition, the increase in gold price is also a signal of rising inflation. Managers, especially Central Banks, need to grasp information forecasting gold price fluctuations to make appropriate monetary policy measures and adjust interest rates. This also has great significance for countries with large gold reserves to have a basis for making buying and selling decisions to optimize the value of national assets in the context of the global financial crisis. The ARIMA(3,2,1) model is the most optimal gold price forecast model, so financial managers should refer to and apply this model to forecast gold prices to improve the effectiveness of implementing strategies, macroeconomic policies and personal investments.

REFERENCES

1) Abdullah, L. (2012). ARIMA model for gold bullion coin selling prices forecasting. International Journal of Advances in Applied Sciences , 1 (4), 153–158.
2) Adkins, LC, & Hill, RC (2011). Using Stata for principles of economics . John Wiley & Sons.
3) Baur, DG, & McDermott, TK (2010). Is gold a safe haven? International evidence. Journal of Banking & Finance , 34 (8), 1886–1898.
4) Box, G., & Jenkins, G. M. (1976). Analysis: Forecasting and Control. San Francisco .
5) Brockwell, P.J., & Davis, R.A. (2002). Introduction to time series and forecasting . Springer.
6) Bunnag, T. (2024). The Importance of Gold's Effect on Investment and Predicting the World Gold Price Using the ARIMA and ARIMA-GARCH Model. Ekonomikalia Journal of Economics , 2 (1), 38–52.
7) DUNG, T. (2004). Global Strife Pushes Local Gold Price to New Heights. Vietnam Investment Review , 650 , 15.
8) Gujarati, D.N., & Porter, D.C. (2004). Basic economics. mcgraw-hill companies. New York, NY, USA .
9) Kristjanpoller, W., & Minutolo, M.C. (2015). Gold price volatility: A forecasting approach using the Artificial Neural Network–GARCH model. Expert Systems with Applications , 42 (20), 7245–7251.
10) Mombeini, H., & Yazdani-Chamzini, A. (2015). Modeling gold price via artificial neural network. Journal of Economics, Business and Management , 3 (7), 699–703.
11) Sharma, R.K. (2016). Forecasting gold price with box jenkins autoregressive integrated moving average method. Journal of International Economics , 7 (1), 32.
12) Tuan, DA, Giang, NT, Dinh, NTQ, Ngoc, DB, & Chi, NTM (2024). Gold Price Forecast Modeling: An Ensemble Learning Approach. International Conference on Advances in Information and Communication Technology , 1045–1053.
13) Yang, X. (2019). The prediction of gold price using ARIMA model. 2nd International Conference on Social Science, Public Health and Education (SSPHE 2018) , 273–276.