



# The 13<sup>th</sup> Undergraduate in Applied Mathematics Conference (UAMC 2025)

## Department of Mathematics, School of Science, King Mongkut's Institute of Technology Ladkrabang

## Comparison of Gold Bar Price Forecasting Models Using Deep Learning Models

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### ABSTRACT

This research aims to compare the forecasting performance of gold bar prices using deep learning models. The models used for prediction include Temporal Convolutional Network (TCN), Gated Recurrent Units (GRU), Self-Attention, and Transformer. The dataset consists of monthly time series data from January 2013 to December 2024, totaling 132 months, and is divided into two parts training data from January 2013 to December 2023, comprising 120 months, used for model development, and testing data from January 2024 to December 2024, comprising 12 months, used for model selection based on Mean Absolute Percentage Error (MAPE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE). The research results indicate that the TCN model is the most suitable for forecasting gold bar prices, achieving the lowest MAPE of the training set at 0.85 percent and the lowest MAPE of the testing set at 1.80 percent, demonstrating its effectiveness and accuracy.

### INTRODUCTION

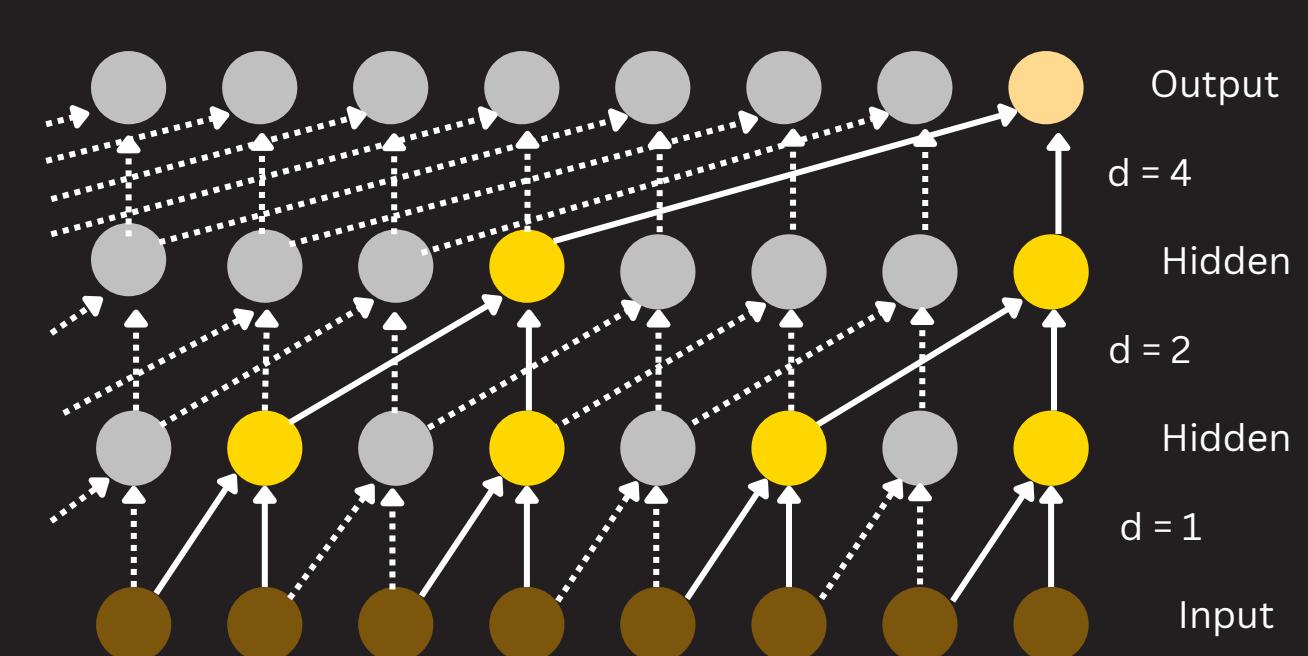
When examining gold bar price forecasting, people across various nations, including Thailand, are facing challenges due to market uncertainty and the complex factors influencing the value of this precious metal. In this study, researchers analyzed the performance of deep learning models such as the Temporal Convolutional Network (TCN), Gated Recurrent Units (GRU), Self-Attention, and Transformer to compare and identify the most accurate and suitable model for predicting gold bar prices. The study considered key factors such as crude oil prices, interest rates, the Core Consumer Price Index (CPI), and the US Dollar Index. These models play a crucial role in enhancing analytical efficiency by utilizing relevant data and factors to help identify trends in gold price fluctuations, ultimately increasing the chances of making precise and timely investment decisions and implementing effective risk management strategies.

### METHODOLOGY

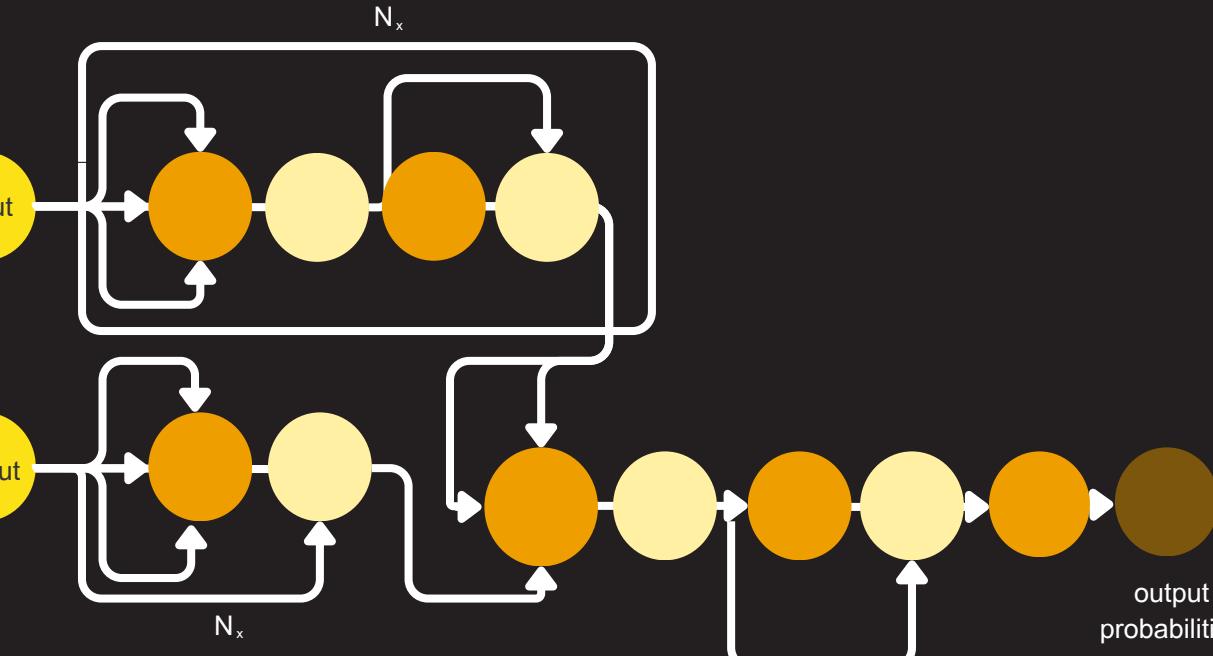


### MODELS

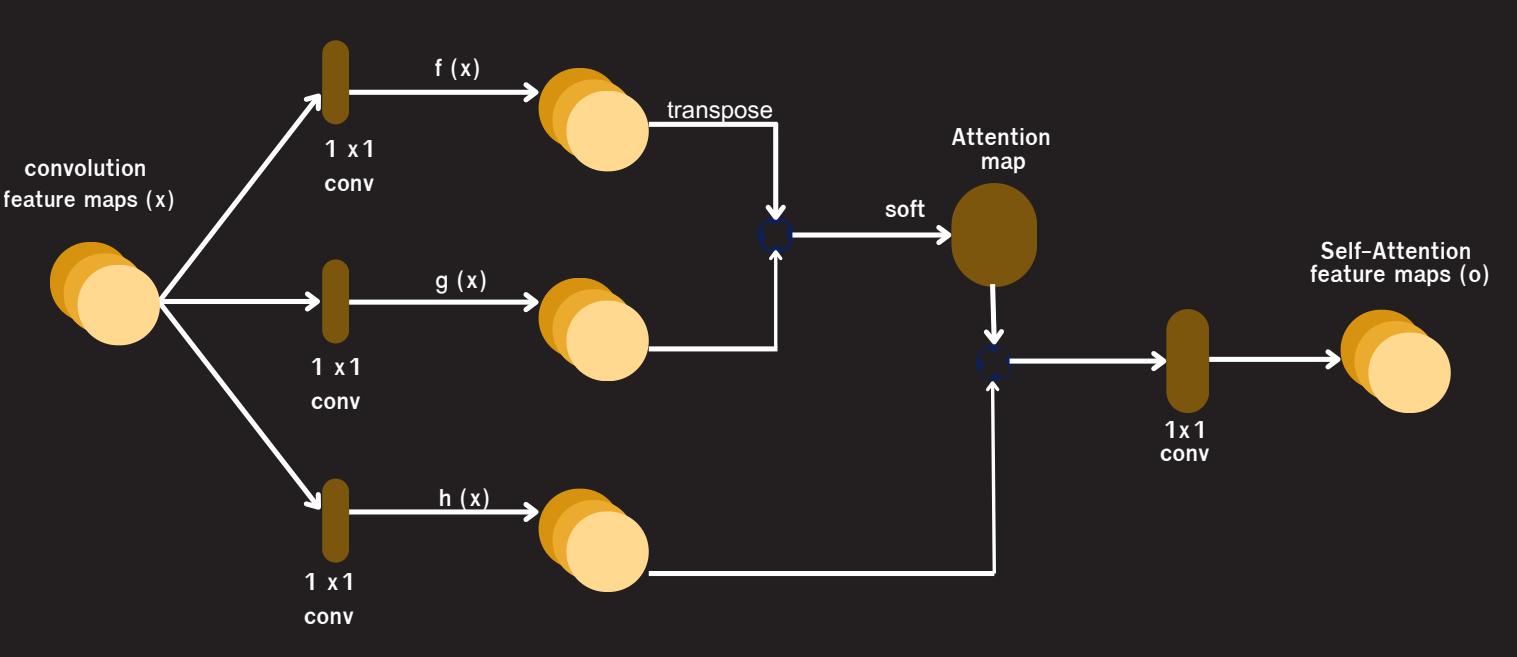
#### Temporal Convolutional Network (TCN)



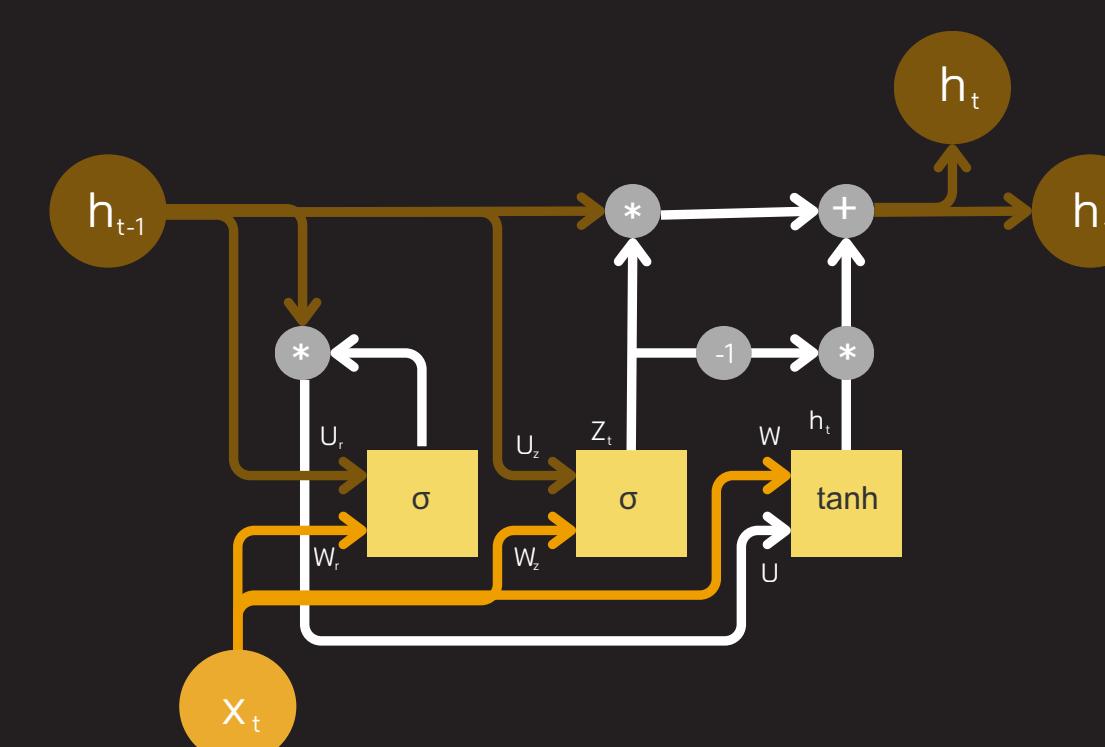
#### Transformer



#### Self-Attention



#### Gated Recurrent Units (GRUs)



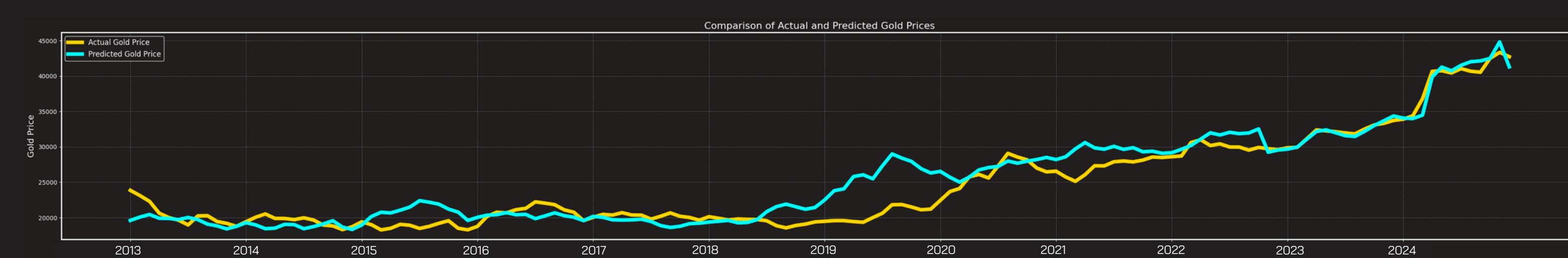
### OBJECTIVES

1. To study factors that effect gold prices.

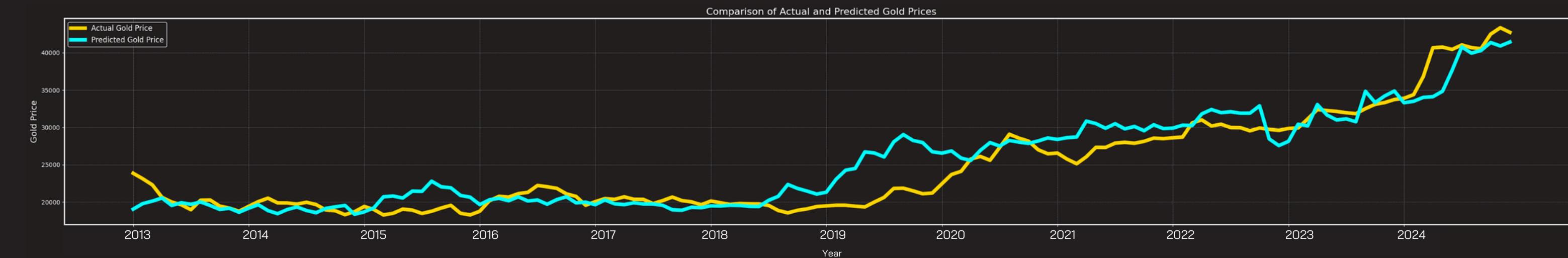
2. Construct model and Comparing the best models: Temporal Convolutional Network (TCN), Gated Recurrent Units (GRU), Self-Attention, and Transformer

### RESULT

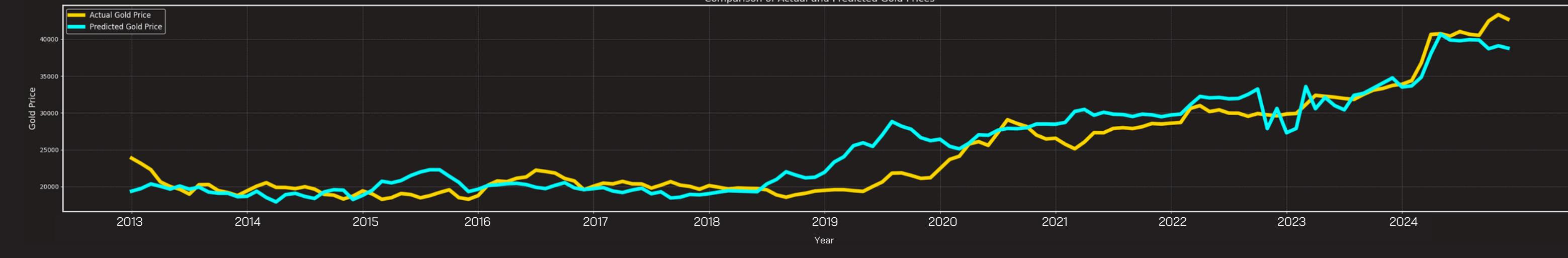
#### Temporal Convolutional Network (TCN)



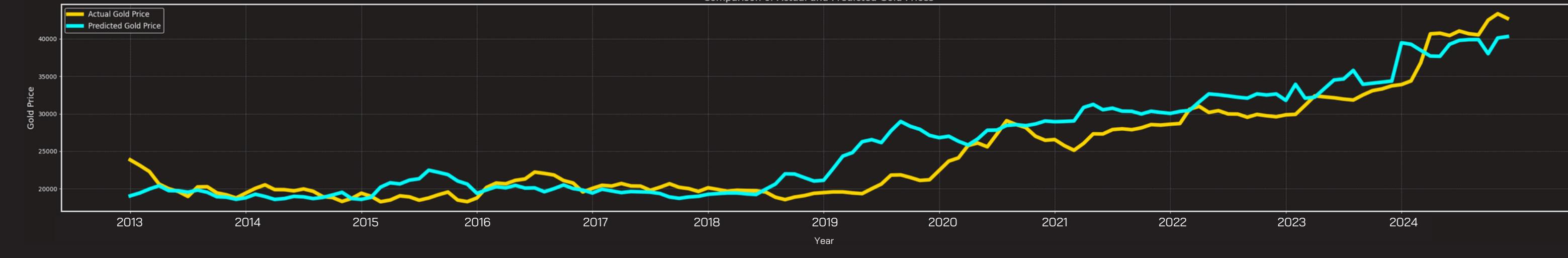
#### Gated Recurrent Units (GRUs)



#### Self-Attention



#### Transformer



The results show that the Temporal Convolutional Network (TCN) is the best model for forecasting gold prices, achieving the lowest MAPE of 0.85%. Various deep learning models, including Gated Recurrent Units (GRUs), Self-Attention, and Transformer, were evaluated, but TCN demonstrated superior accuracy in predicting gold price trends. Key influencing factors considered in the study include crude oil prices, interest rates, the Core Consumer Price Index (CPI), and the US Dollar Index.

### CONCLUSION & DISCUSSION

This model not only predicts future gold prices but can also be applied to assess financial investment risks and other economic scenarios. The researcher employs the Temporal Convolutional Network (TCN) to analyze the relationships between factors influencing gold prices, enabling accurate price forecasting. This result is consistent with the research of (Fajou, J., & McCaren, A. 2021), demonstrating the effectiveness of using the combined forecasting model in forecasting time series data. Furthermore, the model can also be utilized to predict financial investment risks and other applications.

### REFERENCES

- (1) Fajou, J., & McCaren, A. (2021). Forecasting gold prices using temporal convolutional networks. *Proceedings of the Conference on Machine Learning and Applications*, 6(1), 1-12.
- (2) Wetthayawikomrat, R. (2018). Factors affecting gold prices in the world market (Independent Study, Master of Business Administration). Faculty of Commerce and Accountancy, Thammasat University.