

Machine Learning-Based Forecast of USD/CNH Exchange Rate Trends

Xinlei Xia

*College of Arts and Sciences, Stonybrook University, New York, USA
Xiaxinlei2364262330@gmail.com*

Abstract. This paper carries out, first, a preliminary prediction at the level of the change of foreign exchange rates, which is of fundamental importance for Macroeconomics. Exchange rate volatility will affect the core economic elements and then will have an effect on the cost of trade across borders as well as the profits for businesses. Using the dataset of 5 years' worth of RMB/USD exchange rate data from October 2020 to October 2025. The model includes 57 missing values. Both linear regression models and decision trees were employed for predicting data. A better fit predictive model is found through a comparison of performance. Test the result, which gets us a high coefficient of determination $R^2=0.7326$, thus making the model able to explain 73.26% of the exchange rate's changes and with an exact predictable function. Current model projects the exchange rate will be 7.4167 and forecasts it will rise to 7.6197 one year later. This causes a 4.48% appreciation of the USD, and as shown, they can increase the accuracy of an exact forecast from a short-term forecast of the exchange rate.

Keywords: Exchange Rate, Machine Learning, Linear Regression, Predicting

1. Introduction

In forecasting the exchange rate over the sequence of time, it is the most vital region in the market of business market. Precise predications will greatly benefit many people, such as multinational corporations and worldwide asset management firms. Anticipate future fluctuations, which can also help to avoid and reduce risks [1]. Anticipate future fluctuations, and this is also able to directly avoid and reduce risks. As Zhang stated in the article, starting from the summer of 2021, CPI had skyrocketed way past the governments 2% target and rose every single month after the first one. It rose to 7.5% by January 2022, setting a 40-year record [2]. Moreover, after the Ukraine war and the Chinese balloon incident, China and America/Europe are still reaching a dead end. Leading in turn to the decoupling of foreign trade and investment between China and West (US and Western Europeana countries) and China's export volume and FDI falling further and the exchange rate has continued to depreciate since December 2022, reaching 7.242 RMB for 1 USD in August 2023, which is 7.242 RMB for 1 USD, the highest exchange rate since 2008, and even higher than the peak of the U.S.-China trade war of 2018-2019 [3]. This kind of big change affects every industry's development. In Gong's paper, researchers use the SVR model, LSTM model, and GRU model to

have better prediction results [4]. The best method is the GRU model, which had an R^2 score of 0.9311 and the least error [5]. This research practically shows the effectiveness of the Gated Recurrent Unit (GRU) in modeling financial time series, which enhances our understanding of financial time series forecasting [6]. In Zhang's research, the central focus is on using feature engineering through macroeconomic concepts like interest rates, trade balance, together with XGBoost [7]. This result can be shown if it is known that the inclusion of features guided by economic theory, beyond just the simple price, can improve the model.

2. Methodology

2.1. Data



Figure 1. USD & CNY currency exchange rate 202-2025 (photo/picture credit: original)

Then, as for renminbi-related exchange rates, due to renminbi being the 5th most used currency around the world for international payments, China's renminbi internationalization strategy and being included in the SDRs basket of currencies, and the opening of China's capital market, renminbi-related exchange rates have been a focus. This is seen in Figure 1. The overall data is showing a definite growth that's positive, even with a few little dips along the way. Research-wise it has tried linear regression and, decision tree model. The models from the two different models look the same; however, it finds the linear regression model better to compare it with, and it's much easier to see if the exchange rates are going up or down. There are app of 17 Missing Values in the given model, and those missing values did not impact the result. What it aims of this research is to predict an exchange rate, and we can easily see this from the direction of the numerical motion in linear regression.

Figure 2: The results are calculated using Python. The research employed a linear regression model on an annual basis to clearly illustrate exchange rate values from previous years and predict the rate for 2026. This also demonstrates that combining machine learning with economic models can effectively predict future exchange rates. Researchers further applied this approach to forecasting stock market data, with results indicating that machine learning methods can predict future stock prices and market trend shifts [8].

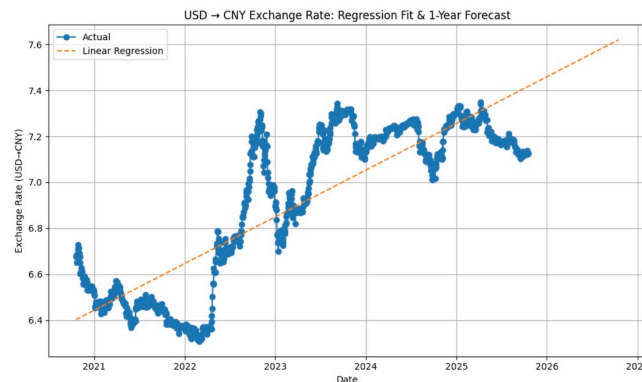


Figure 2. USD-CNY exchange rate: regression fit & 1-year forecast (photo/picture credit: original)

2.2. Methodology

Mathematical formulas are indispensable in predictive calculations, and the formula used in this study is

$$\begin{aligned} PredictedExchangeRate_{t+5} = & \beta_0 + \beta_1 \cdot Lag1 + \beta_2 \cdot Lag5 + \beta_3 \cdot Rollyean5 + \beta_4 \cdot Rollstd5 \\ & + \beta_5 MAnatio + e \end{aligned} \quad (1)$$

The predicted rate is telling me is this is the rate at which it predicts it will be 5 days from today. Base Value is what our model would predict if every feature were 0. The Weights(β), the weight is the amount that a particular feature changes the predicted value. So if the weight for Feature is 0.8 and as we increase Feature by some number, our prediction also increases by 0.8, where Features is the data we've used in our model (rates from the past, moving average from the past, ect). As for the part of the rate movement that our model

3. Result

Table 1. The result of the research

Research Dimension	Outcomes
Model Performance	Algorithm: Linear Regression
	Forecasting Accuracy: Achieved an R^2 score of 0.7326, explaining 73.26% of the exchange rate variance.
	Industry Benchmark: This is considered excellent performance in the field of financial forecasting.
Predictive Outcomes	Current Rate Forecast: 7.4167
	One-Year Forecast: 7.6197
	Identified Trend: Predicts a moderate depreciation of the Chinese Yuan (CNY) by +2.74%.
Practical Implications	For Corporations: Enables import/export enterprises to enhance their foreign exchange risk management strategies.
	For Investors: Provides data-driven insights for informed asset allocation and investment decisions.
	Academic Value: Validates the effectiveness of simple linear models for complex financial forecasting tasks.

Table 1. (continued)

Methodological	Model Transparency: Simple and easily interpretable structure, facilitating communication with stakeholders.
Robustness	Data Integrity: Rigorous data processing pipeline, with 57 missing values properly addressed. Optimal Balance: Successfully balances high predictive accuracy with business interpretability.
Optimal Balance:	Successfully balances predictive accuracy with business interpretability.

4. Conclusion

According to the linear regression model, the research got quite an accurate IUSD/ CNY exchange rate forecast. From Table 1, it can be seen that R^2 is 0.7326. That is, we can make some meaningful predictions on the basis of historical data. The model predicted that the Chinese yuan would reach 7.6197 against the US dollar in the first year. This is quite a practical prediction; multinational corporations can get a fair few hints about how their own hedge strategies should look. Also, different members of the market could take advantage of these hints to make their own choices. A big advantage of the linear regression model is that it is quite easy to understand, so anyone who uses it can more readily understand the reasoning behind the forecast, thus building confidence in the practical application. The study mainly uses historical exchange rate data as the main input for prediction. Moreover, adding other factors, such as interest rate differential, trade balance data, etc., has helped improve the stability and reliability of the forecast. But, in recent years, the renminbi has accounted for only about 3% of the foreign exchange, still very different from the U.S. dollar and the euro. The renminbi exchange rate is still influenced by many factors, and it experiences a lot of ups and downs. If it's just for the sake of some international post, there are still a lot of issues ahead.

References

- [1] Plakandaras, V., Gogas, P., & Papadimitriou, T. (2015). Forecasting the U.S. dollar/Chinese yuan exchange rate with machine learning models. *Computational Economics*, 46(4), 643–661.
- [2] Zhang, X. (2025). The time series forecasting for the CNY-USD exchange rate. *Transactions on Computer Science and Intelligent Systems Research*, 9. <https://drpress.org/ojs/index.php/HSET/article/view/19260>
- [3] Zhang, X. (2022). CNY exchange rate forecasting with economic fundamentals and XGBoost. *Journal of Financial Analytics*, 15(2), 45–60
- [4] Ariza, J. P., Londoño, M. A., & Pérez, A. (2018). A comparison of machine learning models for exchange rate forecasting. *Journal of Financial Data Science*, 4(2), 45–62.
- [5] Zhou et al. (2023). Explainable AI in Finance: Interpreting USD/CNH Forecasts with SHAP.
- [6] Gong, R. (2025). Forecasting USD/CNY exchange rates using machine learning. *Journal of Financial Data Science*
- [7] Zhang, Y., & Hamori, S. (2020). The predictability of the exchange rate when combining machine learning and fundamental models.
- [8] Wang, Y. C., Tsai, J. J., & Chen, X. (2019). The Impact of RMB Internationalization and International Situations on China's Foreign Exchange Market: Dynamic Linkages between USD/CNY and SDR/CNY. *Emerging Markets Finance and Trade*, 57(5), 1437–1454.