Empirical Analysis of the Impact of Chinese Yuan to US Dollars Exchange Rate on the Shanghai Stock Exchange Composite Index

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Abstract. This study extends from the findings of prior research on Exchange Rates and Stock Composite Exchange Indices and explores the influences of the Chinese Yuan Exchange Rate on the Shanghai Stock Exchange Composite Index based on contemporary data. The study uses the daily data of the Chinese Yuan Exchange Rate and the Shanghai Stock Exchange Composite Index from the Choice Database and utilizes the Vector Autoregression Model and the Impulse Response Function to analyze the impact of the Exchange Rate on the Composite Index with the aid of Stata. The primary focus of this study is to suggest a discernible ability of the Exchange Rate to explain the variations in the Composite Index and inspect for potential explicit explication. The purpose of this study is to use the findings in terms of the temporary and lasting effects of the Exchange Rate shocks on the Composite Index to support investors and policymakers in their decisions. The study also takes a different approach that aligns the interconnections between the Exchange Rate, imports and exports indices, GDP, and Composite Index that indirectly evaluate the relatedness between the first and last variables. This study finds that a change in the exchange rate likely causes a relatively positive shift in the composite index, proposing an increasing intensity of investment or a change in investment strategies and that policymakers should attempt methods that either stabilize the alterations to promote economic stability or activates oscillation to foster long-term growth.

Keywords: Shanghai Stock Exchange Composite Index, Chinese Yuan to US Dollars Exchange Rate, Closing Price, Export and Import, Capital Flow.

1 INTRODUCTION

Exchange rates and the stock exchange composite index are two critical areas of study in finance and economics and are always thought to be intertwined. The interrelations of the financial market allude to the fact that exchange rate fluctuations could be a significant factor contributing to stock market performances, affecting economic stability and growth [1]. Therefore, in the context of China, understanding the influences on the Chinese Yuan to US Dollars Exchange Rate (CNYUSD Exchange Rate) on the

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Shanghai Stock Exchange Composite Index (SSE Composite Index) is crucial for investors and policymakers to make better decisions.

Previous research has explored the dynamic structures of financial correlations between exchange rates and stock prices, demonstrating discernible relationships across various markets. In a study of the real exchange rates' influences on stock market performances in multiple countries, the results suggested a strong signal of correlation, either positive or negative, between the two indices [2]. Some direct observations illustrated the remarkable connectedness between the CNYUSD Exchange Rate and the SSE Composite Index. An alternation in the CNYUSD Exchange Rate would cause the SSE Composite Index to oscillate, causing short-term and possibly long-term benefits for the overall economy [3].

Some evidence suggests that the imports and exports cast statistically significant influences on stock market performances, which are affected by the currency exchange values. In regard to the Chinese Yuan Currency Exchange rate's effect on the imports and exports trade, one study suggests that the former poses a statistically significant influence on the total values of the latter [4]. In addition, up till 2023, the data demonstrated a substantial portion of China's GDP up to 19% is constituted from its exports of goods and services [5]. Moreover, there appears to be a lasting correlation between China's GDP and the SSE Composite Index [6]. Furthermore, currency exchange rates present notable impacts on the capital flows which could also cause variations in the stock prices and will eventually influence the SSE Composite Index. In the short term, a change in the Chinese Yuan currency value would lead to a conspicuous fluctuation in the total capital flows [7]. Additionally, total capital flow is an index closely tied to the SSE Composite Index as the prior often explains an important portion of the SSE Composite Index [8].

However, while some studies hint at a strong correlation, others find a lack of evidence to confirm a direct and significant relationship in the short term. The CNYUSD Exchange Rate could potentially explain a portion of the stock market performance, which is interpreted in terms of the SSE Composite Index, yet the effect is minimal, and many other factors could outweigh the prior one [9]. On top of that, in some other findings, currency exchange rate could not be inferred as meaningful in the long-term with possible short-term effects, regarding the market indices, insinuating that the previously discovered correlation could be potentially unassertive [10]. Besides, there are observations indicating results could be context-dependent [11].

The discrepancies emphasize the necessity for further investigation and exploration in the fast-changing and evolving economic environment of China. This study aims to explore and analyze the connection of the CNYUSD Exchange rate to the SSE Composite Index with the vector autoregression model, also known as the VAR model. It will add additional information on the existing conditions in regard to the financial markets in China, possibly offering new investment strategies and economic policy references. Through exploration and examination of the VAR model on the recent market data, this research will enhance the comprehension of the relationships between the CNYUSD Exchange rate and the SSE Composite Index, potentially aiding investors and policymakers in their choices and planning.

2 RESEARCH DESIGN

2.1 Data Source

The Choice Database from East Money Information is a well-known online platform in China for its accessibility to extensive and detailed financial along with advanced analytics tools. This study retrieved separate data from the Choice database of the CNYUSD Exchange Rate and of the SSE Composite Index with daily submission frequencies from June 7, 2021, to June 7, 2024. The Currency exchange rates are interpreted with the original data whereas the SSE Composite Index calculates as follows:

$$SSE\ Composite\ Index = \frac{Market\ Cap\ of\ Composite\ Mmebers \times Base\ Value}{Base\ Period} \tag{1}$$

$$\text{Total Market Capitalization} = \sum(\text{price} \times \text{shares issued}) \tag{2}$$

The Market Cap of Composite Members represents the sum of the market capitalization of all the companies included in the current composite index. The Base Value is a constant, which in this case, is 100. The day that the SSE Composite Index calculation is based in December 19, 1990, and the Base Period is the total market capitalization of all the companies included at the time.

It should be noted that there are dates where the information is not recorded for both currency exchange rates and the SSE Composite Index over the period due to skipping data on holidays and weekends. The study chooses three values as standards to observe correlations between the two labels, which are the closing price of the CNYUSD Exchange Rate, the closing price of the SSE Composite Index, and the trading volume of the SSE Composite Index. Upon using the application of Stata and performing logarithmic and derivative transformations on these standards, the study eventually constructed the Vector Autoregression Model (VAR model) and Impulse Response that further observed the connectedness of the CNYUSD Exchange Rates to the SSE Composite Index.

2.2 ADF Unit Root Test

Following the data preprocessing, the study then performed Augmented Dickey-Fuller (ADF) Unit Root Test to test if the selected variables in the time series data are stationary. The ADF Unit Root Test is regularly applied to determine the stationarity of a given data through observing unit roots. The ADF test can be represented by the following regression equation:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + \epsilon_t \tag{3}$$

Δy_t = the first difference of the time series _t.
α = intercept (constant).
βt = deterministic trend.
γy_{t-1} = the lagged level of the series.

$\sum_{i=1}^{p} \delta_i \Delta y_{t-i}$ = the lagged differences to account for higher-order autocorrelation.

ϵ_t = the white noise error term.

The ADF test statistic is calculated to assess the significance of the lagged level of the series in the regression and when the value is significantly lower than the critical values, or in other terms, the p-value smaller than alpha at 0.1, the test would suggest rejecting the NULL Hypothesis of nonstationary.

Table 1. ADF Unit Root Test

Variables	Test statistic	P value
Logarithmic Values		
SSEC	-3.227	0.0792
Trading Volume	-6.829	0.0000
Exchange Rate	-1.722	0.7410
Growth rate of Logarithmic Values		
SSEC	-17.108	0.0000
Trading Volume	-22.852	0.0000
Exchange Rate	-18.023	0.0000

In the study, ADF Unit Root Test is performed to make the data stationary. As shown in Table 1, only the logarithmic transformation of the variables would not satisfy the test statistics, but upon finding the growth rate of the transformed variables, the values are all made stationary. Therefore, the continuation of the study will go through the analysis process with the growth rate of these logarithmic variables.

2.3 VAR Model

After the variables are all made stationary, the study is able to observe the correlation between the CNYUSD Exchange Rate and the SSE Composite Index. The VAR Model is a statistical model used to capture linear correlations in multivariate time series data where all variables must be made stationary. Hence, the study performed the VAR model after the selected variables were made stationary to further explore the relationships intertwined. The exact mathematical formula is as follows:

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \epsilon_t \tag{4}$$

Y_t = vector of k variables at time t.

c = intercept (constant).

$A_1, A_2, \cdots, A_p$ = matrices of coefficients to be estimated.

ϵ_t = the white noise error term.

3 EMPIRICAL RESULTS AND ANALYSIS

3.1 Order Determination

Preceding further analysis with the VAR Model, the study first calculates the model evaluation rubrics including Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz-Baysian Information Criterion (SBIC) with internal functions in Stata and use the results to determine the most appropriate lag for the VAR Model.

Table 2. VAR Model Order Determination

Lag	FPE	AIC	HQIC	SBIC
0	2.1e-13	-20.6881	-20.6801	-20.6673
1	1.9e-13	-20.7662	-20.7338*	-20.6827*
2	1.9e-13	-20.7711	-20.7144	-20.6251
3	1.9e-13	-20.7843	-20.7033	-20.5757
4	1.9e-13	-20.7762	-20.671	-20.505
5	1.9e-13	-20.7672	-20.6376	-20.4334
6	1.9e-13	-20.7798	-20.626	-20.3834
7	1.9e-13*	-20.7902*	-20.6121	-20.3312
8	1.9e-13	-20.774	-20.5716	-20.2524
9	1.9e-13	-20.7524	-20.5257	-20.1683
10	2.0e-13	-20.7284	-20.4774	-20.0817
11	2.0e-13	-20.729	-20.4538	-20.0197
12	2.0e-13	-20.7226	-20.423	-19.9506

These values are important as the study selects the order for VAR model analysis as the lower these metrics are, the better the model performance. The asterisk symbols in the table demonstrate the most appropriate value for each of these rubrics. However, these metrics did not arrive at a single best order for the VAR Model, so it should undergo some further observation before the final decision of order. As presented in Table 2, the asterisk symbols for FPE and AIC lie on the 7th lag while those of HQIC and SBIC lie on the 1st lag. Yet, this study wishes to choose a better model fit and avoid lower lags of 1 or 2 that oversimplify the model. However, it is still undetermined that lag 7 is the optimal option as the study needs to take the best performance out of all 4 metrics. Through observation and comparison, the model at lag 3 presents the smallest HQIC after lag 2 with an approximately -0.1 difference and the smallest SBIC after lag 2 with an approximately -0.2 difference than the model at lag 7 while the FPE stays almost identical and the AIC with a small difference of 0.005. Therefore, the model at lag 3 is the optimal option to start with. However, the growth rate of the CNYUSD Exchange Rate at lag 3 had a p-value of 0.5563 which is significantly larger than alpha at 0.1 suggesting not enough evidence to reject the Null hypothesis of nonstationary. On the other hand, lag 7 had the lowest FPE and AIC value along with the p-values of variables in the vector autoregression to be all smaller than alpha at 0.1. Hence, the study will proceed at lag 7.

After the determination of the VAR Model's Order, the stationarity test is performed to validate the model. It is important to understand that stationary VAR Mod-

els provide more consistent results as the Impulse Response Functions (IRF) are more interpreted as temporary shocks to the variables whereas the nonstationary VAR Models suggest shocks may produce permanent effects on the variables in long-term observations. By applying functions from Stata, figure 1 shows that all of the roots for the VAR Model at lag 7 lie within the confidence margins for stationarity indicating stationary VAR Models and shocks have temporary effects and will converge to zero in long-term observations.

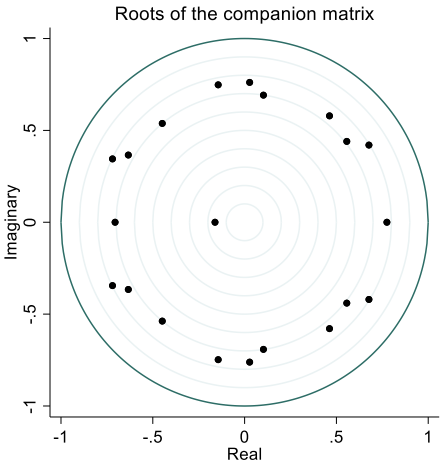

Fig. 1. Model stationary

Photo credit: Original

3.2 Impulse Response and Interpretation

In this section of the study, the results from Impulse Response Functions will be analyzed to finalize the statistical findings of this research. Previous findings provide evidence for the interdependence between the CNY Exchange Rate and the capital flows and suggest that the latter explains a significant portion of the SSE Composite Index. As the capital flow increases, the selling pressure decreases, and when there is an increase in trade volume along the escalation of capital flows, the chance for a subsequent increase in stock price is high, which hints at better market performance and increasing SSE Composite Index [12].

According to Figure 2, the green line, which is the orthogonalized impulse response function, indicates that the shock resulted in a positive response and then quickly drops to zero and below. Subsequent to the first period of the wave, the response function fluctuated around zero for another few periods before converging to zero. In addition, the second and the third fluctuation had increasing confidence intervals suggesting higher uncertainty in those periods after the shock. As steps increase, the fluctuation gradually returns to equilibrium, indicating the effects of the shocks

are likely temporary and as well suggest a stationary VAR Model. From the overall wave structure in this IRF plot, the accumulated positive response is higher than the accumulated negative response, implying that the variables are likely more reactive to positive shocks and the overall impact of the shock would lead to an increase in the SSE Composite Index's value considering cumulative effect over time.

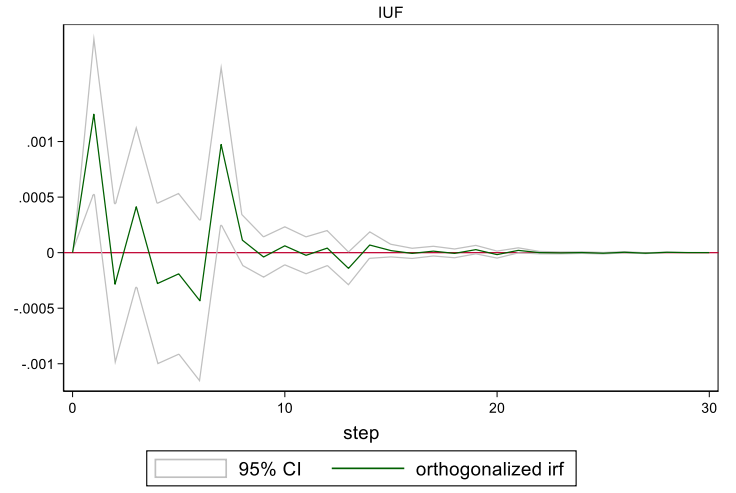

Fig. 2. Impulse (exchange rate) and response (SSEC)

Photo credit: Original

According to Figure 3, the IRF indicated a positive response following observation at step zero, yet there was also an equally significant negative response afterward. Following the first period of fluctuation, the response slowly converges to 0, demonstrating the stationarity of the VAR Model. Since the confidence intervals capture quite large margins for the initial periods of the fluctuation, the few responses observed right after the shock would be highly uncertain. In addition, the accumulated response is relatively neutral as the orthogonalized responses and the confidence intervals are quite symmetric to the mean return. Thus, the impact of the shock would likely exist in temporary terms, causing no additional alternation in SSEC Trading Volume's value in the long term.

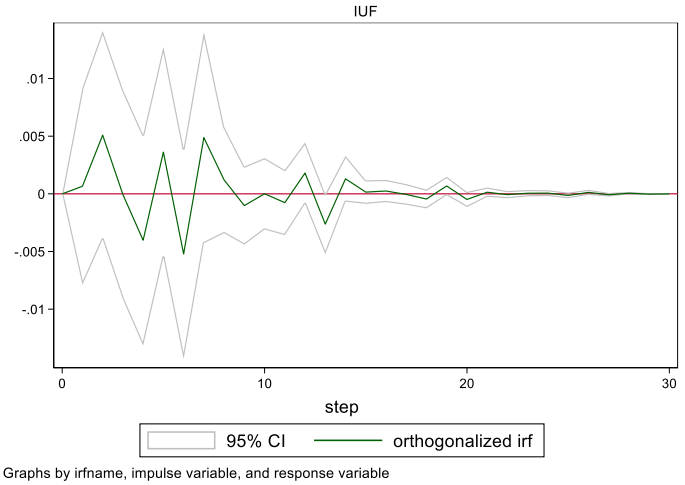

Fig. 3. Impulse (exchange rate) and response (Volume)

Photo credit: Original

4 DISCUSSION

While the earlier research on similar topics produced varied results, the interpretation of the results for this study suggest positive cumulated impacts from the shock of CNYUSD Exchange Rates on the SSE Composite Index and neutral cumulated impacts from the shock of CNYUSD Exchange Rates on the SSEC Trading Volume. Some studies delve into the other currency values and explore their relationships to stock market performances and receive diversified results. Even though some existing research explored the autocorrelations between the Chinese Yuan Exchange Rates and the SSE Composite Index, they arrived at different results up to the different chosen periods of data and submission frequencies. Anyway, some previous research has adopted the application of the VAR Model and analysis of the IRF to explore the impact with a similar intention to aid the decision-making for investors and policymakers.

This study extends the existing body of knowledge by providing recent data analysis from June 2021 to June 2024, capturing the effects of a rapidly evolving Chinese economy. The implications for policymakers are significant as the research suggests that exchange rate stability can positively influence the SSE composite Index which reflects the stock market performance. Policymakers should consider mechanisms to either stabilize the exchange rate to promote economic stability or stimulate shifts in the exchange rate to foster lasting economic growth.

For investors, the study examines the necessity of monitoring exchange rate movements as part of their investment strategy. The findings indicate that positive changes in the CNYUSD exchange rate can lead to increased stock market returns, which can inform investment decisions and risk management strategies, suggesting investors increase the intensity or forms of investments.

5 CONCLUSION

This study investigates the relationship between the CNYUSD Exchange Rates and the SSE Composite Index using the VAR model. The results reveal that upward shocks in the CNYUSD exchange rate led to a cumulative increase in the SSE Composite Index, whereas the trading volume of SSEC remains largely unaffected in the long term. These conclusions are derived from data spanning from June 2021 to June 2024, providing a contemporary perspective on the financial interrelations in China. The research underscores the importance of exchange rate stability in promoting desirable stock market conditions. Policymakers should consider these findings when designing economic policies aimed at stabilizing financial markets. Investors can leverage these insights by incorporating exchange rate trends into their investment strategies to optimize returns and mitigate risks since the SSE Composite Index appears to have positive cumulated impacts from the shocks of the CNYUSD Exchange Rate. Overall, the study contributes to a renewed and deeper understanding of the dynamics between CNYUSD Exchange Rates and SSEC indices, offering valuable guidance for both policymakers and investors in a fast-changing economic environment.

This study interprets the results from data that expands only for the most recent three years, which could be biased in terms of time range and the results can be context-dependent. In addition, there are dates for missing values reported in the data set including weekends, and national holidays, causing the values to be discontinuous. In future research, revised methodologies should be introduced to gather more precise and decisive information and produce better-fitted results. Furthermore, more analysis on the dependently correlated factors like capital flows and international trades should be performed to reconfirm the findings and reinforce the understanding.

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