

Black-White Exchange Rate Dynamic Model

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Abstract

This comprehensive study seeks to thoroughly analyze the trend of the Japanese yen exchange rate by utilizing advanced economic methodologies. The Japanese yen, as one of the most traded currencies globally, significantly influences international trade and investment flows. By employing an innovative black-white exchange rate monetary model, the research aims to extrapolate future trajectories of the yen's value within the currency market. This model offers a sophisticated framework in understanding the complex interactions between domestic economic indicators, such as inflation rates and interest rates, and their effects on the yen's valuation. Additionally, the study will incorporate historical data analysis and current market conditions to make accurate predictions regarding the yen's exchange rate. These predictions are important for stakeholders, including investors who need to manage their portfolios effectively and policymakers who are tasked with maintaining economic stability. Understanding these dynamics becomes increasingly important as the world economy continues to evolve. The findings of this research paper will provide valuable insights into the implications of fluctuating exchange rates on economic policy and strategy. By disseminating this information, this study aims to contribute to a more nuanced understanding of Japanese-yen's role in the global currency market, equipping both investors and policymakers with the knowledge necessary to navigate this complex landscape effectively.

Keywords

Black-White Exchange Rate Monetary Model, Currency Market, Trend of Yen, Black-White Mechanism

1. Introduction

This study aims to analyze the trend of the Japanese yen exchange rate, deduce its future trajectory, and predict its exchange rate using an innovative black-white

exchange rate monetary model.

Recently, news reports indicated that the Japanese yen sharply depreciated in 2024, falling below the 160 mark against the US dollar (Hermes, 2024). Despite this depreciation trend persisting for almost a year, beginning in 2023, the yen's weakness remains consistent with the news released on July 2, 2024. It has now fallen below 160 yen in the Asian foreign exchange market, with the current exchange rate at 161.4 yen, equivalent to 4.83 Hong Kong dollars per 100 yen, dipping below 5 yuan (BBC, 2024).

Although there are many different explanations for this depreciation trend, some experts attribute the decline of the yen to “yen wives”, the so-called Japanese housewives speculating on the yen at home; others point to Japan's aging population and weak economic structure, while some blame its bleak development prospects.

In fact, if we start from the theory of money supply, we will find that the exchange rate is actually determined by its money supply, which in turn is influenced by the monetary policy decisions of the Bank of Japan. As we all know, Japan has been pursuing a low-interest/zero-interest policy since the structural recession in the 1990s, and the zero-interest currency has consistently proven effective. In addition to preventing Japan's economy from further recession, low interest rates (close to 0%) can stimulate low-interest loans to drive economic growth.

2. Black Market and the Open Market

Sometimes, trends go against the current. This monetary policy, effective for nearly 30 years, has been drastically altered by the new central bank governor, Kazuo Mita. He advocated for and led the exit from the quantitative easing policy and significantly reduced the scale of bond purchases to escape the liquidity trap. Reducing bond purchases means the government will inject less money into the market, resulting in higher interest rates. Yet, why did the yen interest rate fall (depreciate) instead of rising when exiting zero interest rates?

The answer to this question must start with the black market and the open market. In the open market, that is, the formal foreign exchange currency market, if the aforementioned monetary policy measures are effective—specifically, reducing bond purchases—interest rates may rise sharply in the foreseeable future. However, this structural significance also reflects another implication: Japan's finances are becoming increasingly exhausted, which may be due to the aging of its population, the loss of the demographic dividend, or the failure to completely eliminate deep-rooted structural contradictions in its economy.

From another perspective, it can be observed that in the black market, the Bank of Japan undertakes bilateral operations. On one hand, it intervenes in the foreign exchange market by buying yen and selling US dollars to support the exchange rate. However, the market may perceive that its central bank is significantly increasing the supply of yen, which is the root cause of the decline in the yen exchange rate.

As discussed earlier in this study, the supply of currency is crucial in determin-

ing the exchange rate. If the market loses confidence in the Bank of Japan and begins to intervene to stabilize the yen's value, believing instead that the Bank is conducting bilateral operations—specifically, Spearhead foreign exchange operations—where it secretly issues a large currency supply while publicly appearing as a minor supporter (referred to as Black & White Spearhead operations), this suggests that the Bank of Japan is, in fact, engaging in reverse bilateral operations to mask market behavior rather than merely conducting unilateral buying operations as claimed by the Bank itself.

3. Black and White Dynamic Currency Markets

The market reaction caused by the black and white markets has generated a newly formed gray market. The emergence of the gray market creates a balance between the black and white markets. The foreign exchange market exists in a unique gray environment and may also involve bilateral market operations. For example, to avoid the force majeure risks posed by pure unilateral operations, this “big stone” passive mode enables machine buyers to take passive bilateral actions to mitigate those risks. This includes passive bilateral buying and selling, where long positions are bought in the open market and short positions are sold in the black market.

4. Black & White Dynamic Currency Model

$$\begin{array}{c} \text{Black \& White BS-Model} \\ \downarrow \\ \text{Black} \times \left[\frac{\partial v}{\partial t} + \frac{1}{2} \partial^2 S^2 \frac{\partial^2 v}{\partial S^2} + rs \frac{\partial v}{\partial S} - rV \right] \times \text{White} = 0 \\ \uparrow \\ \text{Probability (long Option)} \\ (0-1) \end{array}$$

Or

$$\text{White} \times \left[\frac{\partial v}{\partial t} + \frac{1}{2} \partial^2 S^2 \frac{\partial^2 v}{\partial S^2} + rs \frac{\partial v}{\partial S} - rV \right] \times \text{Black} = 0$$

Let Black = α , White = β

$$\text{Modify Approach: } \alpha \times \left[\frac{\partial v}{\partial t} + \frac{1}{2} \partial^2 S^2 \frac{\partial^2 v}{\partial S^2} + rs \frac{\partial v}{\partial S} - rV \right] \times \beta = 0$$

Or

$$\beta \times \left[\frac{\partial v}{\partial t} + \frac{1}{2} \partial^2 S^2 \frac{\partial^2 v}{\partial S^2} + rs \frac{\partial v}{\partial S} - rV \right] \times \alpha = 0$$

Cumulative distribution function probability for normally distributed variables

$$\alpha = N(x) = \frac{1}{2} \left[\frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-z^2/2} dz \right] \beta (\text{Short Put Option})$$

The chances of probability rise and fall are each half

$$\beta = N(x) = \frac{1}{2} \left[\frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-z^2/2} dz \right] \alpha (\text{Long Call Option})$$

↑
The chances of probability

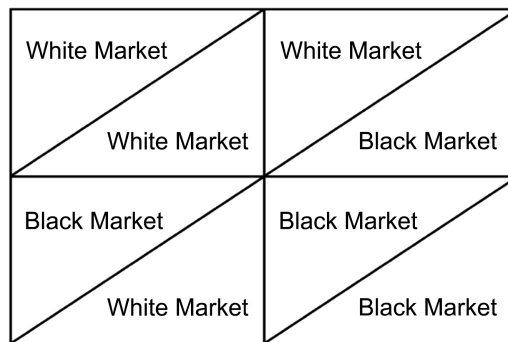
Modify B-S Model Approach

$$\frac{1}{2} \left[\frac{\partial v}{\partial t} + \frac{1}{2} \underbrace{\partial^2 S^2 \frac{\partial^2 v}{\partial S^2}}_{\text{B-S Model}} + rS \frac{\partial v}{\partial S} - rV \right] \alpha = 0$$

↑ probability ↑ α male share hold probability distribution

Assuming that the exchange rate increases, institutional investors will likely exercise most of their exchange rate warrants, resulting in a corresponding rise in the price of their securities over the long term.

Due to dilution from the significant increase in the number of stake portions, the likelihood of a price decline, over the long term, will align with the rise and fall ratio. This means that each scenario has at least a 0.5 probability and remains consistent, whether the price rises or falls. If we assume that the exchange rate decreases and institutional investors do not exercise their subscription rights, the decrease in their securities prices has already been reflected in their participation, meaning the relevant probability remains equal at 50 - 50.



Black & White Fx Spearhead Operation Dynamic Model

We will temporarily refer to this type of short position, leveraging operations involving long-holding and short-selling, as gray foreign exchange market operation. This so-called “passive operation” aims to address the risk-averse strategies of policymakers, which this study terms “gray area operation” (long hold short sell or short hold long sell).

5. Bank of Japan’s Bilateral Operations

Institutional investors are not solely focused on profit from the black market; some engage in passive risk trading to mitigate the risks arising from central bank

actions.

Returning to the Bank of Japan's bilateral operations, its unique advantage depend in its ability to issue additional currency and its right to exercise extensive currency issuance. This supreme authority is unparalleled by other institutional investors.

In 1986, Japan signed the Plaza Accord, which aimed at artificially increasing the value of the yen. This agreement utilized the Group of Seven to enhance the yen's exchange rate and encourage appreciation. As a result, the yen rose significantly from 286 yen in 1986 to 80 yen by 1995.

Some people may ask why the Japanese government signed the Plaza Accord. In fact, even if the Japanese government had not signed the Plaza Accord, the G7 group would have bought a large amount of Japanese yen to make it appreciate, resulting in a substantial increase in the yen's value. This would severely impact Japan's exports and manufacturing capabilities, weakening its primary source of success: the manufacturing industry and its ability to earn foreign exchange through exports. Therefore, the Japanese government felt compelled to sign the agreement under circumstances that left them feeling helpless. However, individuals in the Japanese government and business circles could also leverage the yen's appreciation to invest heavily overseas. Each had their own wishful thinking. Ultimately, this situation could be termed the first currency war, and the big winners were certainly the interest groups led by the United States.

The reason the United States was able to win the currency war was not due to extraordinary tactics, but because it holds the power to print money worldwide, specifically the right to issue the world's currency. The U.S. dollar, as the global common currency, is influenced by its unlimited issuance. Japan can only endure the passive price situation. Although Japan benefits from the high premium of the yen, this also impacts its export, manufacturing, and foreign exchange earning capabilities. This situation significantly erodes Japan's competitiveness as a global factory and severely undermines its relative competitive advantage (Maude, 2023). From a long-term perspective, this appreciation will inevitably affect export dividends and seriously harm Japan's domestic economy.

Although Japan has now emerged from deflation and entered a period of prosperity, the Japanese stock market has also reached new highs, hitting 40,000 points. The Bank of Japan stands to benefit from the depreciation of the yen, which has significantly increased its use and bolstered tourism and hotel services, generating excess foreign exchange income. The export dividend from yen depreciation has greatly enhanced Japanese factory competitiveness. This increase in profitability has further driven stock market values to new heights. This is a very positive development. According to statistics, the average usage rate of the Japanese yen used to be only 6 to 7 percent of the world's total. In recent years, it has risen sharply to 10 percent. This 3 to 4 percent increase is sufficient to push the Bank of Japan's foreign exchange reserves to a new high, nearing the world's top position, as of China.

6. Trend on Yen in Near Future

This study predicts that if the trend of yen depreciation continues (black-white foreign exchange rate model), the foreign exchange reserves of the Bank of Japan will undoubtedly reclaim the top position globally, surpassing other countries to become the nation with the largest foreign exchange reserves in the world in the near future. This article even boldly predicts that the yen will depreciate significantly, from the current 5 yen to 1 RMB, down to a discount of 55% at 2.5 yen to 1 RMB. By then, the number of individuals investing in real estate or traveling in Japan will inevitably increase significantly, and its export volume, along with foreign exchange reserves, will also see a notable rise (Craig, 2007).

Of course, the depreciation of the yen has certain drawbacks (Shi et al., 2021; He & Pan, 2022), notably imported inflation, which decreases citizens' real income. Additionally, the gross domestic product (GDP) calculated in US dollars is likely to decline as a result of the yen's depreciation. Consequently, there is a possibility that emerging countries like Brazil and Indonesia may surpass it during this period.

7. Conclusion

Finally, this study innovatively established a black-white exchange rate model to predict the future direction of the Japanese yen effectively and more accurately. The key aspect of this model is its capacity to accurately forecast the future direction of the Japanese yen, utilizing its related black-white mechanism purchasing game. This represents a significant predictive advancement. This study can contribute valuable insights to the economic and investment communities, and it will also benefit the academic community.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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