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How Do Interest Rates and Exchange Rates Interact

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Abstract:

This research aims to explore the relationship between interest rates and exchange rates from theoretical interactions to concrete linear relationships. Interest rate parity theory plays an important role in this topic, where forward discounts and forward premiums are discussed. What's more, by analyzing the interest rate and exchange rate data of the countries using LIBOR, this study seeks changes in the correlation between interest rates and forward premium/discount before and after the cancellation of LIBOR. The reasons for switching from LIBOR to SOFR are also analyzed. The expected outcome includes, providing that how do interest rates and exchange rates interact, whether the removal of LIBOR has affected market efficiency.

Keywords: interest rate; exchange rate; relationship; LIBOR; SOFR

1. Introduction

Nowadays, with the deepening of globalization, the linkage between financial markets has been significantly enhanced, and the relationship between exchange rate and interest rate has become an indispensable part of macroeconomic and financial research. As the embodiment of the relative value of two countries' currencies, exchange rates directly affect international trade, capital flow and economic competitiveness between countries. As the cost of using funds, interest rates are the core tool of monetary policy and plays a crucial role in regulating domestic economic activities.

The primary objective of this study is to analyze the relationship between interest rates and exchange rates. To achieve this, the research will answer the following questions: impact of interest rate changes on exchange rates and impact of exchange rate changes on interest rates. The interaction requires the analysis of the effects from two different perspectives.

Besides, LIBOR and SOFR, as the international benchmark interest rates, which play an important role in the interest rate market, are unavoidable issues to be discussed under this topic. The reason for the switch from LIBOR to SOFR, the process from LIBOR to SOFR, and whether the abolition of LIBOR has affected market efficiency will be discussed in the paper.

The purpose of this study is to explore how interest rate changes affect exchange rate fluctuations and how exchange rate adjustments react to interest rate levels, so as to provide reference for policy making. This study analyses the interaction mechanism, which is helpful to understand the interaction of financial markets, and has important significance for policy making, corporate decision making and mar-

ket forecasting.

2. Literature Review

2.1 Theoretical Research

Several studies have focused on key themes in interest rate parity theory. When interest rates in one country are higher than in another, investors tend to move money from countries with low interest rates to countries with high interest rates in order to obtain higher yields. Such capital flows lead to increased demand for currencies in countries with high interest rates, which in turn drives up the value of their currencies. The currencies of countries with low interest rates depreciate as demand wanes. The forward exchange rate tends to move in the opposite direction to the spot exchange rate, with the forward exchange rate of the currency of the high-interest rate country falling relative to the spot exchange rate (forward discount) and the forward exchange rate of the currency of the low-interest rate country rising (forward premium). Interest rate parity theory states that the difference between the interest rates of two countries should equal the difference between the forward exchange rate and the spot exchange rate. The core of this theory is that when there is a difference in interest rates between two countries, investors will use arbitrage or arbitrage to earn the price difference, which will cause fluctuations in the exchange rate of the two countries until the arbitrage space disappears.

In addition, the Mundell-Fleming model further explores the interaction between interest rates and exchange rates under different exchange rate regimes, and emphasizes the effects of monetary policy and fiscal policy in an open economy.

2.2 Empirical Research

The research shows that the increased linkage of the financial market makes the interest rates of different countries affect each other, which supports the prediction of interest rate parity theory to a certain extent. However, empirical studies in specific countries and regions have also found that due to market friction, capital controls and other factors, interest rate parity theory may be biased in practical applications.

2.3 Research gaps

Although the theory of interest rate parity provides an important basis for the study of the relationship between interest rate and exchange rate, the theoretical models in previous studies are mostly based on strict assumptions, which are often difficult to be established in the complex and changeable real economic environment. For example, the theory of non-offset interest parity assumes that investors are risk neutral and can accurately predict future exchange rates, which is difficult to achieve in practice.

Moreover, in terms of empirical research, the previous studies mostly focused on the markets of developed countries, and there were differences in the selection of data and the selection of sample time frame, while the particularity of the economic structure and financial market of developing countries was not taken into account. This not only affects the comparability of the findings, but also limits the applicability of the theoretical model to the broader economic environment.

3. Research Method

3.1 Research Design

This study adopts a qualitative and quantitative mixed analysis approach to explain the relationship between the interest rate and exchange rate.

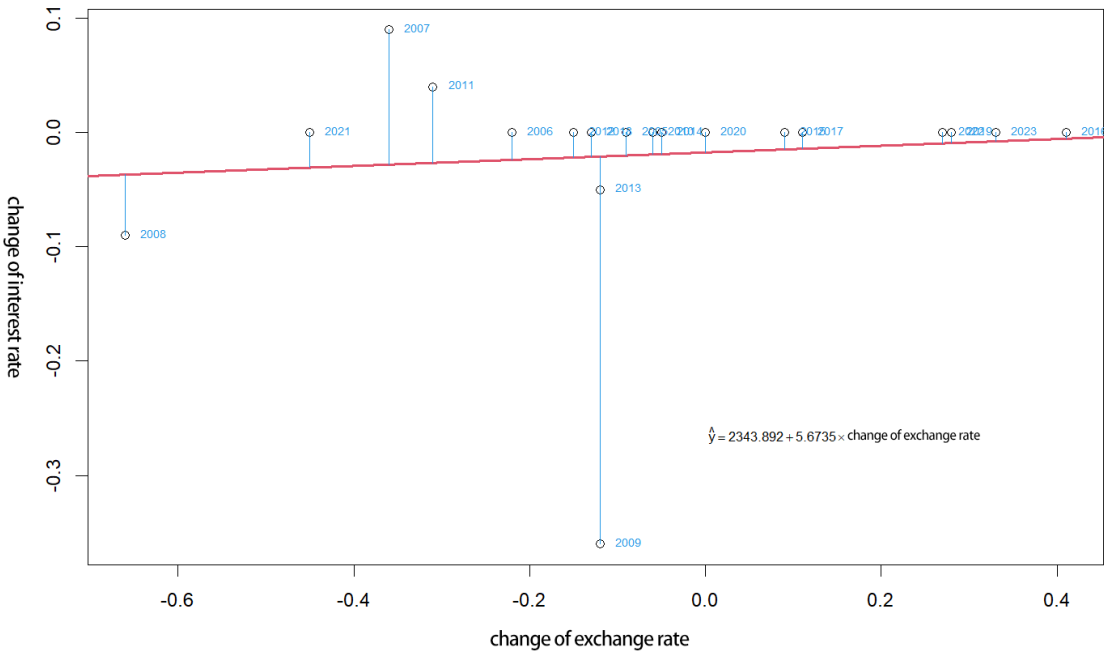
3.2 Data Sources

Interest rates and exchange rates are sourced from the International Monetary Fund Website. China's interest rate policy is taken from the People's Bank of China official website.

3.3 Research Design

The collected data will be analyzed using regression model and least squares estimation by R. Through this model, the correlation between interest rates and exchange rates can be obtained. What' more, lining up plots of deposit rates and forward premium/discount over the last decade are plotted in the same figure, then we can know whether the removal of LIBOR has affected market efficiency.

3.4 Data Analysis



Using the data of China's annual exchange rate (against US dollar) and deposit interest rate from 2004 to 2023, the change of exchange rate and the change of exchange rate are calculated. Because of the high autocorrelation of levels data for each year, the data about change from year end to year end are finally taken. The regression model is established by least squares estimation method, and the regression equation of change in interest rate and change in exchange rate estimation is obtained and the regression fitting graph is drawn.

Through anova, we can get the multiple R-squared is 0.8161 and the adjusted R-squared is 0.5018, which show that the regression model has a strong ability to explain the observed data, and the model fits well. Besides, the mean standard error of change in interest rate is 0.0204 and the mean standard error of change in exchange rate is 0.0631. The smaller the standard error, the more reliable is the inference of population parameters with sample statistics. What'more, through Durbin Watson test, the p-value is 0.512, which is greater than 0.05 and indicates that there is no autocorrelation in the residuals.

From the model, we can see that the two are positively correlated. The model is tested and the correlation analysis is carried out, and it is concluded that the interest rate and exchange rate are closely related, and the regression model has a good fit. But at the same time, due to the many influencing factors in practice, such as national fiscal policies and international political and economic environment factors, there may be some errors in the regression equation.

In order to ensure the validity of the research results, the data of two countries from August 2014 to August 2024 are selected for the study, namely the United Kingdom and the United States. Both countries have used LIBOR as a reference for their benchmark interest rates. First, the forward premium and discount are obtained by taking the difference between the pound's spot interest rate (against the dollar) and the six-month forward exchange rate. The annual UK deposit rate and the forward data derived earlier are then plotted as line graphs. Since the forward premium/discount figure is too small to reflect the magnitude of the change in the same chart as the interest rate, it is easy to see the correlation and the trend of the change by zooming it up to ten times. Repeating the above procedure, using the dollar interest rate (against the pound) and the US deposit rate, you can also draw a line chart.

By observing the statistical chart of the broken lines, it can be seen that the volatility of the two lines has changed around 2022. Before that, the deposit rate changes by a small amount, and after that, it changes by a large amount. The relationship between the two data times has also changed. This shows that the removal of LIBOR will have an impact on the global exchange rate market. However, there are many realistic factors that are not taken into account, such as the Russia-Ukraine war and the Federal Reserve's interest rate hike, which affect the reliability of the research results. In addition to this, the implementation of SOFR after the removal of LIBOR may also have improved the efficiency of the market.

4. Finding

4.1 Impact of Interest Rate Changes on Exchange Rates

Capital Flow Effect: When interest rates rise in a country, it attracts international capital inflows seeking higher returns. This increased demand for the domestic currency pushes up its exchange rate, while the foreign exchange rate depreciates.

Current Account Effect: Changes in interest rates also indirectly impact exchange rates through the current account. For instance, higher interest rates can discourage domestic investment and consumption, potentially lowering prices and boosting exports over imports. This reduces demand for foreign currency, increases its supply, and further depreciates the foreign exchange rate while appreciating the domestic one.

4.2 Impact of Exchange Rate Changes on Interest Rates

Inflation and Price Level Effect: When a country's currency depreciates, the cost of imported goods rises, potentially fueling domestic inflation. Rising prices can lead to a decline in real interest rates but may prompt an increase in nominal interest rates to compensate for inflation losses.

Capital Flows and Market Expectations: Exchange rate movements can also influence market expectations and capital flows. For example, persistent currency depreciation can foster further depreciation expectations, leading to short-term capital outflows and a reduction in domestic liquidity, which may push up interest rates.

4.3 Linear Relation

According to the data analysis, we developed a regression model with a good fit. The specific expression is " change of interest rate = 2343.892 + 5.6735 * change of exchange rate ", which shows that the change of interest rate and the change of exchange rate have a positive linear relationship. This means that when the domestic interest rate rises, the domestic currency may appreciate, but considering the market reaction and capital flows, the actual result may show up as the exchange rate rises (the domestic currency depreciates), because high interest rates attract foreign capital inflows and increase the demand for the domestic currency, but at the same time, they may also push up the domestic currency's exchange rate, making exports more expensive in the international market. This may trigger a reverse adjustment of the exchange rate.

However, this relationship is not absolute, and the actual situation may be complicated and difficult to predict due to a number of factors. For example, changes in monetary policy, fluctuations in the international political and economic situation, and changes in market expectations may all have a significant impact on interest rates and exchange rates. In addition, interest rate and exchange rate relationships may differ across economies. Some economies may have more flexible exchange rate regimes, making exchange rates more responsive to changes in interest rates; While others may intervene in the foreign exchange market to maintain exchange rate stability.

4.4 the Role of LIBOR Plays in the Relationship

As a benchmark interest rate, LIBOR is often used as a benchmark for lending and financing rates, and is also an important reference for the pricing of financial products. LIBOR reflects the flow of funds between banks and the cost of financing in the market, and is an important indicator to assess the health of the financial market. Its openness and transparency help to enhance the transparency of the financial market and promote fair competition among market participants. Some national central banks take LIBOR as one of the standards of their monetary policy operations, and influence the level of market interest rates by adjusting LIBOR, so as to achieve the monetary policy objectives. At the same time, every change of LIBOR will have a significant impact on the global financial market, so its stability and accuracy are of great significance for maintaining the stability of the global economy.

4.5 From LIBOR to SOFR

The reasons for the cancellation of LIBOR are as follows: first, due to the rapid development of the money market, the scale of the interbank lending market has shrunk sharply in recent years, resulting in a serious mismatch between the scale of transactions generated by LIBOR and the scale and variety of financial products used to price it, weakening its robustness as a benchmark interest rate. Second, the deep foundation of financial operation is credit. LIBOR is an unsecured interest rate, and its price includes the credit risk of the quoted bank. In times of liquidity stress such as the financial crisis, this credit risk cannot be ignored, resulting in LIBOR's inability to accurately reflect the true cost of funds in the market. Third, because the quotation is not based on the real transaction data, but submitted by the banks participating in the quotation according to their own judgment, the transparency of the formation mechanism of LIBOR also began to decline under the situation of shrinking trading volume and insufficient quotation sample size, and the problem of LIBOR manipulation gradually emerged, and its credibility and market confidence were questioned.

To this end, the Fed established the Committee on Alternative Reference Rates in 2014 and developed the benchmark interest rate curve replacement plan, which officially selected SOFR as the alternative rate three years later. SOFR ameliorates two of LIBOR's most fatal flaws and is more representative of current interbank funding costs than LBOR. First,SOFR is calculated not by quoted prices but by transaction prices, which makes manipulation more difficult. Second, repo is the most traded item in the money market, which ensures that SOFR can reflect the interest rate level of the money market to the greatest extent.

However, has the removal of LIBOR affected market efficiency?

LIBOR is an important pricing benchmark in financial markets, and its cancellation means that the market needs to find a new pricing benchmark to replace it. In the broken line chart, it can be seen that the volatility of the two lines has changed around the time LIBOR was cancelled. Before that, the deposit rate changes by a small amount, and after that, it changes by a large amount. According to the data analysis, the cancellation of LIBOR has a certain impact on the exchange rate and interest rate, which leads to the volatility of the market. However, the new pricing benchmark may provide greater transparency and stability, which could help promote market recovery and improve market efficiency.

5. Discussion

5.1 Research Significance

Macroeconomic policymaking: Understanding the interaction mechanism between interest rates and exchange rates helps governments and economic policy makers more accurately evaluate the effects of monetary and exchange rate policies, so as to take more precise and effective macroeconomic control measures. In the face of economic overheating, the central bank may raise interest rates to attract foreign capital inflows, thus stabilizing or appreciating the domestic currency and curbing inflation. Conversely, when growth is weak, lower interest rates may encourage a weaker currency and increase export competitiveness.

Global economic dynamics: Fluctuations in interest rates and exchange rates have a direct impact on financial market stability. Studying the relationship between the two can help regulators predict market trends and take timely measures to prevent financial risks, such as controlling excessive exchange rate fluctuations by intervening in the foreign exchange market or guiding market expectations by adjusting the benchmark interest rate to maintain the smooth operation of the financial market.

Corporate and individual financial decisions: For multinational enterprises, changes in interest rates and exchange rates directly affect their financing costs, overseas investment returns and exchange rate risks. Studying the relationship between interest rates and exchange rates can help enterprises better evaluate the feasibility of overseas investment projects, formulate appropriate financing and risk management strategies, and optimize global resource allocation. For ordinary investors and consumers, understanding the relationship between interest rates and exchange rates is also an important part of personal financial planning. For example, allocating overseas assets when exchange rates are favorable, or adjusting savings and investment portfolios in response to interest rate movements, so as to maintain and increase the value of assets.

5.2 Research Limitations

Relationship complexity and model applicability: The relationship between interest rate and exchange rate is often affected by a variety of factors, including domestic and foreign economic environment, policy changes, market expectations, etc. The interaction between these factors makes the relationship between the two show a high degree of complexity and nonlinear characteristics, which is difficult to be fully and accurately described by a simple model. At the same time, theoretical models are often based on a series of assumptions when explaining the relationship between interest rate and exchange rate, which may not be fully established in reality, resulting in deviation between model prediction results and the actual situation.

Limitations of data acquisition and processing: It is difficult to obtain high-quality macroeconomic data and there is a time lag, which to some extent limits the timeliness and accuracy of the research. In addition, errors and biases in data processing may also affect the reliability of research conclusions.

Neglect of micro-level factors: current studies mostly focus on macro-level analysis, with less attention paid to the impact of micro-level corporate and individual behaviors on the relationship between interest rates and exchange rates. In fact, the decision-making behavior of firms and individuals can also have an important impact on exchange rates and interest rates, thus changing the relationship between the two.

To sum up, the exploration of the relationship between interest rate and exchange rate still needs continuous in-depth research to overcome the shortcomings of the existing research and improve the scientific and practical nature of the research.

6. Conclusion

Data analysis reveals the dynamic relationship between interest rate and exchange rate, and provides suggestions for policy makers on how to coordinate interest rate and exchange rate policies to achieve economic stability and financial market balance. Besides, aiming at the shortcomings of current research, it also provides a new perspective and entry point for future research.

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