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A Quantitative Study of Influential Factors on HIBOR under Hong Kong's Linked Exchange Rate System

Jianbin SITU

Abstract

Hong Kong Inter-Bank Offered Rate (HIBOR) is one of the most important interest rates in the Hong Kong money market. This paper studied some of the significant factors in determining HIBOR under Hong Kong's Linked Exchange Rate System using a VAR model to describe how various factors affect the movement of HIBOR. The result indicates that HIBOR, foreign exchange rate and M1 are correlated.

1. Introduction

According to Investopedia, Hong Kong Inter-Bank Offered Rate is an interest rate stated in Hong Kong dollars on the lending and borrowing between banks in the Hong Kong interbank market. The interbank market is a crucial component of the money market; it is used by banks for transferring funds and currencies and managing liquidity. Interbank offered rate reflects the cost of capital that financial institutions can acquire funds by wholesale; therefore, the interbank offered rate plays an indicative role in the interest rates system.

The relationship between interest rates, foreign exchange rate and Money supply can be theoretically explained by interest parity model.

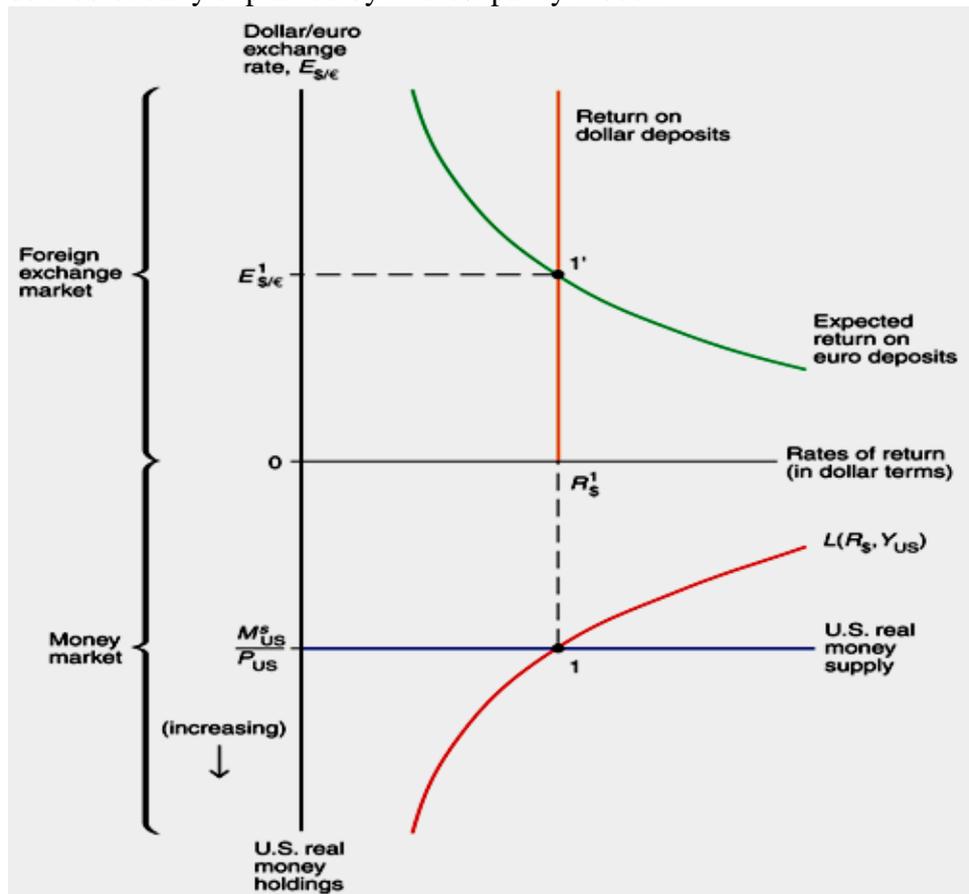


Figure 1: Interest Parity Model Source: International Economics Theory and Policy, 7th Edition, Paul R. Krugman, P349, Figure 14-6.

As depicted in figure 1, Interest rates act as a bridge between the money market, and the foreign exchange market. When the currency depreciates, the $E_{\$/\text{€}}$ moves up along the curve, resulting in a leftward shift in $R_{\$}$. Therefore, under the fixed exchange rate system the central bank has to adjust interest rates by adjusting money supply in order to restore exchange rate. Naturally, it is expected that the operating theory of Hong Kong's Linked Exchange Rate System would correspond with interest rate parity model and therefore would react in the same way as previously explained.

2. Review of literature

Until recently, only a few studies used VAR model to examine factors that affect the movement of HIBOR. Mok, Henry M K (1993) has done the Granger Causality Test on some factors including stock price, exchange rate and HIBOR, by using ARIMA

approach. His research mainly focused on the linkage between stock price and other economic factors. The Hong Kong Monetary Authority (2009) used VAR model to briefly analyze the linkage between the HIBOR, LIBOR, exchange rate and the stock indices. This report helps us understand the relationship between HIBOR and some economic factors in different periods.

3. Data

Considering the economics theory and the principle of Hong Kong's Linked Exchange Rate System, I chose the overnight HIBOR as the dependent variable and the exchange rate against US dollar as well as M1 as independent variables. (Figure 2 shows how foreign exchange rate and money supply affects interest rates under Hong Kong's Linked Exchange Rate System).

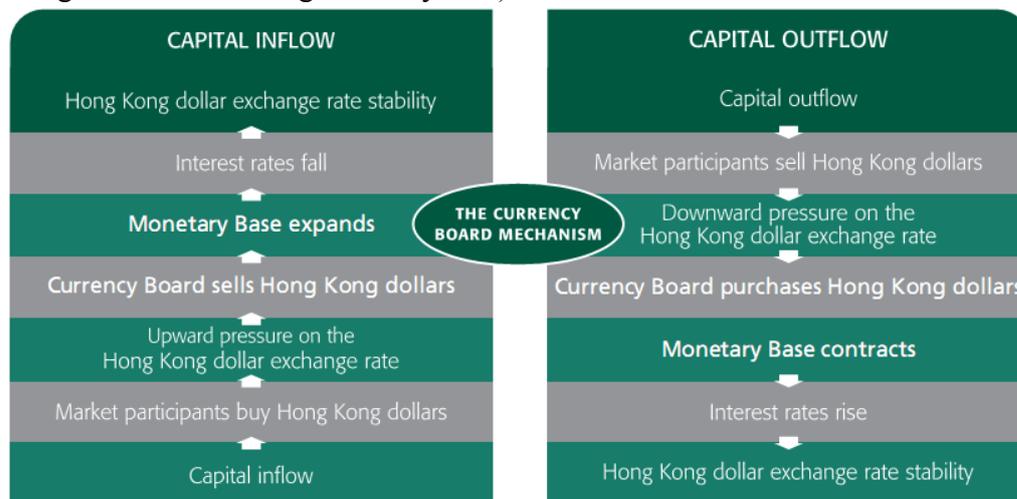


Figure 2: Source: Hong Kong's Linked Exchange Rate System, HKMA

1) Foreign Exchange Rate

Since 15th of October 1983, under the Hong Kong's Linked Exchange Rate System, the Hong Kong dollar has been pegged to US dollar at HK\$7.8 to US\$1. According to the interest parity theory, in order to maintain the link, HK's interest rate will have to adjust when the HK dollar depreciates (or appreciates), which puts pressure on interest rate to rise (or fall).

2) M1

Interest rate is determined by the interaction of money supply and demand. The money market is in equilibrium when the money supply equals money demand. If there is an excess supply of money, the interest rate falls, and if there is an excess demand, it rises.

Data Source: Hong Kong Monetary Authority

It is necessary to give some explanation to the variables before running regression.

T=time trend: from October 1999 to August 2009(monthly), 119 observations

HIBOR=Hong Kong Inter-Bank Offered Rate

dHIBOR=HIBOR_t-HIBOR_{t-1}

FOREX=foreign exchange rate (HKD per USD)

LNFOREX=log (FOREX)

$$d\text{LNFOREX} = \text{LNFOREX}_t - \text{LNFOREX}_{t-1}$$

M1=money aggregate (including currency, checks, demand deposits)

$$\text{LNM1} = \log(\text{M1})$$

$$d\text{LNM1} = \text{LNM1}_t - \text{LNM1}_{t-1}$$

4. Methodology

The paper develops the model by applying several techniques. The variables are mainly subject to bivariate analysis including Augmented Dickey-Fuller Test (ADF), Engle-Granger Test (EG), Granger-Causality Test, Vector Autoregressive model (VAR) or Error Correction Model if necessary.

4.1 Augmented Dickey-Fuller Test

This paper verifies the Stationarity of the time series by going through the ADF Test. Based on the result of ADF Test, HIBOR, lnM1 are non-stationary processes, but lnForex is a stationary process. Table 1 shows the results of the ADF Test.

Table 1: ADF Test of time series

Variable	Type of Test	t-Statistic	5% Level Critical Value	Conclusion
HIBOR	Intercept	-1.646293	-2.886290	Non-stationary
dHIBOR	None	-14.71512	-1.943587	Stationary
lnM1	Trend and intercept	-3.132140	-3.449020	Non-stationary
dlnM1	None	-12.23364	-1.943612	Stationary
lnFOREX	Intercept	-2.947296	-2.886074	Stationary

4.2 Engle-Granger Test

The paper tests the cointegration between the dependent variable and the independent variable by means of the Engle-Granger Test. Based on the EG Test on the 5% critical values, there is no cointegration between the dependent variable and the independent variable. Thus, I will apply the VAR model. Table 2 shows the results of Engle-Granger Test.

Table 2: Engle-Granger Test

Variable	Type of Test	t-Statistic	5% Level Critical Value	Conclusion
Residual(HIBOR, lnM1)	None	-1.213318	-1.943612	NOT cointegrated

4.3 VAR model

The following equation explains how a VAR model is estimated. We assume that the equation contains p lag values of y and x. In this case, one can estimate the equation by OLS:

$$y_t = a_0 + a_1 y_{t-1} + \dots + a_p y_{t-p} + b_1 x_{t-1} + \dots + b_p x_{t-p} + e_t$$

Where a_0 is the constant term, y_t and x_t are the dependent variable and independent variable respectively. p denotes the lag length, a_p and b_p represent the coefficients and e_t denotes residual.

Based on the minimum AIC criterion, I obtain two VAR models, dHIBOR-lnFOREX 3-lag VAR model and dHIBOR-dlnM1 2-lag VAR model.

4.4 Granger Causality Test

Table 3: Granger Causality Test

Model	Direction of Causality	p-Value	Conclusion
3-lag VAR	FOREX→HIBOR	0.0241	Reject
	HIBOR→FOREX	0.6776	Do not reject
2-lag VAR	M1→HIBOR	0.0417	Reject
	HIBOR→M1	0.9794	Do not reject
2-lag VAR	FOREX→M1	0.0000	Reject
	M1→FOREX	0.0872	Do not reject

From Table 3, we see that at a 5% level critical value, p value of FOREX to HIBOR is .0241, so I reject the null hypothesis that foreign exchange rate does not Granger cause HIBOR. That means, foreign exchange rate is the Granger Causality of HIBOR but the opposite is untenable. For the period 1999 to 2009, the paper identifies the unidirectional causality running from foreign exchange rate to HIBOR.

I also reject the null hypothesis that M1 does not Granger cause HIBOR at 5% level critical value. M1 is the Granger Causality of HIBOR. For the period 1999 to 2009, the causality relation between M1 and HIBOR is unidirectional either.

Despite the fact that the paper is more focusing on influential factors on HIBOR, I still want to find out whether there is causation relationship between M1 and exchange rate. Not surprisingly, the direction of causality is from FOREX to M1 at 5% critical value. This means, in order to maintain the exchange rate at HK\$7.8 to US\$1, the currency has to adjust the interest rates by changing the money supply.

The results verify that it is reasonable to choose these variables. Based on this, the paper conducts impulse response analysis between the variables that have causality relation.

4.5 Impulse Response Analysis

To better demonstrate the dynamic movements on Granger-Causality Test, I will identify the structural shocks and the impulse response.

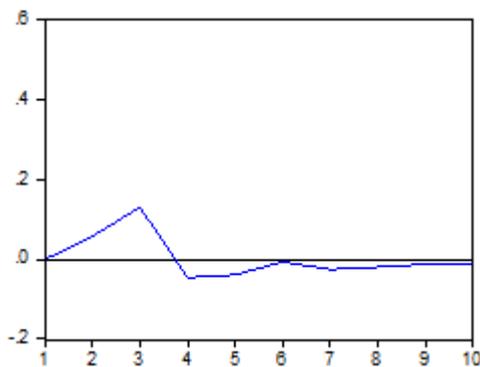


Figure 3: Impulse Response of DHIBOR to LNFOREX

Figure 3 displays the impulse response for one-standard foreign exchange rate. It indicates that a one-time shock on HIBOR would lead to a positive response and the positive response reaches a peak at the 3rd period. After that, the response shows a reverse trend then becomes negative and converges towards zero eventually.

Hence, I conclude that the depreciation of Hong Kong Dollar would prompt HIBOR to rise in the short-run. But it cannot hold in the long-run. This may be because the

system would adjust rapidly. As a result, the response of DHIBOR to LNFOREX would be getting weaker after the 4th period.

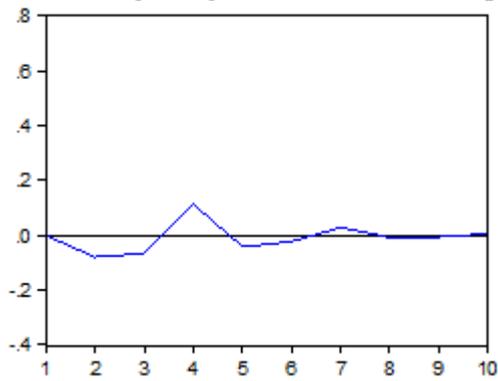


Figure 4: Impulse Response of DHIBOR to DLNM1

Figure 4 reveals that a one-time shock on DHIBOR would first cause a negative response and then it becomes positive and gradually reaches a peak at the 4th period. After that it changes into negative again and starts to converge to zero after the 5th period.

In conclusion, an increase in money supply will cause HIBOR to go down in the short-run. This is the opposite of our expectation that the impact of the increase in money supply would not be that strong. This may be because of the fact that the interest rates were very low in some periods. Actually, the result is somehow puzzling and I am still trying to find the reason for that effect.

4.6 Variance Decomposition Analysis

Besides the impulse response analysis, I carried out another exercise, that is, the variance decomposition for each series.

As shown in Table 4, foreign exchange rate shocks in period 8 determined more than 12% of HIBOR. This suggests that HIBOR changes, to some extent, are driven by exchange rate changes.

Table 4: Variance Decomposition of DHIBOR

Variance Decomposition of DHIBOR:			
Period	S.E.	LNFOREX	DHIBOR
1	0.581481	4.763779	95.23622
2	0.598912	6.507938	93.49206
3	0.613256	10.78401	89.21599
4	0.621508	11.56910	88.43090
5	0.623010	11.79636	88.20364
6	0.623050	11.80742	88.19258
7	0.623814	11.98502	88.01498
8	0.624112	12.06491	87.93509
9	0.624238	12.10008	87.89992
10	0.624400	12.14414	87.85586

Cholesky Ordering: LNFOREX DHIBOR

Table 5: Variance Decomposition of DHIBOR

Variance Decomposition of DHIBOR:			
Period	S.E.	DHIBOR	DLNM1
1	0.621630	100.0000	0.000000
2	0.673641	98.62948	1.370524
3	0.676963	97.68434	2.315656
4	0.688391	95.00713	4.992872
5	0.689946	94.66578	5.334220
6	0.690334	94.55987	5.440132
7	0.690981	94.38913	5.610866
8	0.691032	94.37635	5.623652
9	0.691058	94.36926	5.630741
10	0.691085	94.36192	5.638083

5. Conclusions and Suggestion for Further Research

This study confirms that Hong Kong's Linked Exchange Rate System is exerting great impact on Hong Kong economy. In order to maintain the exchange rate, the currency board has to adjust the interest rates by expanding the money base. Evidence reveals that Hong Kong's Linked Exchange Rate System has been functioning effectively since its recovery from Asian Financial Crisis. It is crucial to maintain a stable exchange rate because Hong Kong is highly externally oriented and has an open economy. However, under such a fixed exchange rate system, the monetary authority is not capable of entirely determining the interest rate or the money supply. The currency board may have to change interest rates due to the inflation in USA. These actions may cause inflation in Hong Kong as well. It is beneficial to understand the interaction between HIBOR, exchange rate and money supply more deeply. By doing so, the policy makers can handle the financial problems more efficiently and more effectively.

With the increase in globalization trend in the world economy, Hong Kong is likely to establish tighter connection with more countries and regions, such as mainland China. This paper has provided a preliminary analysis of some influential factors on HIBOR. To find some other factors that affect HIBOR can be an important topic for future research.

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