Forecasting Value at Risk of Foreign Exchange Rate by Integrating Geometric Brownian Motion

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Abstract. Foreign exchange is one of the most important financial assets for all countries around the world including Malaysia. After recovering from the Asian financial crisis, Malaysia tried to build a strong currency in order to maintain the economic performance. The study focuses on Malaysia foreign exchange rate and foreign exchange risk between ten currencies, which are CNY, SGD, JPY, EUR, USD, THB, KRW, IDR, TWD and AUD. Unpredictability of the foreign exchange rate makes the traders hard to forecast the future rate and the future risk. The study implements the parametric approach in the Value at Risk (VaR) method and the geometric Brownian motion (GBM) model. The objectives of the study are to integrate the VaR model with the GBM model in order to compute or forecast the VaR. By using parametric approach, the study successfully computes the VaR of foreign exchange rate for different confidence levels. The GBM model is suitable to forecast the foreign exchange rate accurately using less than one year input data and using the log volatility formula. Lastly, the study verifies the feasibility of the integrated model for a one month holding period using the data shifting technique. In conclusion, the prediction of future foreign exchange rate and foreign exchange risk is important in order to know the performance of a country and to make better decision on investment.

Keywords: Forecasting · Foreign exchange rate · Parametric approach
Value at risk · Geometric Brownian motion

1 Introduction

The near-breakdown of the European Exchange Rate Mechanism in 1992–1993, the Latin American Tequila Crisis following Mexico's peso devaluation in 1994–1995 and the Asian financial crisis in 1997–1998 were several episodes of currency turmoil in 1990s [1]. In view of Asian's currency turmoil, Thailand, Korea, Indonesia and also Malaysia were among the countries that were affected. A strong currency is able to form a shield against any possible problem with the economy of a country.

Malaysia Ringgit denoted as MYR is the national currency of Malaysia federation. The three letter system of codes in ISO 4217 is introduced by the international organization for standardization to define the currency [2]. Besides that, currency trades in

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pairs, therefore, Malaysia deals a lot with China, Singapore, Japan, European Union, United States, Thailand, Korea, Indonesia, Taiwan and Australia [3]. Foreign exchange rate is the monetary value of one currency in terms of another currency. Foreign exchange rate has become more volatile during the past decades. It also gives big influence on the whole economy and the country itself. Foreign exchange transaction nowadays involves greater foreign exchange risk.

According to [4], the foreign exchange risk refers to the risk that the value of trading return may change due to the fluctuation of exchange rate. It can occur because of the international obligations span time between the day of transactions and payment. Value at risk (VaR) is the most popular method in the risk management department. VaR can simply be defined as a measure of potential loss of some risk value associated with the general market movements over a defined period of time with a given confidence interval.

One of the earliest past researches in VaR of exchange rates was by [5] that examined the model of conditional autoregressive VaR (CAViaR) that was proposed by [6]. A study [7] states the risk value for currency market can be predicted by using the variance covariance model. It concludes that the proposed model is approved of its accuracy in valuation the risk of the forex market. Nevertheless, VaR is essential and most of the models calculate the VaR for the current time. Hence, to be able to forecast the VaR accurately can lead to better decisions.

In this study, the focus is on the VaR method using parametric approach. The objectives of this study are to integrate the VaR model with the GBM model in order to compute the VaR for currencies for different confidence levels, to forecast the foreign exchange rate, for example, between CNY, SGD, JPY, EUR, USD, THB, KRW, IDR, TWD and AUD with MYR using GBM model and to identify the feasibility of the integrated VaR model with the GBM model.

2 Mathematical Models

Parametric and non-parametric models are the most common model in VaR method. The study applies the parametric model based on statistical parameter of the risk factor distribution. This model considers the rate of returns of foreign exchange rate as the risk factor that follows a normal distribution curve as in Eq. (1) below [8–10]:

$$v = AS(\mu\delta t - \sigma\delta t^{\frac{1}{2}} \cdot \alpha(1 - c)). \tag{1}$$

Based on the above VaR model, the terms A and S are the number of portfolios and the foreign exchange rate respectively. It is followed by the terms

$$\mu\delta t - \sigma\delta t^{\frac{1}{2}}\alpha(1 - c).$$

The quantity $\mu\delta t$ refers to the average annual return μ of the foreign exchange rate with the timestep δt is equal to 1/252. The quantity σ in the term $\sigma\delta t^{\frac{1}{2}}$ is the standard

deviation with timestep $\delta t^{\frac{1}{2}}$. The last term $\alpha(1-c)$ is the value of quartiles of the standard normal variable in a given confidence level c as in Table 1.

Table 1. The value of lower quartile of normal distribution

C	$\alpha(1-c)$
99.9%	−3.090
99%	−2.326
97.5%	−1.960
95%	−1.645
90%	−1.282

Source: [11]

The study computes the VaR on foreign exchange rate using the above parameters.

From the historical data, the relative daily return of the i^{th} day, R_i is computed using equation below [9, 11]:

$$R_i = \frac{S_{i+1} - S_i}{S_i} \tag{2}$$

where S_i is the foreign exchange rate on the i^{th} day. Then, the values of the average daily return $\mu\delta t$ are calculated using equation as below [10, 11, 15]:

$$\mu\delta t = \overline{R} = \frac{1}{M}\sum_{i=1}^{M} R_i \tag{3}$$

where M is the number of foreign exchange rate return. Then, the standard deviation of daily return $\sigma\delta t^{\frac{1}{2}}$ is calculated based on

$$\sigma\delta t^{\frac{1}{2}} = \sqrt{\frac{1}{(M-1)}\sum_{i=1}^{M}((\log S_i - \log S_{i-1})^2}. \tag{4}$$

The quantity σ is the log volatility.

Equations (3) and (4) are used to calculate the VaR in Eq. (1). By using Eq. (1), the VaR is calculated for one day holding period $v(1)$ for five different confidences. In order to compute the future VaR in foreign exchange trading, the study focused on using the historical data and the foreign exchange rate Malaysia Ringgit was chosen as the domestic currency. The study [13] focused on secondary data that was obtained from the session at 12.00 pm and used the middle rate of data. The data had information on the foreign exchange rate among various countries.

VaR can also be calculated using the root function $v(h)$ as below [14]:

$$v(h) = v(1) \cdot \sqrt{h} \tag{5}$$

where h is equal to the number of the holding period.

This study proposes to forecast VaR by using the forecast foreign exchange rate. In order to find the forecast value of the foreign exchange rate, the equation of the log normal random walk is used [8, 9, 11, 12] as follows:

$$S(t) = S(0)\, e^{[\mu - \frac{1}{2}\sigma^2]t + \sigma(x(t) - x(0))} \tag{6}$$

where $S(0)$ is actual foreign exchange rate at $t = 0$, μ is equal to drift, σ is equal to volatility, t is equal to timestep and $x(t)$ is equal to the random number at time t.

Here, the study integrates VaR model with GBM model. It substitutes Eq. (6) into (1) with $A = 1$. An integrated VaR is

$$v(t) = A(S(0)\, e^{[\mu - \frac{1}{2}\sigma^2]t + \sigma(x(t) - x(0))}) \cdot (\mu\delta t - \sigma\delta t^{\frac{1}{2}} \cdot \alpha(1 - c)) \tag{7}$$

where the forecast foreign exchange rate is used in order to forecast the VaR accurately.

In order to verify this model, the study compared both values of VaR calculated using the forecast and the actual foreign exchange rate by using the mean absolute percentage error (MAPE) as a model of accuracy in Eq. (8) [11]:

$$E = \sum_{t=1}^{n} \frac{\left| \left(\frac{e_t}{y_t} \right) * 100 \right|}{n} \tag{8}$$

where n is the effective data points and $\left| \left(\frac{e_t}{y_t} \right) * 100 \right|$ is the absolute percentage error with, $e_t = y_t - \hat{y}_t$, y_t is the actual value and $\hat{y}_t$ is the forecast value. In order to judge the accuracy of the model, a scale based on the MAPE measure was used as in Table 2.

Table 2. A scale of judgement of forecast accuracy.

MAPE	Judgement of forecast accuracy
Less than 10%	Highly accurate
11% to 20%	Good forecast
21% to 50%	Reasonable forecast
51% or more	Inaccurate forecast

Source: [11]

Therefore the study compares the VaR of the historical data and the VaR of forecast foreign exchange rates.

3 Methodology

The integrated model of VaR and GBM that produces Eq. (8) can be verified by using the foreign exchange rate data.

3.1 Data Collection

There are many currencies in the world, but in this study only eleven currencies were selected. The countries that had been chosen were Malaysia (MYR), China (CNY), Singapore (SGD), Japan (JPY), European Union (EUR), United State (USD), Thailand (THB), Korea (KRW), Indonesia (IDR), Taiwan (TWD) and Australia (AUD). These are the countries that deal regularly with Malaysia in international trading, investment and others [15, 16].

In order to calculate the VaR and forecast the foreign exchange rate, the rates that had been chosen are Malaysia Ringgit as the domestic currency. The study focused on secondary data because it was more reliable than other sources. The data were obtained from [13] that had provided three sessions of data which were taken at 9.00 am, 12.00 pm and 5.00 pm. There are slight differences of foreign exchange rates between the three sessions. It also provided three different types of rate, which were buying rate, middle rate and selling rate. The study focused on the session at 12.00 pm and used the middle rate of data. According to the interview with the senior executive of foreign exchange at Bank Negara Malaysia, the session at 12.00 pm is the most active trading time in Malaysian market.

In this study, the data were obtained from 2nd May 2013 until 27th August 2014. All the historical data within the covered period was used to calculate the VaR. For the forecast foreign exchange rate, data from 2nd May 2013 until 30th May 2014 was considered as input data that was used to generate initial forecasts. Data from 2nd June 2014 until 27th August 2014 was used as comparison with forecasting values. From the historical data, the study analyzed its characteristic and performance for each currency.

3.2 Computation of Value at Risk Using Parametric Approach

In order to analyze the risk in foreign exchange rate, the VaR using the parametric approach was selected. The VaR measures were expressed in terms of currency, which is Ringgit Malaysia (RM). The probability of maximum loss is usually about 10% and it depends on the degree of choosing confidence level. The degrees of the confidence level of this stage are 99.9%, 99%, 97.5%, 95% and 90%.

Firstly, the study used one day VaR as the holding period and thirteen months historical data to calculate the VaR. The VaR today can be calculated using the previous historical data. Then, the study calculated the average of VaR from the 90% until 99.9% confidence level. The currency is ranked in decreasing order to identify the most risky country in foreign exchange trading pairs. Secondly, the study analyzed and compared the VaR for different holding periods. The chosen holding periods are 1-day,

5-days, 20-days, 40-days and 60-days with the fixed confidence level of 99%. The study calculated the VaR by shifting the 13 months historical data usage using Eq. (1). It shifted the historical data usage by 5, 20, 40 and 60 days in order to calculate VaR today for the next 5, 20, 40 and 60 days respectively, and the results were compared with the VaR calculation using the root function (5).

3.3 Identify the Feasibility of Integrated Value at Risk Model with the Geometric Brownian Motion Model

At this stage, the aim was to measure the feasibility of integrating VaR model with GBM model. The VaR model for foreign exchange rate was calculated using (1). The VaR calculation method by shifting the historical data was selected. The VaR was calculated using a confidence level of 99% and different holding periods that are 1-day, 5-days, 20-days, 40-days and 60-days. Therefore, the study compared the VaR that uses totally historical data (HD) and the VaR from mixed data with the GBM forecast rate. The model of accuracy, MAPE in (8) was selected and the result was analyzed based on Table 2.

4 Results and Discussion

4.1 Analysis of Data

It was found that the most volatile currency was AUD and the less volatile was KRW. This could be shown from the value of R^2 and movement of the currencies itself. The upward movement of the currencies means that the currency is depreciating while the downward movement means that the currency becomes a little stronger currency. The movement of the foreign exchange rates affects the daily profit and loss. IDR had shown a different pattern of daily returns from the other currencies. The daily returns produced were equal for certain dates. The normal distribution of daily returns produced did not provide a right fit to the foreign exchange data, but at the same time it still maintained the bell shape curve. All currencies produced the short and wide curve since the value of standard deviation is large within the covered period.

4.2 Value at Risk Using the Parametric Approach

Parametric approach is the simplest and convenient method to compute the VaR. The study applied the value of lower quartiles of the normal distribution of returns to calculate VaR of the foreign exchange rates. The study compute the 1-day VaR using Eq. (1) for five confidence levels, which are 90%, 95%, 97.5%, 99% and 99.9%. All the steps were repeated in order to calculate the VaR for SGD, JPY, EUR, USD, THB, KRW, IDR, TWD and AUD and rank them. The result is shown in Table 3.

Table 3. VaR of 1-day holding period

Currency	VaR of 1-day holding period (RM)						
	Confidence levels						
	90%	95%	97.5%	99%	99.9%	Average	Rank
CNY	0.0032	0.0040	0.0048	0.0057	0.0075	0.0050	6
SGD	0.0107	0.0136	0.0162	0.0191	0.0253	0.0170	10
JPY	0.0298	0.0382	0.0455	0.0540	0.0717	0.0478	1
EUR	0.0295	0.0375	0.0444	0.0524	0.0691	0.0466	4
USD	0.0201	0.0257	0.0305	0.0360	0.0476	0.0320	5
THB	0.0460	0.0596	0.0714	0.0852	0.1138	0.0752	9
KRW	0.0017	0.0022	0.0026	0.0030	0.0040	0.0027	7
IDR	0.0002	0.0002	0.0003	0.0004	0.0005	0.0003	3
TWD	0.0573	0.0731	0.0868	0.1027	0.1360	0.0912	8
AUD	0.0225	0.0290	0.0346	0.0412	0.0548	0.0364	2

Table 3 shows the results of VaR for all currencies. Here, there exists a linear relationship between VaR and confidence levels. The largest confidence level within the period will produce the largest VaR. Moreover, the VaR for all currencies show a rapid growth of the movement between 99% and 99.9% confidence levels. Overall, the changes in VaR with respect to the change in the confidence levels are the same for all the foreign exchange rate at any time *t*. The study also ranks the currencies from larger to smaller risk in order to know the risky currency. The most risky currency within the covered period is JPY. Then, followed by the AUD, IDR, EUR, USD, CNY, KRW, TWD, THB and SGD. Based on the average of VaR the study ranked the currencies from larger to smaller risk in order to know the risky currency. Table 4 shows the currency rank.

Table 4. Currency rank

Rank	Currency	Initial portfolio (RM), y	Average VaR (RM), x	$\frac{x}{y} \times 100\%$ Percentage VaR
1	JPY	3.1655	0.0478	1.51
2	AUD	2.9954	0.0364	1.22
3	IDR	0.0277	0.0003	1.08
4	EUR	4.3737	0.0466	1.07
5	USD	3.2150	0.0320	0.99
6	CNY	0.5150	0.0050	0.98
7	KRW	0.3150	0.0027	0.86
8	TWD	10.7217	0.0912	0.85
9	THB	9.8078	0.0752	0.77
10	SGD	2.5624	0.0170	0.66

Even though, the JPY is a more risky currency, Japan was still on the top three of Malaysian trading partners due to the demand and supply of certain products at that time.

Then, the study computes the VaR for different holding periods. From the model of parametric approach in (1), the study calculated the 1 day of VaR, $v(1)$. It shifted the historical data usage by 5, 20, 40 and 60 days in order to calculate VaR for the next 5, 20, 40 and 60 days respectively. The VaR using shifted historical data, HD and VaR using root function (RF) are calculated using Eqs. (1) and (5) respectively.

From the results of the MAPE, the large value of error and the study concludes that the RF model in (5) for different holding periods is inaccurate forecast for foreign exchange rate for both confidence levels. Besides that, the study finds that VaR of HD and RF is not close to each other for both confidence levels. It found that the graph of VaR using the HD method is smooth for the 95% and 99% confidence level for all currencies. In conclusion, the VaR calculate using HD is more reliable in order to obtain the actual VaR in the real situation. In the real situation, the VaR depends on the fluctuation of the foreign exchange rate. The VaR that is computed from Eq. (5) is only for 1-day holding period because the square root rule is very unreliable over a longer horizon for the foreign exchange rates. The VaR from the parametric approach with the shifted data decreases as holding period increases. The VaR using the root function by [20] increases with the increasing holding period. Therefore, RF model does not portray the real situation of risk on a definite holding period.

4.3 Future Foreign Exchange Rate Using the Geometric Brownian Motion Model

GBM model is a model of time series data that deals with the randomness. Based on the assumption of GBM model, the randomness of the data must be normally distributed in order to get accurate forecast value. The study assumes that the length of input data gives the different value of accuracy. The study found that the value of MAPE for ten currencies with 13 observations is less than 5%. The MAPE of GBM model is highly accurate for all observations. The time span for forecast value was less than one year and highly accurate for the initial three months. Although the result produced was highly accurate for all observations, the study must obtain the best of duration of daily data used in getting the most accurate forecast. The result of best duration of daily data for each currency is shown in Table 4. The MAPE accuracy model produces almost the same results of the best durations.

Based on Table 5, the duration of observation may be different among the ten currencies. The best duration of observations to forecast CNY is to use 6 months observations, SGD and TWD use 5 months observations, JPY and KRW use 1 month observation, EUR, USD and AUD use 2 months observations, IDR was 3 months observations and lastly the longest observations is 12 months for THB. Table 6 shows the forecast foreign rate for the currencies using the best durations for CNY, SGD, JPY, EUR and USD.

Table 5. The best duration of observations

Currency	Duration (Months)	Average MAPE	Log volatility
CNY	6	0.7776	0.0219
SGD	5	0.6053	0.0143
JPY	1	1.1797	0.0268
EUR	2	0.9951	0.0257
USD	2	0.8928	0.0211
THB	12	1.6522	0.0238
KRW	1	0.8493	0.0175
IDR	3	1.5325	0.0298
TWD	5	0.7406	0.0175
AUD	2	1.1250	0.0250

Table 6. The forecast value of foreign exchange rate using the best durations of CNY, SGD, JPY, EUR and USD

Date	CNY		SGD		JPY		EUR		USD	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
2/6	0.5159	0.5221	2.5668	2.5553	3.1597	3.1742	4.3933	4.3993	3.2235	3.1872
3/6	0.5168	0.5200	2.5703	2.5609	3.1522	3.2010	4.3912	4.3383	3.2280	3.1771
4/6	0.5169	0.5226	2.5701	2.5667	3.1468	3.1930	4.4014	4.3828	3.2335	3.2169
5/6	0.5169	0.5210	2.5714	2.5654	3.1525	3.1481	4.3962	4.3874	3.2330	3.1858
6/6	0.5155	0.5179	2.5712	2.5851	3.1485	3.1465	4.4013	4.3823	3.2220	3.2100
9/6	0.5125	0.5232	2.5563	2.5570	3.1183	3.1313	4.3628	4.3855	3.1975	3.1932
10/6	0.5137	0.5213	2.5602	2.5733	3.1288	3.1932	4.3518	4.3612	3.2020	3.1967
11/6	0.5144	0.5157	2.5626	2.5825	3.1325	3.1786	4.3355	4.2925	3.2035	3.2060
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19/8	0.5138	0.5160	2.5346	2.5525	3.0728	3.1388	4.2115	4.1851	3.1528	3.1581
20/8	0.5155	0.5110	2.5383	2.5466	3.0707	3.0697	4.2160	4.2391	3.1685	3.1200
21/8	0.5159	0.5158	2.5346	2.5523	3.0536	3.0729	4.2021	4.2459	3.1725	3.1520
22/8	0.5136	0.5081	2.5336	2.5716	3.0487	3.0969	4.2029	4.2179	3.1635	3.1322
25/8	0.5150	0.5120	2.5324	2.5370	3.0397	3.1056	4.1833	4.2544	3.1680	3.1519
26/8	0.5140	0.5175	2.5295	2.5694	3.0448	3.1124	4.1758	4.2570	3.1625	3.1478
27/8	0.5128	0.5102	2.5248	2.5482	3.0323	3.0848	4.1493	4.2548	3.1525	3.1572

4.4 Feasibility of Integrated Value at Risk Model with Geometric Brownian Motion Model

This study integrates VaR model with the GBM model in order to forecast the VaR. It means that the study calculates the VaR from the distribution of returns that includes the GBM forecast foreign exchange rate. All the steps to compute the VaR is similar for VaR using HD, but now, the data usage includes the forecast GBM foreign exchange rate.

In this section, the study uses confidence level of 99% with the holding period of 1-day, 5-days, 20-days, 40-days and 60-days. The historical data used from 2nd May 2013 to 27th August 2014 while the use of forecast GBM foreign exchange rates were from 2nd June 2014 until 27th August 2014. The steps of integrating the VaR with GBM model are shown in Fig. 1.

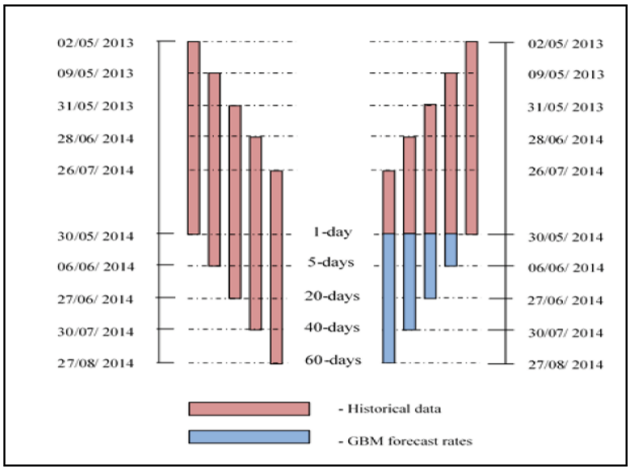

Fig. 1. Historical data for GBM forecast

There are two non-working days in a week. Hence, 5-days, 20-days, 40-days, and 60-days of the holding periods mean a duration on 1 week, 1 month, 2 months, and 3 months respectively. Based on the Fig. 1, the overall historical data used to calculate VaR was from 2nd May 2013 until 27th August 2014. The historical data used to calculate 1-day VaR was from 2nd May 2013 until 30th May 2014. For 5-days VaR, the historical data used was from 9th May 2013 until 6th June 2014. Then, for 20-days VaR was from 31st May 2013 until 27th June 2014. Followed by the 40-days VaR was from 28th June 2013 until 30th July 2014. Lastly, 60-days VaR was from 26th July 2013 until 27th August 2014.

The study compares the VaR using actual historical data and the VaR that integrates the forecast GBM foreign exchange rate in Eq. (7). The MAPE is used to determine the accuracy of the forecast VaR model. Tables 7, 8 and 9 show the results of VaR using actual and forecast exchange rates of 10 currencies with the error values.

Based on Tables 7, 8 and 9, the MAPE of VaR with GBM increases proportionally with the holding periods. The VaR with HD decreases while the VaR with GBM increases within the holding period. The 1-day VaR is the same for both the actual and the forecast exchange rate because both use the same value of the initial exchange rate. The 5-days and 20-days VaR produce highly accurate forecast, which are 3% and 9% respectively. For 40-day VaR and 60-days VaR, the study concludes that VaR with GBM are reasonable forecast. The movement of VaR with GBM is close for the 1-day,

5-days and 20-days holding period than after that the forecast VaR diverges from the VaR that uses HD.

Table 7. VaR using actual and forecast exchange rates of CNY, SGD, JPY and EUR

	CNY			SGD			JPY			EUR		
	Actual	F'cast	*E%*	Actual	F'cast	*E%*	Actual	F'cast	*E%*	Actual	F'cast	*E%*
1-day	0.0057	0.0057	0	0.0191	0.0191	0	0.0540	0.0540	0	0.0524	0.0524	0
5-days	0.0054	0.0056	3	0.0176	0.0180	2	0.0515	0.0532	3	0.0511	0.0522	2
20-days	0.0053	0.0057	9	0.0171	0.0189	10	0.0502	0.0549	9	0.0496	0.0583	18
40-days	0.0050	0.0066	34	0.0163	0.0210	29	0.0436	0.0522	20	0.0454	0.0580	28
60-days	0.0049	0.0073	49	0.0156	0.0228	46	0.0410	0.0556	36	0.0410	0.0616	50

F'cast – Forecast *E* – MAPE

Table 8. VaR using actual and forecast exchange rates of USD, THB, KRW and IDR

	USD			THB			KRW			IDR		
	Actual	F'cast	*E%*	Actual	F'cast	*E%*	Actual	F'cast	*E%*	Actual	F'cast	*E%*
1-day	0.0360	0.0360	0	0.0852	0.0852	0	0.0030	0.0030	0	0.0004	0.0004	0
5-days	0.0344	0.0356	3	0.0793	0.0827	4	0.0029	0.0031	6	0.0003	0.0004	5
20-days	0.0334	0.0358	7	0.0777	0.0959	23	0.0029	0.0031	9	0.0003	0.0004	17
40-days	0.0314	0.0377	20	0.0730	0.1031	41	0.0028	0.0035	26	0.0003	0.0004	21
60-days	0.0304	0.0399	31	0.0713	0.1223	71	0.0026	0.0036	36	0.0003	0.0005	40

F'cast – Forecast *E* – MAPE

Table 9. VaR using actual and forecast exchange rates of TWD and AUD

	TWD			AUD		
	Actual	F'cast	*E%*	Actual	F'cast	*E%*
1-day	0.1027	0.1027	0	0.0412	0.0412	0
5-day	0.0962	0.1004	4	0.0405	0.0422	4
20-days	0.0955	0.1064	11	0.0398	0.0425	7
40-days	0.0907	0.1109	22	0.0372	0.0435	17
60-days	0.0886	0.1187	34	0.0346	0.0455	31

F'cast – Forecast *E* – MAPE

5 Conclusion and Recommendation

The use of input data can affect the forecast values and in forecasting the foreign exchange rate, the duration of input data is determined for each of the considered currencies. There are currencies that are sharing the best duration of input data. The best duration of input data chosen is based on the lowest MAPE.

The study is able to forecast VaR for one month holding period for most of the country currencies. The VaR using forecast exchange rate is closer to the VaR using HD due to the better forecasting GBM model in currency. Each currency had produced different accuracy of MAPE since the VaR was depending on their foreign exchange rate.

The prediction of the future foreign exchange rate is important in order to know the future performance of the country and to be able to manage the foreign exchange risk in trading. As a developing country, Malaysia must be able to manage the foreign exchange risk.

It is recommended to use other VaR models and other forecasting model [15] in calculating the foreign exchange. In order to hedge the foreign exchange risk, the study recommends doing a swap currency and this needs more quantitative research in swap derivatives.

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