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Prediction and Impulse of Major Currency Pairs Using VAR Model

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A B S T R A C T

This paper aims to study the impulse response of major currency pairs and their impulse response of the exchange rates to the dynamic system in response to the external changes. For this the researcher used data of major currency pairs such as USD/JPY, EUR/USD and GBP/USD last 5 years monthly data from 2012 to 2017 September. And the last five years monthly data predicted using VAR Model and the researcher also check the response of the exchange rate to the external change.

Introduction

The exchange rates are influenced by various factors like inflation, interest rate, capital flow, national income, export and import, political environment and so on. The changes in these variables are affected by the interested party like that affects businesses, policymaker's financial institutions, foreign exchange investors, exporter, importer and tourists in the developing world. So far so many studies have been done in this field of the prediction of the exchange rate using econometrics models and machine languages. All though several factors affecting the exchange rates it is the most important and difficult function of the modern study.

For foreign exchange rate prediction various method are used. Past two decades the Autoregressive Moving Average Method (ARIMA) are widely used for the exchange rate prediction. It is a univariate model and data should be linear and

stationery. Recently the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model has been using for prediction because of the better prediction than ARIMA. Even though many other models are using for prediction like Neural Network, Markov Model, Support Vector Machine(SVM), Moving- average (MA), Exponentially Weighted Moving Average(EWMA) and so on. GARCH prediction outcome are taken as the best. And VAR is the best model to estimate and forecast the values. In this paper the VAR model is used.

Opinions on forecasting are probably as diverse as views on set of scientific methods used by decision makers. The users may question the validity and efficiency of the predictions as the future is uncertain. For the accuracy of the prediction in econometrics there is some test like MSE, RMSE and MAPE values and many more.

The contributions in this paper are divided in to sections:

- * The introduction and forex prediction review
- *Represents the background of the study and data and methodology
- *Empirical approach towards study
- *Finding and Conclusion

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Background of the Study

There are a lot of empirical studies in the field of exchange rates, so the review of literature is relevant. Its sounds good to provide a brief summary of research have done in this field.

Many researchers have done prediction of Euro currency because of the single monetary policy of the country (Sartore, Trevisan, Trova, 2002). They build a model to forecast the US dollar/ Euro real exchange rate using VECM form. According to him the prediction using VAR model is better than the VECM, which will not consider the structural breaks. And he found that the predictions of USD/EUR exchange rate are satisfactory. Another study for the same, US Dollar/ Euro for modeling and forecasting using ARIMA model (Ghalayini, 2013).

Some researchers has design a model to predict the exchange rate considering the current set of fundamentals(Kouwenberg, Markiewicz, Verhoeks, & Zwinkels, 2013). They use quarterly real time data of 41 years of 10 currency pairs, and forecast the combination rule based on the backward elimination (BE) in both statistical and economics terms. They conclude that the performance is driven by time-varying and excessive weight on fundamental models. And also found they could predict well 8 currency pairs using MSPE.

There is another study of forecasting the exchange rates using ARIMA model from a sample currency of Kazakhstan (Tlegenova, 2015). They take sample of US Dollar, Euro, Singapore Dollar against Kazakhstani Tenge. And in this paper the author analyses the accuracy of the prediction using MAE, MAPE and RMSE.

Technical analysis is profitable for short period currency trading in sport market(Krishnan & Menon, 2009). Their study focuses on the impact of popular currency pairs, time frames and technical indicators on trading profit in forex spot market through analyzing the relationship between various related parameters, and they found that EUR/USD yielded maximum profit among other currency, it is also observed that it is very strong and less risky.

The impulsive response function mainly used to understand the impact of policies, (Sylvia Beatriz Guillermo Peóna, 2014), in this study the authors analyzed the impact of formal adoption of inflation targeting policies. This work focus on the nominal exchange rate depreciation is influencing the domestic price and they found the exchange rate influencing the consumer price is in a very small level.

The motive for taking the data is USD/JPY, GBP/USD and EUR/USD are the three major currency pairs in the world. These exchange rates are univariate data. The econometric method the researcher used study is VAR Model. The most important motive of studying the behavior of the foreign exchange rate is to predict the exchange rate. There are two approaches, fundamental approach is based on the macro economic variables that are affecting the exchange rate and on

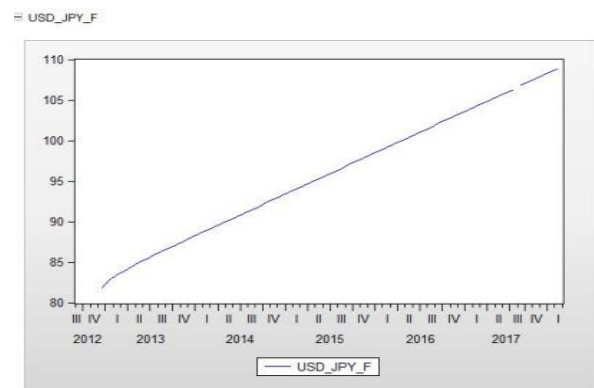
the other hand technical analysis is based on the small period of available data. Here the researcher used the technical approach using econometric model. By taking the past five years monthly data of major exchange rates pairs such as USD/JPY, GBP/USD and EUR/USD. In this paper the researcher also try to show the impulsive response of the exchange rates. The response to choleskey decomposition of the exchange rates.

Empirical Evidence

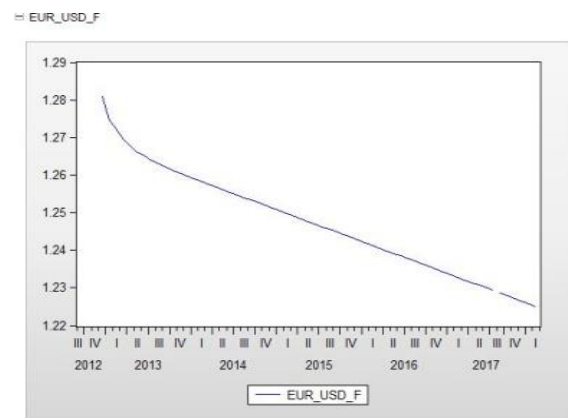
A VAR Model is quite helpful in examining the relationship among the set of econometrics variables. Moreover a VAR estimate is helpful for forecasting purposes .For doing VAR Model, the variable should be stationery. Estimate the equation and forecasting and checking the impulse response function. To apply the VAR model the data should be stationarity. The row data is having non- stationary behavior. For doing further test data much is stationary and it is found that the data is stationary at 1 level difference. For testing the stationary the Augmented Dickey–Fuller (ADF) is used.

$$xt = Ao + a1xt - 1 + et$$

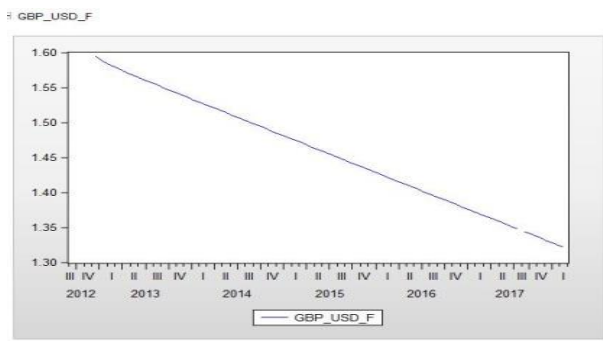
In this study the researcher tries to study the to predict the major exchange rate using VAR Model for the next 5 months, namely last three months of the 2017 and first two month of the 2018. The result is follows



USD/JPY (a)



EUR/USD (b)



GBP/USD (c)

Graph (a) shows an upward trend of the USD/JPY exchange rate. And the forecast shows the upward trend. This is profitable and strong investment. Graph (b) shows a downward trend of the EUR/USD exchange rate. so the forecast also having a downward trend. And graph © shows also shows that a deep downward trend so automatically it the next five months also, there is a downward trend.

Although econometric model never reveal the actual forecast there will be forecast error also so the researcher used MSE, RMSE and MAPE values to identify the accuracy of the prediction of the exchange rate.

Forecast Evaluation					
Date: 08/18/17 Time: 21:44					
Sample: 2012M09 2018M02					
Included observations: 65					
Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
D(USD_JPY)	59	2.764157	2.267563	181.7779	0.696542
D(GBP_USD)	59	1.472725	1.470767	100.3437	0.983777
D(EUR_USD)	59	95.06567	94.80128	100.0019	0.999779

RMSE: Root Mean Square Error
 MAE: Mean Absolute Error
 MAPE: Mean Absolute Percentage Error
 Theil: Theil inequality coefficient

$$\text{Mean absolute error: } MAE = \text{mean}(|e_i|),$$

$$\text{Root mean squared error: } RMSE = \sqrt{\text{mean}(e_i^2)}.$$

$$\text{Mean absolute percentage error: } MAPE = \text{mean}(|p_i|).$$

These tests are used to analysis the accuracy of predicted values, For MSE, RSME and MAPE the lower value is better. The prediction is suggesting that the investing in the USD/JPY currency pairs is much profitable than the two other currency pairs.

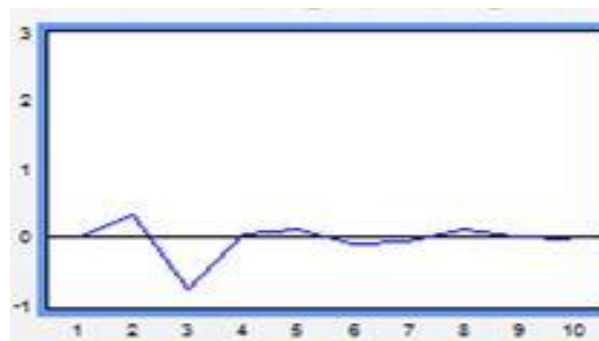
Impulse Response Function

Another motive of the paper is to identify the responsiveness of major currency pair to the external environment. Impulse response functions represent the mechanisms through which the shock spread over time. The choleskey decomposition is mostly used to analysis the impulse response function. The order is like USD/JPY, GBP/USD and EUR/USD at 1 level of difference. In this study the response of D(USD/JPY) to D(USD/JPY), response of D(GBP/USD) to D(GBP/USD) and the response of D(EUR/USD) to D(EUR/USD) is not needed because they are the response of the same currency. The response of to the change in One S.D Innovation will create a shock in D(USD/JPY) to D(GBP/USD) is like at first there will be a increase then the exchange rate will be negative and after that there will be a slight variation and at last there will be no shock at all. The exchange rate will become constant. And in the case of D(USD/JPY) To D(EUR/USD) there is more or less constant, There will not be not that much shocks. The response of change in one S.D innovation the shocks in the case of GBP will be like against USD/JPY there will be not heavy shocks but in the case of EUR/USD at first the exchange rate tend to fall negative then after some time it will increase and there will be a slight variation and at last period the exchange rate will be constant. In the case of the EUR/USD the response to Cholesky One S.D innovation against the USD/JPY will be at first there is a huge negative variation from the zero after some time it is constant and in the case of GBP/USD there will be a huge positive variation from the level of constant and after some period it will be constant.

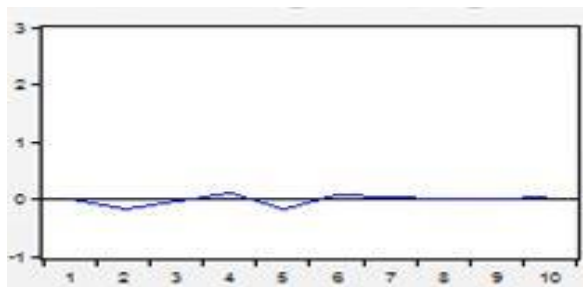
The shock spread in the case USD/JPY is the response of the EUR/USD is good, while comparing the response of the exchange rate of the GBP/USD. In the case of the GBP/USD the response of change in one S.D is good against the USD/JPY, while comparing with EUR/USD because the variation is less in the case of USD/JPY. And in the case of EUR/USD the shock is good in the case GBP/USD there is a positive shock and later on the exchange rate will be constant. But in the case of response against USD/JPY there is a negative shock so it is too bad for the exchange rate even though it is constant at last.

Here is the result

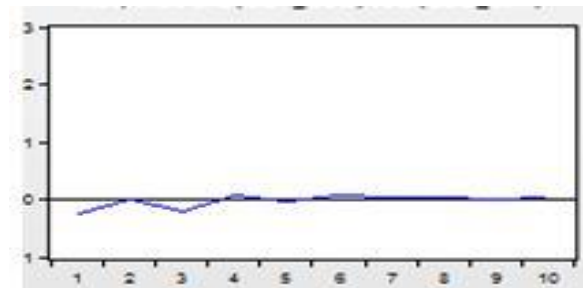
Response to Cholesky S.D One Innovation



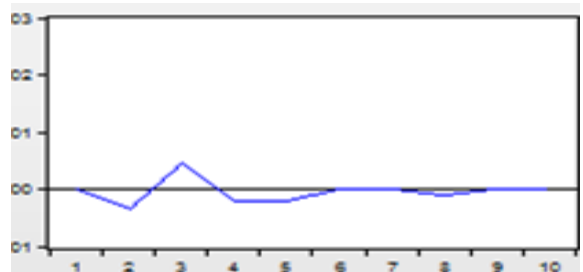
Response to D(USD/JPY) to D(GBP/USD)



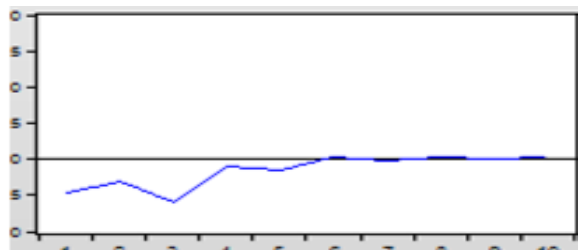
Response to D(USD/JPY) to D(EUR/USD)



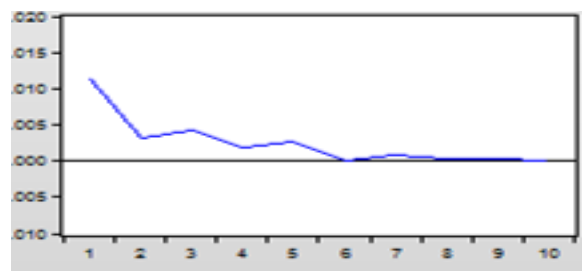
Response to D(GBP/USD) to D(USD/JPY)



Response to D(GBP/USD) to D(EUR/USD)



Response of D(EUR/USD) to D(USD/JPY)



Response of D(EUR/USD) to D(GBP/USD)

Conclusion

For this study the researcher used three major currency pairs in the world namely USD/JPY, GBP/USD and EUR/USD from

September 2012 to 2017 monthly data and in this paper we are predicting the next five months data and checking the impulse response function of these exchange rates. In this paper researcher tries to show an empirical approach of the forecasting of exchange rates using VAR model and checking the accuracy of the predicted values using MSE, RMSE and MAPE. The analyses find that there is an upward trend in the USD/JPY exchange rate pair. They are very strong and less risky. But other two major currency pairs such as GBP/USD and EUR/USD are having a downward trend. And for checking the impulse response function we used Cholesky decomposition method. Based on the impulse response function we are able to analyze the immediate impact of the exchange rate for the shocks of change in One S.D Innovation. Comparing the impulse of these exchange rates the GBP/USD currency pair is better because this currency pair is not changing so fast and immediately they are becoming constant. This study found that investing in currency pairs of USD/JPY is better than the other two currency pairs such as GBP/USD and EUR/USD because it is clearly evident that USD/JPY currency pair is much stronger and safer than the others in the next five months.

In this paper we conclude that the forecast error is unimportant in the case of VAR Model and it is necessary to have a structural shock to check the impulse response function.

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