Relationship Between GDP, Inflation and Real Interest Rate with Exchange Rate Fluctuation of African Countries

Qaisar ABBAS
Department of Management Sciences
COMSATS Institute of Information Technology
Islamabad, Pakistan
E-mail: qaisar@comsats.edu.pk

Javid IQBAL
Department of Management Sciences
COMSATS Institute of Information Technology
Islamabad, Pakistan
E-mail: javidiqbal@comsats.edu.pk

AYAZ
COMSATS Institute of Information Technology
Islamabad, Pakistan
E-mail: ayaz.luni@yahoo.com

ABSTRACT
This paper tries to explore the relationship between, gross domestic product, inflation and real interest rate with the exchange rate. 10 African countries with 15 years of data from 1996 to 2010 were used for this study. Three independent variables i.e. inflation, interest rate and Gross Domestic Product were used in order to investigate their relationship which causes exchange rate fluctuations. Three hypotheses served as a basis to analyze the results. Based on the analysis, it is found that that the GDP has significant relationship with the exchange rate where interest and inflation has non-significant relationship with the exchange rates of African countries.

KEY WORDS
Exchange rate, inflation, real interest rate, and gross domestic product

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1. Introduction
1.1. Background
Countries around the world do not have enough resources to fulfill all its need that’s why they have to involve in international business. Ricardo, D. (1817) in comparative advantage theory suggests that a country should specialize in producing those products in which it has competitive advantage and should import the products that will need higher resource utilization and energies. Trading in this way will benefit all the countries around the world. Imperfection of market condition also provides the incentive to be involved in international businesses because immobility of factors of production provides conditions to enter in the international trade. One additional reason for involving in international trade is explained by product life cycle theory, which is presented by Vernon, R. (1966). This theory states that firms having higher information about domestic market initially introduce goods and services in domestic market and meet international trade by exporting it. The import and export of goods or services does not take place in same currency. So, trading countries need to determine the currency exchange rate which is widely
accepted all over the world. According to Madura, J. (2006), Rugman, M.A., Collinson, S & Hodgetts, R.M. (2006), Hall E.R. (2006) and Lieberman (2004), the exchange rate is “the amount of one unit of currency that is traded for one unit of another currency.”

The purpose of currency exchange rate is to determine the value of goods or services imported or exported. Conversion of one currency into their home currency demonstrates the revenues and profits in the own currency of traded countries. Values of these currencies always fluctuate due to the demand and supply of currencies.

1.2. Why exchange rates fluctuate?

According to Madura, J. (2006) and Rugman, M.A., Collinson, S. & Hodgetts, R.M. (2006) fluctuations in the exchange rates are due to change in demand and supply of currencies. Fluctuation in exchange rate could be found with the help of different economic factors that affects the demand and supply. When fluctuation occurs, the new exchange rate is determined where demand and supply meets together at an equilibrium level. On the other hand, Broda, C. (2004) and Meese, R. (1990) after examining several studies conclude that the economist is not able recognize that why exchange rate fluctuates. Ray, H. (2008) argued that there is a positive relationship between macroeconomic variables and exchange rate. The relationship is positive when time factor is involved. According to Madura, J. (2006) common factors that effect on demand and supply of currency are inflation rates, national income growth rate, relative interest rate, exchange rate expectations, government intervention, terms of trade, political stability and public debt etc.

1.3. Objectives and significance of the study

The objective of this paper is to determine the relationship between the economic factors mentioned by Madura, J. (2006) and the exchange rate fluctuations in African countries. Normally, developing countries have higher imports than exports. So exchange rate can either increase or their payments for the purchase of goods or services from developed countries. Moreover, these African countries have lower value of their currencies against US dollar or Euro. The significance of studying exchange rate fluctuation is to investigate the extent of relationship between economic variables which effect on exchange rate. Studying exchange rate fluctuation for African countries helps in identifying the economic factors that have relationship on the exchange rate fluctuation.

2. Literature Review

Bodnár, K. (2007) argues that the developing and emerging economies are not more efficient due to which they are exposed by the exchange rate fluctuation which has often a negative impact. According to Rugman, M.A., Collinson, S. & Hodgetts, R.M. (2006) the supply and demand for a currency comes from both trade flows (exports and imports) and capital flows (investments and borrowing). So, the balance of payments implications for exchange rates must include both sides of the story, the “real” flows, and the financial flows. According to Madura, J. (2006), the government in freely floating exchange rate does not find the values of transaction currency, but it is finding through markets’ interaction. This market interaction finds exchange rate value through demand and supply. When there is a fixed or peg exchange rate system, than the trade shocks has negative impact on the real GDP. However, McPherson, M.F., & Rakovski, T. (2000) concluded that there is no relationship of gross domestic product (GDP) and interest rate with exchange rate.
They used vector auto regression model (VAR) for analyzing a data of Kenya, which is based on 26 years from 1970 to 1996 by creating a direct and indirect relationship with gross domestic product and interest rate. According to Simpson et al. (2005), the exchange rate will appreciate if the variation in inflation rate of both countries is in same direction when the inflation of country at domestic level remains low as compared to the other country. According to Rebitzky, R.R. (2010), exchange rate reactions to macroeconomic news hardly vary over time. Hsing, Y. (2007) explains the relationship between inflation rate and exchange rate and found that there is adverse association among them.

According to Dornbusch, R. (1976), the effect of monetary policy on interest rates and exchange rates is significantly affected by the behaviors of real output. Fausta et al. (2007) based on concerned economic variables, divides the information into two types: strong information and weak information. Strong information about economic variables leads to appreciation in the exchange when there is same trend of movement in interest rate and exchange rate. Inci and Lu (2004) developed a model that explains the effect of interest rate on the exchange rates and concluded that there are also some other factors or dynamics other than the interest rate, which have an impact on the exchange rate fluctuations. According to Kim, S. & Roubini, N. (2000), whenever there is a positive change in interest rate, the exchange rate appreciates and whenever there is a negative change in interest rate, there is a decrease in exchange rate at the domestic level. Kanas, A. (2005) found that exchange rate is affected by legged interest rate. The model that Kanas used shows the changes that are due to using both fixed exchange rate and floating exchange rate. Cavaglia, S.M.F.G. & Wolff, C.C.P. (1996) have combined the exchange rate and interest rate to find out that how much they have an impact on exchange rate to fluctuate through change in risk, interest rate news. They found that the interest rate news has not a significant effect on the exchange rate movement however, revision of these variables on daily basis is important to change the demand and supply of the currency in order to fluctuate. Dominguez (2006) supported it by arguing that the relationship between interest rate and exchange rate depends upon the economic policy of country.

3. Hypothesis

H1: There is a relationship between Gross domestic product and exchange rate of African countries.
H2: There is a relationship between real interest rate and exchange rate of African countries.
H3: There is a relationship between Inflation and exchange rate of African countries.

4. Methodology of research

According to Medura, J. (2006) common factors that effect on demand and supply of currency are inflation rates, national income growth rate, relative interest rate, exchange rate expectations, government intervention, terms of trade, political stability and public debt etc. We have delimited our study by choosing gross domestic product, inflation and real interest rate. We assumed that these variables have an impact on the exchange rate to fluctuate in African countries (figure 1).
We selected 10 African countries with 15 years of data from 1996 to 2010. Data was collected from World Bank website. These countries include Cameroon, Cape Verde, Comoros, Burundi, Ethiopia, Algeria, Gambia, Kenya, Egypt and Angola. We systematically selected developing countries of Africa with the similar features. Due to their similarity in features, the data could easily be analyzed and the results could be obtained in a realistic way. Furthermore, each country was analyzed independently so that results of one country could not be intervened on other country’s results.

4.1 Equation Model

According to Madura, J. (2006), change in exchange rate is caused by the change in GDP, Inflation, interest rates, income level, government control and future expectations of exchange rate etc. So this can be interpreted as follows;

$$\Delta ER = C + f(\Delta GDP, \Delta I, \Delta R, \Delta I, \Delta GC, \Delta EXP) + \epsilon$$

(1)

Where:

- $\Delta ER = \text{change in exchange rate}$;
- $\Delta GDP = \text{change in the differential of African countries’ GDP}$;
- $\Delta I = \text{change in the differential of African countries’ inflation}$;
- $\Delta R = \text{change in the differential of African countries’ real interest rate}$;
- $\Delta I = \text{change in the differential of African countries’ income level}$;
- $\Delta GC = \text{change in the differential of African countries’ government control}$;
- $\Delta EXP = \text{future expectations of exchange rate}$;
- $\epsilon = \text{Error term}$.

So, we selected only three components from the above equation because the data of these three items was easily accessible.

$$\Delta er = f(\Delta DP, \Delta I, \Delta R, \epsilon)$$

(2)

Eviews is used to analyze the data in which AR (1) autocorrelation is eliminated from regression model. AR(1) process is the equations is:

$$U_t = PU_{t-1} + \epsilon_t$$

(3)

So we put in eviews to eliminate the autocorrelation to observe the relationship of independent variables with the dependent variables.
5. Data Analysis and Interpretations

5.1. Egypt
During regression analysis of Egypt, results shows that p-value of the GDP is 0.0432 which is less than 5%. So, it has a significant relationship on the exchange rate fluctuation. Whereas, the p-value of the real interest rate is 0.2852 and inflation has 0.8714 which shows no relationship between these variables on exchange rate. The result shows that gross domestic product has relationship with the exchange rate, which is H1, and it is accepted in this case where real interest rate (H2) and inflation (H3) shows no relationship which means rejection of both hypotheses.

5.2. Kenya
During regression analysis of Kenya, result shows the p value of the GDP is 0.0005 which shows significant relationship with the exchange rate fluctuations. Whereas the p value of the real interest rate is 0.9385 and Inflation is 0.7120 shows non-relationship with the exchange rate. So, we accept hypothesis H1 while H2 and H3 are both rejected.

5.3. Cameron
Analysis of Cameron shows that the p-value of the GDP is 0.0003 which reflect the significant relationship on the exchange rate which cause to fluctuation. Whereas the p-value of the real interest rate is 0.4623 and Inflation of 0.4941 shows statistically non-significant. The result shows that gross domestic product has impact on the exchange rate, which is H1 that is accepted. While real interest rate H2 and inflation H3 shows no relationship which are rejected.
5.4. Algeria
Statistical data shows that there was abnormal rise in the real interest rate from 2009 which we excluded from our analysis to show consistency of data. Regression analysis of Algeria shows that all the results are insignificant. It means that data shown regarding GDP, interest and inflation do not have any relationship on the volatility of exchange rate. So, hypothesis H1, H2 could be accepted but H3 is rejected in the case of Algeria.

5.5 Ethiopia
Like Algeria, regression analysis of Ethiopia shows similar results. It means that data shown regarding GDP, interest and inflation do not have any impact on the volatility of exchange rate. Statistical data shows that real interest rate was continuously showed decreasing trend at a sharp decline while inflation showed a continuous increasing since 2003. Furthermore, we deducted inflation of year 2008 because it has a big value which could effect on our results. Deducting 2008 inflation cause improvement of results but still it was non-significant. So, hypothesis H1, H2, and H3 are rejected in the case of Ethiopia.

5.6. Angola
Date of Angola shows a very inconsistent data. There were huge variations in the data. From 1996 to 2000, inflation was very high while GDP was very low. As a result, we excluded 1996 to 2000 to get sustainable results. Now, after the analysis, it is observed that all the results are insignificant. So, the entire hypotheses H1, H2, H3 are rejected in this case.
5.7. Comoros
Regression of Comoros shows relatively consistent results as compared to other African countries. If we observe, there is a suave data with small volatility. Result shows strong relationship of GDP with the exchange rate whereas real interest rate has also significant relationship with the exchange rate while relationship of inflation with the exchange rate is non-significant. As a result, we accept H1 and H2 but reject H3 hypothesis.

5.8. Burundi
Analysis shows for Burundi that GDP has a significant relationship whereas relationship of inflation and real interest rates are non-significant. The reason is that data of GDP is consistent with exchange rate while inflation and real interest rates is asymmetric with high volatility. So, in the case of Burundi, we accept only H1 but H2 and H3 hypothesis are rejected.

5.9. Gambia
Like Comoros, regression analysis of Gambia shows relatively consistent results as compared to other African countries. We observe that there is a smooth data with low variations. Result shows that relationship of GDP and inflation is significant with the Exchange rate. Whereas real interest rate has non-significant relationship As a result, we accept H1 and H3 but reject H2 hypothesis.
5.10. Cape Verde
Analysis of Cape Verde shows that there is a significant relationship of GDP with the exchange rate whereas the values of the real interest rate and Inflation show statistically non-significant relationship. The result shows that gross domestic product has impact on the exchange rate, which is H1 that is accepted. While real interest rate H2 and inflation H3 shows no impact which are rejected.

A summary and cumulative result could be seen at the end of paper in appendix 1.

6. Conclusions
Importance of exchange rate increases as financial liberalization increases. This study is carried out to find the relationship between GDP, inflation, and interest rate on exchange rate. In order to examine the relationship, three hypotheses were used to analyze. It is found that GDP is only variable which shows a significant relationship with exchange rate while other two variables i.e. inflation and real interest has shown non-significant relationship. Furthermore, interest rate of Comoros and inflation of Gambia has the only countries which have significant effect on exchange rate. Lastly, the data of Ethiopia and Angola is not statistically sustainable for analysis because there were huge variations in the data of both countries.

7. Recommendations
The future work can be done by spilling the data quarterly, increased number of years with adding other factors which cause exchange rate volatility.

References
## Appendix 1

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