

## **RMB Exchange Rate Volatility and its Impact on FDI in Emerging Market Economies: The Case of Zambia**

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### **Abstract**

*Foreign Direct Investment (FDI) theories and empirical studies have generated mixed results for the link between exchange rates, their volatilities and FDI. This study argues that large RMB exchange rate volatilities negatively affect inward FDI into Zambia because of the costs inherent in the volatility risks. I use daily exchange rate data from January, 2009 to April, 2011 for statistical manipulation in GARCH (1, 1) model. Estimates show that volatility of the RMB is relatively high and likely to pose greater impact on FDI flow into Zambia. A multiple regression analysis, using Ordinary Least Square (OLS) method, reinforces the findings of a negative correlation between RMB exchange rate fluctuation and FDI into Zambia. I argue that if the RMB appreciates, China's economic growth slows down due to the fact that Chinese economy greatly depends on exports. A slowdown therefore, negatively affects the flow of FDI from China into Zambia.*

**Key Words:** RMB Exchange Rate Volatility, FDI in Zambia, Garch (1, 1) Model, Regression Analysis

### **1.0. Introduction**

Sino-Zambia relationship has grown in the recent past to unprecedented levels. According to Zeng Qiang (2007) of the Institute of Asian and African studies, China and Zambia established diplomatic relations on October 29, 1964. Bilateral relations between the two countries have since seen a smooth development. China and Zambia have signed several bilateral trade agreements and agreements on economic and technical cooperation. According to the Zambia Development Agency (2011), Zambia is home to three Multi-Facility Economic Zones (MFEZ), that China is establishing in the continent of Africa as a way to further cement Sino-African ties. Additionally, Zambia became one of the first African countries where transactions in RMB were launched by top Chinese leaders. It is against this backdrop that with increasing trade relationship between China and Zambia, RMB exchange rate volatility is likely to have greater impact on the inflow of FDI into the Zambian economy Xinhua (2011).

### **1.1. Statement of the Problem**

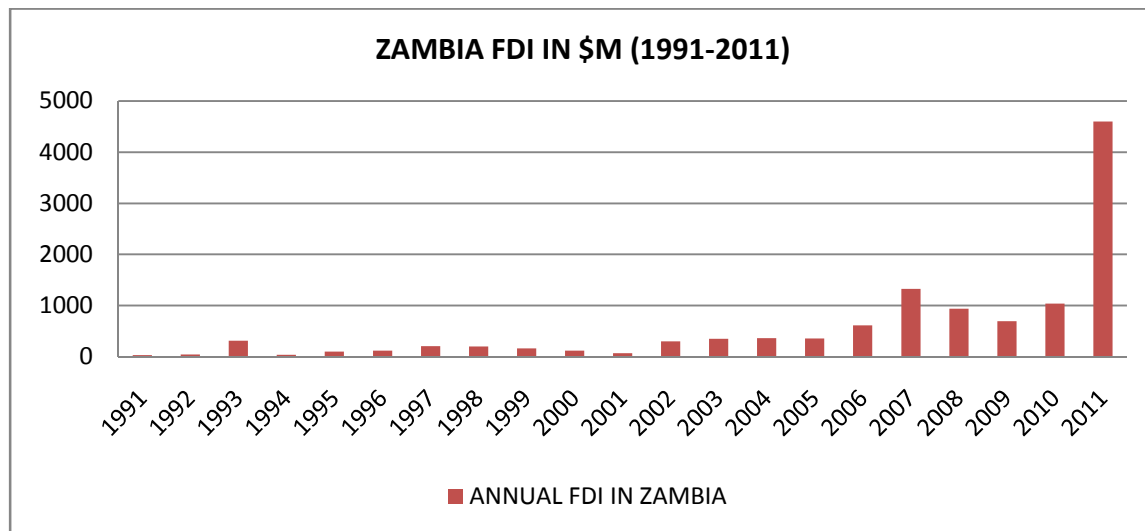
Given the level of Chinese investment into Africa and Zambia particularly, it is widely believed that the use of RMB in doing business will increase in importance. However, according to the Bank of Zambia (2010), it is important to note that despite so much effort to internationalize the RMB and increase investment by China in Zambia, there is a growing demand; mostly by developed countries that China should allow its currency to appreciate so as to achieve a balanced global trade. It is arguably asserted that China artificially devalued its currency by about 25 to 40 percent in favor of Chinese exports. If the revaluation of the RMB is effected, it is likely to have greater impact on emerging countries taking into consideration the fact that China has become a bigger economic player on the global stage.

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## 1.2. FDI in Zambia

FDI is now a very large share of capital formation in Zambia (Ndulo, 2005). Since FDI plays such an important role in the development of the Zambian economy, it is thus important to maintain a stable flow of FDI into the country and control any other factors that may cause disruption to the flow of FDI.



(Source: Bank of Zambia)

## 1.3. The Significance of the Study

The main contribution of this paper is its departure from the use of ratios in examining the effect of real exchange rate risk on FDI to a more rigorous and robust methodology, and the fact that studies of this nature are virtually non-existent in the Zambian context.

## 1.4. General Objective

The general objective of this paper is to assess the impact of RMB exchange rate volatility on FDI inflow into Zambia. To achieve the above, the following specific objectives are considered and analyzed in detail so as to offer a real and balanced perspective.

### 1.4.1. Specific Objectives:

- (a) To assess the impact of RMB exchange rate volatility on FDI into Zambia.
- (b) To assess the impact of Kwacha exchange rate fluctuation on FDI into Zambia.
- (c) To assess the impact of Zambia's GDP growth rates on FDI into Zambia.
- (d) To assess the impact of Inflation rates on FDI in Zambia

## 2.0. Literature Review

Since the reform of RMB exchange rate regime in 2005, RMB exchange rate is much more flexible and volatile. The status and influence of RMB are greater with a sustained growth of Chinese economy. Foreign Direct Investment (FDI), in its simplest form and definition, according to (Onyeuwu et al, 2004), is investment in one country by individuals and/or companies owned in another country. It is the acquisition of an equity interest in a foreign enterprise with the intention of acquiring control, investment diversification and/or return optimizing.

There is, indeed, a vast amount of research that covers exchange rate topics especially exchange rate responsiveness to international trade. Most of the researches in this field are aimed at finding out how changes in exchange rates affect international trade, namely export/import trades of different countries. A few studies have been done on the effect of bigger economies' currency exchange rate volatility on investment in Africa and particularly, Zambia.

One paper that investigated Africa is by Ahmed et al (2005) where they empirically re-examined the impact of real exchange rate volatility on South Africa’s export flows to the United States for the period January 1992 to April 2004 using the two country model of international trade. The results they obtained provide evidence that real exchange rate volatility has a negative effect on real exports. In their study they used the Exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model which, as they explain, they used to measure the real exchange rate volatility. The other two models they used are Cointegration and error-correction models which they used to obtain the estimates of the cointegrating relations and the short-run dynamics, respectively.

In addition, Chukwu (2007) and Holland and Nigel (1998) noted that foreign exchange rate is a determinant of export trade and economic growth in developing countries. In their study, they observed a coincidence in exchange rate appreciation with a contraction of 3% in the country’s gross domestic product in the manufacturing sector; with a 2% average decline in manufacturing GDP over a 20 year period characterized foreign exchange rate appreciation.

**2.1. The Case of China**

In the past, China has been very successful in attracting foreign direct investments. As a matter of fact and as espoused by Asiedu (2002), China represents the largest FDI recipient among all developing countries and exchange rates have played a major role in determining its inward FDI. For instance, economists see cheap labor as one factor that has attracted foreign investors. China’s FDI boom in foreign investments inflows actually started in the 1990s when China devalued the Yuan (RMB). This reduced the cost of operations like labor and gave China a comparative advantage of investment. Yuqing Xing (2003) studied exchange rates and Japanese Direct investment in China and found that there is a positive correlation between exchange rate fluctuations and inward FDI in China. Using the data of Japanese FDI in China’s nine manufacturing sectors from 1981 to 2001, over the past three decades, China’s fast economic growth and its expansion, the paper found that there is a significantly positive correlation between the bilateral real exchange rate of Yen and Yuan and Japanese direct investment in China.

**3.0. Data and Methodology**

Data was sourced from official published records found on the World Bank databank. To achieve the desired results for the aforementioned objectives, the study starts by first determining the volatility of RMB using the GARCH (1, 1) Model using daily exchange rate data from 2009 to 2011 with approximately 500 samples. Thereafter a regression analysis is performed to determine the effect of some market variables on the inflow of FDI into Zambia. Note that in this paper, I assume that FDI into Zambia is to a large extent a function of RMB exchange rate.

**3.1. Garch (1, 1) Model Specifications**

To determine volatility, ARCH and GARCH models are widely used as outlined by bellverles (1986).In this paper I use GARCH (1,1) model to determine the volatility of the RMB.

$$\text{Log } (RER)_t = \gamma \text{log } (RER)_{t-1} + \mu \tag{1}$$

t= 2009-2011 Daily data of USD/RMB

$$Q_t^2 = \omega + \alpha \mu_{t-1}^2 + \beta Q_{t-1}^2 \tag{2}$$

$$\omega = \gamma V_L \tag{3}$$

Where: RER is RMB Exchange Rate with a one period lag. In the model,  $\omega$  is the constant,  $\alpha \mu_{t-1}^2$  is the last period volatility the (ARCH term) and the  $Q_{t-1}^2$  is the last period variance the (GARCH Term). In GARCH (1, 1) Model  $Q_n^2$  is calculated from a long-run average variance rate,  $V_L$  as well as  $Q_{n-1}$  and  $\mu_{n-1}$ . This is the model used for the purpose of estimating parameters. For a stable GARCH (1, 1) we require  $\omega + \alpha + \beta = 1$  (Hull, 2007).

E-views results are as in the table:

Estimates	$\omega$	$\alpha$	$\beta$
Coefficients	0.00000405	0.234773	0.753557
	Constant	(GARCH term)	(ARCH term)
$(\alpha + \beta) \leq 1$		Last period variance	Last period volatility

$\text{Log}(RER)_t = 0.98833 \text{log}(RER)_{t-1} + \mu$  Standard errors are in parentheses below.

$$Q_t^2 = 0.00000405 + 0.234773 \mu_{t-1}^2 + 0.753557 Q_{t-1}^2$$

(0.004) (0.3437) (0.278)

DW=2.317, AIC= -1.347961, SC= -1.315606. From the above estimates,  $\gamma = 1 - \alpha - \beta$ .

The long term variance is therefore calculated as  $V_L = \omega/\gamma$   
0.012

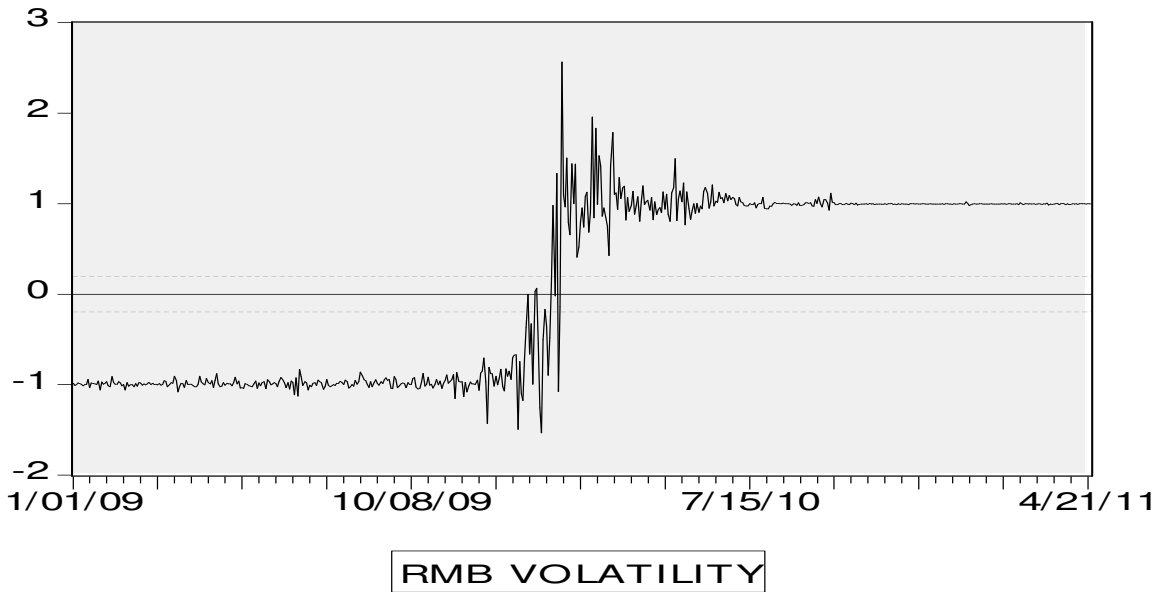
(4) In this case,  $\gamma =$

$V_L = 0.0003375$  this is the long run average variance per day implied by the model. This corresponds to the volatility of  $\sqrt{0.0003375} = 0.01837$  or 1.837% per day. The annual equivalent volatility is as below:

$$Q_{day} = Q_{year} / \sqrt{252} \quad \text{(Hull, 2007)} \quad (5)$$

That is,  $0.01837 * \sqrt{252} = 0.292$  or 29.2% per annum.

From the above model, it can be seen that the volatility of the RMB is high.



### 3.2. Regression Analysis (Model Specification)

The model uses time series annual data from 1991 to 2011 and suggests that FDI in Zambia is determined by the exchange rate volatility of the RMB, the Zambian currency (Kwacha) exchange rate volatility, Gross domestic Product growth, and inflation of the host country. Note that this model assumed that RMB exchange rate and independent variables in this model were the sole determinants of total FDI into Zambia. Other important factors that affect FDI inflow into Zambia were assumed to have been represented in the error term as indicated in the multiple regression models below.

$$\text{Log}FDI_i = \beta_1 + \text{Log}\beta_2 RMB_{i-2} + \text{Log}\beta_3 ZMK_{i-3} + \text{Log}\beta_4 GDPG_i + \text{Log}\beta_5 INFL_{i-3} + \varepsilon_i$$

WHERE:  $i$  is the country,  $\beta_1$  Is the constant, Log is the logarithm, RMB is the Chinese currency also known as Yuan with a 2 period lag, ZMK is Zambian currency (kwacha) with a 3 period lag, GDPG is Gross Domestic Product Growth, INFL is annual inflation of the country as measured by the Consumer Price Index (CPI) with a 3 period lag.  $\varepsilon_i$  is the error term.

### 3.3. Data Manipulation

Data collected was the actual level experienced by the market, as quoted daily. This paper however, called for the manipulation of each variable by inserting logarithm and lags year on year so as to achieve appropriate and scientific findings in this paper.

### 4.0. Analysis and Discussion

Results for the regression analysis are displayed in the table below using **Ordinary Least Square (OLS)**. It is important to note that data on Zambia’s economic indicators suffers from the fact that it contains many sudden variations in values, which unfortunately reduces the consistency and completeness of the results.

Variable	Coefficient	Std.Error	t-Statics	Prob.
C	27.11552	6.686860	4.055045	0.0023
RMB	-13.20991	3.941132	-3.351806	0.0073
Kwacha	1.131389	0.395569	2.860156	0.0170
GDP	0.664734	0.555389	1.196879	0.2590
Inflation	1.387557	0.809309	1.714496	0.1172

**Dependent Variable FDI. Note: significant at 5% level of significance.**

R-squared =0.798076, Durbin Watson = 2.317872, S.E of regression = 0.582218.

Consistent with other theories in the literature review above, RMB exchange rate has a negative effect on FDI inflow into Zambia and is significant. With a coefficient of -13.20991, RMB exchange rate fluctuation can arguably be said to be a fundamental driver for FDI inflow into Zambia. The reason behind this is that, investors from China will consider the effect RMB appreciation (decreased exchange rate) will pose on the export of Chinese goods into foreign countries. Appreciation of the RMB will negatively affect Chinese exports, as the Chinese economy is to a large extent dependent on exports. In this regard, it will affect Chinese investment decision into Zambia, at least in the short term. In the long run however, the results may be different.

**Kwacha Fluctuation and FDI**

Variable	Coefficient	Std.Error	t-Statistics	Prob
Kwacha	1.131389	0.395569	2.860156	0.0170

**Note: significant at 5% of level of significance.**

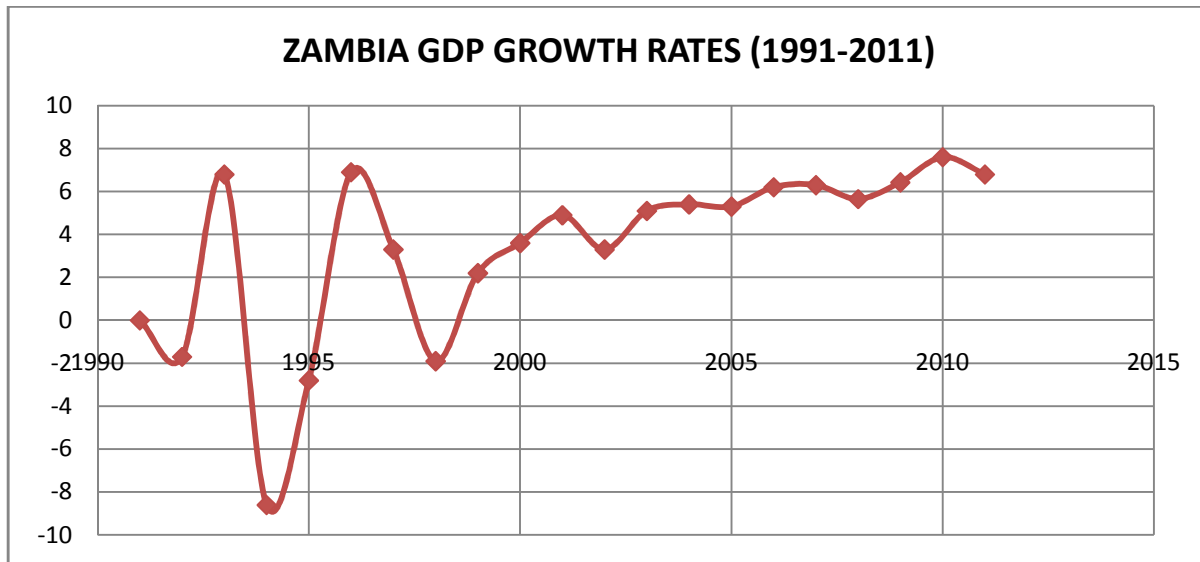
The Kwacha was found to have a positive slope and statistically significant at 5% level of significance, that is  $p < 0.05$  as indicated in the table above. This is more likely due to the fact that Zambia depends on the export of copper for foreign exchange, Fundanga (2006). In this case, as the economy continues to grow, the availability of the 'green bag' (US dollars) in the country strengthens the local currency due to more demand for the local currency by firms for wages and subsequent tax remittances as per statutory requirement of the host country. It is seen that the appreciation of the local currency (kwacha) is more to do with the economic growth of the entire economy. According to Chikwanka (2007), foreign investors who invest into the Zambian economy rarely rely on the local capital market for investment. In the same vein, the appreciation of the local currency (kwacha) reduces the cost of doing business in the country because wages and operational bills are paid in local currency. However, Adubi et al (1999) pointed out that depreciation of the local currency attracts FDI into the host country. Nevertheless, it is important to note that if the volatility of the Kwacha is high, an expected reduction in FDI inflow into Zambia is highly likely to occur. This is also consistent with the theory by (Rose et al,2000) that risk averse investors will avoid high currency risk and either shift their investments to other economies or maintain a 'wait and see' scenario which in effect reduces FDI flows.

**Gdp and FDI into Zambia**

Variable	Coefficient	Std.Error	t-Statistics	Prob.
GDP	0.664734	0.555389	1.196879	0.2590

**Note: significant at 5% of level of significance.**

GDP growth which represents the growth rate of a country has a positive effect on FDI but is not statistically significant;  $p = 0.2590$ . This is also in tandem or consonance with widely held theories that high GDP growth is a sign of good investment climate in the country and that economic fundamentals in a host country are strong.



Data Source :( World Bank Databank)

**Inflation and FDI**

Variable	Coefficient	Std.Error	t-Statistics	Prob.
Inflation	1.387557	0.809309	1.714496	0.1172

Note significant at 5% of level of significance.

Inflation has a positive slope though not statistically significant. This though is a surprising result considering the fact that high inflation is seen as a cost of doing business over time. It is generally assumed that high inflation would be negatively correlated with FDI inflows. This emanates from the views espoused by Ahmed and Funnke (2005) that high inflation shows lack of monetary and fiscal discipline, thus reflecting poor macroeconomic conditions. However, according to Onyeiwu and Shrestha (2004), inflation theories and trends seem to indicate that moderate inflation increases could be positively correlated with FDI. Economies in the boom phases of their business cycles find themselves with moderate increases in inflation. As the economy is expanding, inflation increases as well, not as a signal of loose monetary policy but due to economic growth taking place.

**5.0. Conclusion**

In this study, I have empirically investigated the relation between inward FDI into Zambia and volatility of RMB from 1991 to 2011. I have employed a method pertinent to the data set with time-series dimensions: The GARCH (1, 1) model has been used to determine the volatility of RMB. The findings are that RMB has been highly volatile at least enough to cause imbalances in other economies such as Zambia. Ordinary Least Square has been used to determine the regression analysis so as to determine the predictability of some of the independent variable and the effect they pose on FDI inflow into Zambia. The findings can be summarized as follows: RMB exchange rate volatility negatively influence inward FDI into Zambia in the short to medium term. Where RMB volatility is examined, foreign direct investments reduces as the volatility increases. The fluctuation of the local currency (Kwacha) has been found to have a significant effect on the flow of FD into the country. This is because exchange rate volatility of the local currency significantly affects the operations of foreign firm in the country. I did not find any significant impact the GDP growth poses on attracting FDI into Zambia, though the slope sign seem to be positive. The positive slope indicates that investors are more comfortable to invest in an economy that is developing.

On the whole, the contribution of this study is to emphasize the fact that the volatility of RMB doesn't only affect the Chinese economy but the entire globe especially countries in emerging markets such as Zambia where Chinese investment has surged in the recent past. It is hoped that this analysis contributes to the discussion on an appropriate exchange rate system and/or new methods by governments' intervention in exchange rates fluctuations and motivate further research into the positive effects of RMB volatility on FDI into emerging markets like Zambia in the case of this study.

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