SEASONALITY OF EXCHANGE RATES IN GHANA

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Abstract

The seasonality of Ghanaian economic activities such as agriculture, consumption, money supply among others which affect exchange rate gives the impression that, the Cedi – US Dollar rate also follows a particular pattern within the year.

Using quarterly interbank Exchange rate data from 2000 to 2014, sourced from Bank of Ghana, this study has established the quarterly behaviour of the Cedi against the US Dollar. To achieve this, both statistical analysis and econometric model including trend, F – Test, K – Test and regression were computed with the aid of X-12 Census ARIMA program provided by the US Census Bureau.

Whiles the trend analysis suggest seasonal depreciation of the Cedi with peak in the fourth quarter, the regression results indicates statistically insignificant average mean difference between the quarters. However, the moving seasonality test showed a cyclical pattern of seasonal frequencies evolving from year to year. The general conclusion we established from the study is that depreciation of the Ghana cedi to the dollar follows a moving seasonality with a pattern constantly repeated year to year

Keywords: Cedi, US Dollar, quarters, seasonality, depreciation

1.0 INTRODUCTION

In a fast globalization era like this, a country cannot survive without any trade with other countries; hence the exchange of currency is inevitable. Every country been small or big has to exchange its currency to other country currency in order to trade internationally.

Foreign exchange is the currency or many claims such as bank balances and bank drafts expressed in equivalent value in foreign money.

Since the adoption of inter- bank exchange rate (also called as floating rate system), the debate of exchange rate in Ghana continues unabated. This is due to the instability of the Ghana Cedi against major currencies like US-Dollar, Euro UK Pounds.

Ghana as many other nations was using fixed or pegged exchange rate system under the Bretton Wood agreement till 1986. Between 1987 and 1992, the country opted for the auction system also known as the managed flexible system. The start of constitutional government in the country saw the adoption of freely floating exchange rate system in 1992. The floating system caused almost 1500% depreciation of the Cedi over 10years periods. That is the Cedi felt several hundred folds from 520 Cedi in 1992 to 8000 Cedi in 2002 against the US Dollar.

Free-floating system allows a country currency rate to be freely determined by demand and supply against another currency, whereas in the fixed rate system, the country currency is pegged at

specific price for specified time against an amount of gold. In between these two extreme systems is the managed float where both the invisible hand of demand and supply as well as major government force operates in the same market. Thus free market is allowed to some extent while government intervene where necessary to achieve a desire economic objective. Almost all countries in the world have gone for free-float or managed float since the breakdown of the Bretton Wood fixed exchange rate. It is often said that most countries go for managed float because no country will sit down for its currency to fluctuate beyond expectation without any government intervention. This is the same case with Ghana while on the face value, exchange rate practice is free float; the government sometimes intervene the market to achieve some economic objectives like inflation and interest reduction.

There will not be any issue on currency exchange if the whole world uses one common currency or monetary units. But single global monetary unit can only be an opinion but not a reality; hence there exist foreign exchange,

In addition to the enhancement of international trade, exchange rate also makes it possible for foreign direct investment and transaction. Again, international movement of people have become easier through exchange rate system.

Ghana as a developing and import led country is much affected by exchange rates. The import led feature of Ghana economy means that any fluctuation in exchange rate does not only affect the country's currency on the international market but almost the macro economic variables such as inflation and interest rates. Further, Ghana economy, especially the purchasing behavior usually follow specific pattern. For instance, rice and clothing purchases are much during the last month than any other time and these are largely imported goods. Also doing the off farming season such as July-August most people including farmers turn on imported rice because local food becomes expensive.

Moreover other economic factors which affect the exchange rate such as money supply also experience some seasonality. To add up, the importation of oil as well as the export of cocoa which are the major international commodity of the country also follows a certain pattern.

On these bases, people believe that the fluctuations of the Ghana Cedi against US – Dollar follow particular trend within the year yet little research has been done to empirically validate these assumption. In line with this, the study attempts to proof or otherwise the quarterly seasonality of the Ghana Cedi against the US Dollar.

2.0 LITERATURE REVIEW

The study on seasonality of exchange rate across the world has not attracted much attention by both empirical and theoretical researchers perhaps due to the mix trend of most currency rates.

While An and Kim (2011) found no seasonality between Japan Yen – US Dollar rate, Cellini and Cuccia (2011) failed to identify any clear cut monthly time series of Euro- Dollar exchange rate. Similarly, Roberto et.al (2013) found a significant weekday effects as well as some monthly effects but at conditional mean dynamics on Euro-Dollar exchange rate. Contrary, in a related research Jimenez et.al (2009) study on seasonality of exchange rate, observed that, no seasonality and integration of order between Euro-Dollar exchange rates.

In an exploratory analysis on assumption of non-seasonality of exchange rate, Tiziana et.al (2011) found that, there is significant seasonal component in monthly time series. But the seasonality is

less in recent data due to the global financial integration. Their argument was that, as people demand more capital across the globe and capital easily flow, there is continuous need for foreign exchange regardless of the time it may be during the year. The study made an extensive use of F-Test to evaluate both stable seasonality and moving seasonality between the Euros and US Dollar through X – 12 – ARIMA computation program.

A bank of Ghana working paper (2004) on Cedi – Dollar rates by Zakari and Afriye deduced the following behavior of the Cedi against the US Dollar. While there is no clear cut seasonal pattern in the first three (3) quarters of the year, the end of year economic activities pressures causes the exchange rate to outbound the trend path in the last quarter. The last quarter force on the exchange rate can be attributed to the Christmas buying behavior of Ghanaians. The strong fundamental economics in 1999 cause the exchange rate to move below this trend line which was the only exception to the seasonality behavior of the Cedi – Dollar exchange rates.

Owusu and Mumumi (2004) argue that, both economic fundamental and speculation are the influencing factors of exchange rate in Ghana. Their analysis indicates high inflation depreciates the Cedi while high domestic Treasury bill rate appreciate the Cedi in the short run. This means, if the country has seasonal inflation rate and Treasury bill rate then the exchange rate will also be seasonal.

An early study by Bawumia and Abradu (2003) also reveals the seasonal pattern of exchange rate in Ghana. The study shows a steady depreciation in the first three (3) quarters against a peak depreciation in the last quarter of the year. The study also indicates that unlike inflation, the exchange rate responds to changes in the money supply immediately. Money supply is seasonal in nature with a noticeable year end hump. Thus the seasonal behaviour of the exchange rate in Ghana can be explained by money supply especially in the fourth quarter.

3.0 SEASONAL ECONOMIC ACTIVITIES IN GHANA

Economic activities of the three main sectors of the Ghanaian economy fluctuate in diverse magnitude during the course of the year. Activities of these sectors are influenced by seasonal patterns that are caused by economic behavior or recurrent exogenous factors such as weather pattern, holidays, religious events and festive seasons.

Of the three sectors, the service sector which encompasses information, communication, real estate, professional, and administration and support services has been found to show no evidence of seasonality as majority of the sector activities are carried out throughout the year with little or no variations. However the tourism industry which comes under the umbrella of this sector exhibit some form of seasonal pattern with increasing patronage during the festive occasions.

Industrial and commercial activities exhibit some seasonal pattern. During the peak seasons, such as festive, holidays and religious seasons which usually occur during the 3rd and 4th quarters, the sector experience a booming demand and supply mostly for household consumables, clothing and recreational commodities. During these times, traders increase their import to restock their stores to meet demand whiles producers import more raw materials for production.

Economic activities in the Agriculture sector – livestock, forestry and logging and fishing sub sectors usually record a slow growth during the first and second quarters of the year. Agriculture in Ghana continues to be rain fed which is dictated by the pattern of the rainy and dry season in country. Cocoa which is one of the main export commodity of Ghana is usually harvested in September which is

the main season and may-august; the midseason. Since the cocoa revenue constitute a major source of revenue to farmers, the time of harvest leads to increase in demand for industrial output and imports. A noticeable characteristic of the Ghanaian economy is that any factors that increase demand for goods and services also invariably leads to increase in import.

Each period within the year is dominated by the activities of a particular sector. The industrial (manufacturing) sector is known to exert much pressure during the first three months of the year through the importation of inventory. Due to the dominance of Multi-NationalCompanies (MNC) in the country, most of the company's inventories are imported from outside. Similarly, capital in both cash and machinery also flows into the country for start of new investments. These opposing movements of international transaction also exhibit an opposing force on the exchange rate. Whiles the inventory imports are very high during January, the high capital inflow in the following subsequent months offset the inventory pressure, thereby strengthen the Cedis at the end of the quarter. These capital inflows also include government borrowings and grants.

The second quarter which begins the farming season of the country does not see much of international business except for the expiration of company returns in the April. Both the accounting year and fiscal year of the country ends in December with auditing and subsequent Annual General Meeting at the end of the first quarter. As usual, MNC repatriate their returns after AGM hence the Cedi is expected to depreciate due to the demand for US-Dollars for transfers. But this phenomenon is significantly to influence the Cedi as most companies retain much of profit for reinvestment.The farming season used to be locally dependent in both inputs and methods. The revolution of crop production through the massive application of chemicals has brought some international influence on the farming season. Recent trend shows that, there is much preference for imported agricultural chemicals by farmers which also exert some pressure on the Ghana Cedi – US Dollar rate. These pressures are not a problem, because only few farmers have access to the imported chemicals.

The farming season continues through the third quarter with harvesting of the crops. The labour intensive as well as the subsistence nature of the agricultural sector make the season less influential period on exchange rate. Traditional, the first month of the quarter is known to be learn economic period with hardship as farmers wait for their produces

The final quarter is known to be the lighting season of the country's economy in terms of business activities. This is usual due to the Christian dominance of the country coupled with the cocoa production season. The festive seasons mainly Christmas brings in lots of household purchases which are imported goods. The Cocoa beans which is the major export of the country also brings in some Dollars. Interestingly, the high demand for imported goods during the season out-weights the Dollars from cocoa exports. Cocoa farmers also exert more pressure on the imported goods when the cocoa money lands in their pockets. These cause high depreciation of the Cedi at the end of the year.

4.0 METHODOLOGY

The study seeks to establish whether or not a unique seasonal pattern exists on exchange rate in Ghana. A quarterly data on interbank exchange rate for a period spinning from 2000 to 2014 have been

used for the analysis. All data are sourced from Bank of Ghana (BOG) time series data base. Each monthly data is the daily is daily average of interbank exchange rate as provided by the BOG

4.1 Test of seasonality

The D8 F-test is employed to test for the presence of stable and moving seasonality based on one way analysis of variance (ONE-WAY ANOVA).

The Kruskall-Wallis statistic, (K-statistics), which evaluates the equality of median values across Different quarters (a value of this statistic falling into the rejection region means that median Values are not constant across quarters) is also employed to lend consistent conclusion to the results.All of the mentioned tests are computed by the X-12 census-ARIMA program, which is the program provided by the US Census Bureau for evaluating (and disentangling) the seasonal components of time series.

The following hypothesis is tested:

H0: Q1=Q2=Q3=Q4(seasonality is not present in the data)

AgainstH1: $Q_P \neq Qq$

Where (Q1, Q2, Q3, Q4- quarterly means)

The decomposed variance is given as

$$\sum_{j=1}^{k}\sum_{i=1}^{nj}(\bar{x}_{ij}-\bar{x})^2=\sum_{j=i}^{k} nj(\bar{x}j-\bar{x})^2+\sum_{j=1}^{k} nj(\bar{x}ij-\bar{x}_j)^2$$

The total variance will be broken down into two; variance of the average due to seasonality and variance due to residual

$$F=\frac{\sum_{j=i}^{k} nj\,(\bar{x}j-\overline{xG})2/\ \mathrm{K}-1}{\sum_{j=1}^{k} nj\,(\bar{x}ij-\bar{x}\mathrm{j})\ 2/\mathrm{n}-\mathrm{k}}$$

4.2 Model specification

The paper further uses regression model based on seasonal dummies to test if there is a significant difference among exchange rate in each quarter of the year. The regression model estimates the impact of each quarter of the years on interbank exchange rate.

$$Y_t = \beta_0 + \beta_1 Q_1 + \beta_2 Q_2 + \beta_3 Q_3 + u_t$$

Where

Yt is interbank bank exchange rate at time t, $\beta_{0,\ is}$ the intercept (measures the mean exchange rate for the fourth quarter. Q1, Q3, Q4 are seasonal dummies for the first, third and fourth quarter respectfully. The second quarter is omitted as a reference category

And U_t is the classical stochastic error term.

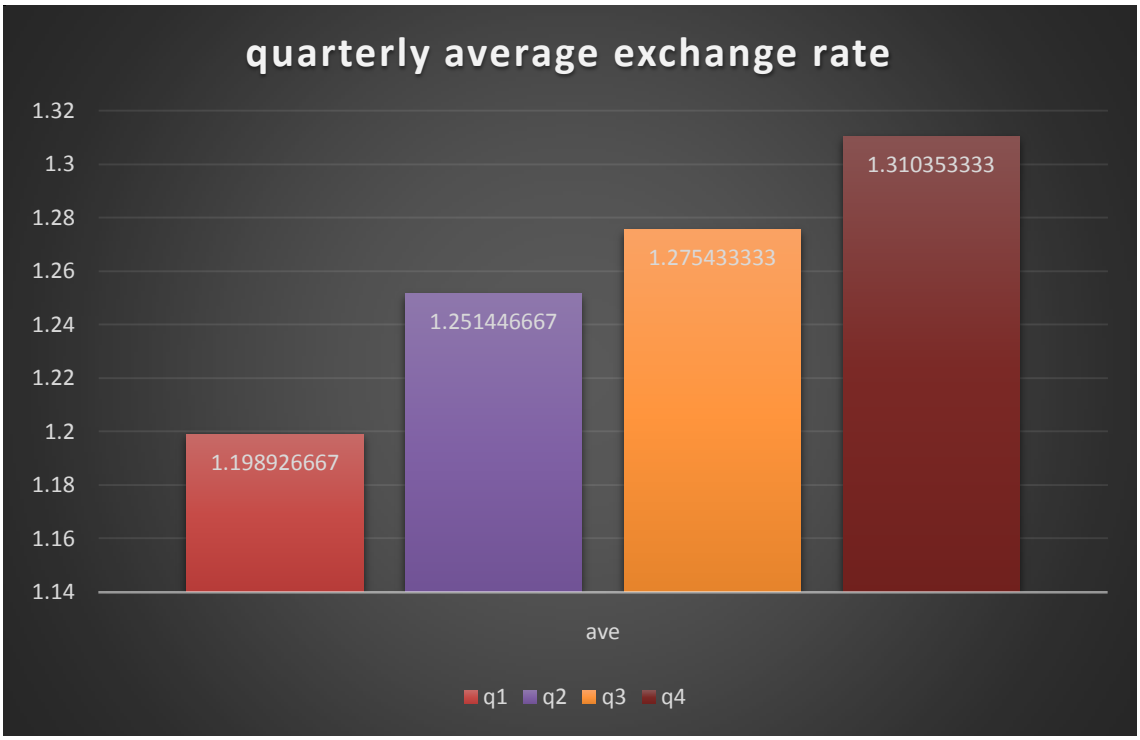
5.0 ANALYSIS AND DISCUSSION

5.1 Trend analysis

As it can be seen from *figure 1*, the Cedi depreciates as the quarters goes by. That is the depreciation increases throughout the year with the highest in the last quarter. But this depreciation is not equal among all the quarter. Whiles the change from the first quarter to second is about 5%; that of second tothird quarter is 1.6% with last quarter percentage change to be 3%. This implies that, the Cedi-Dollar change vary much between the first two quarters but marginal from the third quarter. This margin change can be attributed to the fact that there is no much international activities during these period in the country. As it has be discussed under the economic pattern of the country, the quarter

four is the boom of international business in the country. Hence is usual for country to experience depreciation,because this boom is just an import booming marketing.

Figure 1 Quarterly averages

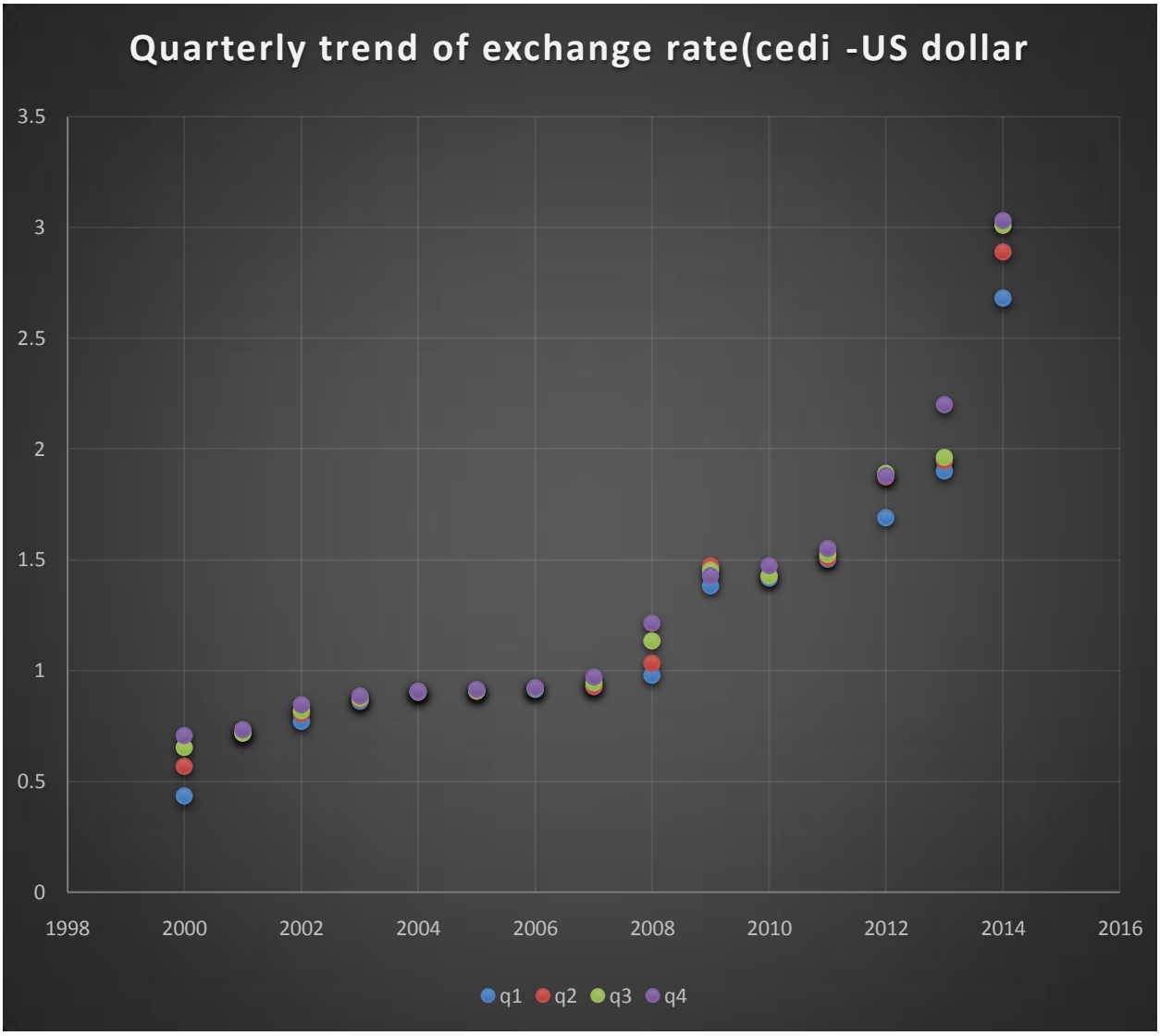


The figure 2 below also suggests the seasonal pattern of the Cedi – Dollar rates but with more details. The diagram demonstrated that, the quarterly seasonality of the exchange rate is not same over the years. Through 2003 to 2007, the rate was equal over the year without any distinctive seasonality whiles 2008 to 2014 signals some fluctuations depending on the quarter of the year. Notwithstanding this difference over the periods, the one common feature over the periods is that, the highest change (which is mostly Cedi depreciation) is felt in the last quarter.

Similarly, 2009 to 2011 also depicts same marginal seasonality of Cedi – Dollar rate. The recent years of 2012 – 2014 does not follow any clear cut pattern, apart from the highest change in the final quarter. This trend confirms the studies by Tiziana et.al (2011) that, currency exchange rate may be seasonal in the past but not recent years.

It can be inferred from the above trend behaviour that, the Cedi usually depreciate significantly during the last quarter of the year and will experience marginal changes during the year especially at the mid seasons.

Figure 2 Quarterly Trend of Cedi-Dollar rates



5.2 D8 F- Test of stable and moving seasonality

Table 1.0

D8 F-test Stable seasonality	Sum of squares	Df	Mean square	f-value
Between quarters	25.7128	3	8.57093	5.946
Residual	80.7211	56	1.44145	
total	106.4339	59		

F-test of moving seasonality				
Between Years	31.2862	14	2.234728	3.063*
Error	30.6403	42	0.729531	
	Kruskal –Wallis stastistics	Degrees of freedom	Probability level	
	20.0142*	3	0.017%	

***evidence of seasonality presence at 1% significant level**

The D8 F-test (F_S)was used to test the hypothesis of equal means of the quarterly exchange rate. If the F- test supports the Null hypothesis of no seasonality then the time series are considered to be non-seasonal. A consistent conclusion is also given by the Kruskal-Wallis non parametric test.The test results gave no evidence of stable seasonality of exchange rate between the Ghana cedi and the US dollar. The K- statistic was however unable to support the results of no stable seasonality as it was found to be significant at 1% level.

The F-test for moving seasonality across the years showed an evidence of seasonality at 1% level. This is consistent with the K-statistic.it shows that intra year variation in the exchange rate series is repeated constantly or evolves from year to year.

5.3 Regression Results

Dependent variable: EXCHR

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	1.251447	0.159326	7.854630	0.0000
D1	-0.052520	0.225321	-0.233090	0.8165
D3	0.023987	0.225321	0.106456	0.9156
D4	0.058907	0.225321	0.261434	0.7947

The intercept value of GH¢1.251447 measures the average exchange rate for the second quarter which was chosen as a reference category. The coefficient of the first quarter shows that the first quarter's average exchange rate isGH¢ 0.052520 less than the second quarter.

D3, the slope coefficient for the third quarter shows that the mean exchange rate in third quarter is GH¢0.052520 higher than the mean value in the second quarter. The fourth quarter exchange

rate volatility is also GH¢0.058907 more than second quarter. The hypothesis testing using the P-values of the various coefficients of the 1st, 3rd and 4thquarters shows insignificant difference between the exchange rate in the first,third and fourth quarters and that of the second quarter.

The insight drawn from the regression results is that exchange rate in Ghana generally increase from the first quarter through to a peak at the 4th quarter but the average mean difference between the periods are statistically insignificant.

CONCLUSION

The paper sought to find out if a unique seasonal pattern exists between exchange rate volatility of the Ghana cedi and the US-Dollar using the interbank exchange rate. The trend results gave an overall picture of the depreciation of the cedi. It shows that the rate of depreciation is low during the first quarters of the years and increases through the second and third quarter reaching a peak in the fourth quarter. The insight from the trend results was anchored by the regression results using seasonal dummies.The regression results revealed that exchange rate variation in Ghana generally increase from the first quarter through to a peak at the 4th quarter but the average mean difference between the periods are statistically insignificant.

The test results for stable seasonality between the quarters could not be substantiated by the F-test. However, the moving seasonality test showed a cyclical pattern of seasonal frequenciesevolving from year to year. The general conclusion we established from the study is that depreciation of the Ghana cedi to the dollar follows a moving seasonality with a pattern constantly repeated year to year.

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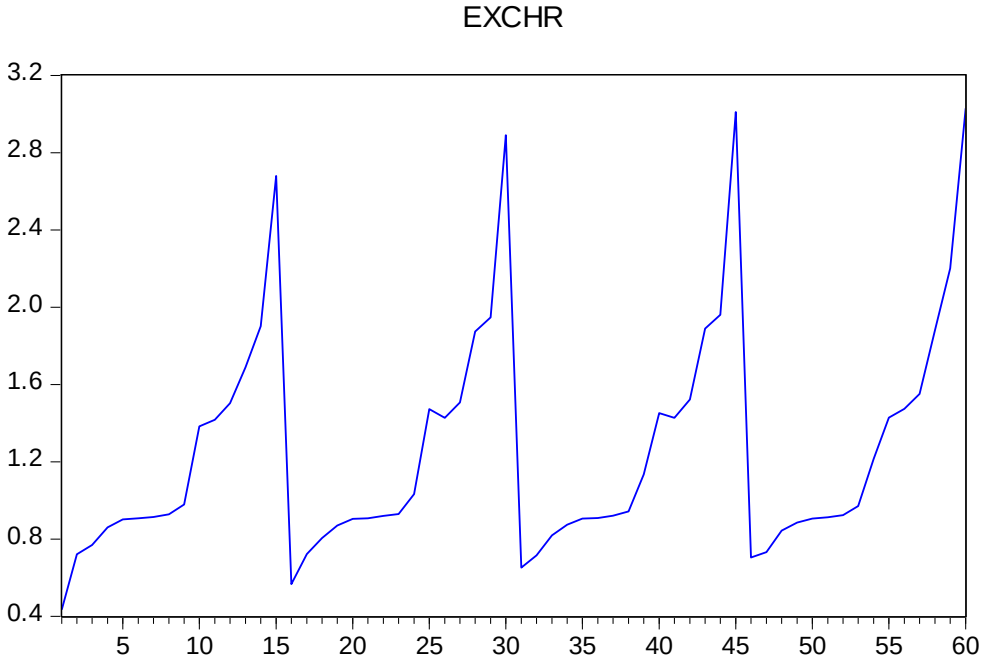
Appendix

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
Q1	15	1.198927	0.572598	0.147844
Q2	15	1.251447	0.615024	0.158799
Q3	15	1.275433	0.630766	0.162863
Q4	15	1.310353	0.647377	0.167152
All	60	1.259040	0.602562	0.077790


EXCHR
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
5
10
15
20
25
30
35
40
45
50
55
60