World Journal of Social Sciences
Vol. 3. No. 2. March 2013 Issue. Pp. 62 – 81

Currency Crisis and Output Growth in Nigeria

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This study examines related shock impacts among macroeconomic variables considered as key indicators that matter for early warning signals before a currency crisis, in an attempt to evaluate their impacts on the levels of output growth in the economy between 1981Q1 to 2009Q4. To investigate these facts, we represented currency crisis by the levels of volatility in the rate of exchange as a measure of the degree of market driven financing in the economy and changes in the level of reserves as an indication of the levels of monetary authority intervention in currency situation. To estimate their impacts on output growth, we introduced the monetary policy overhang variable, monetary policy stability variables and a variable to represent the impact of fiscal policy pressure on the economy, in a vector autoregression (VAR) model. We discovered that the exchange rate volatility variable shock impacts are negatively associated with growth, indicating that the degree of market driven financing in terms of the levels of currency impact in the economy is negatively associated with output growth while the changes in reserve had weak mix impacts suggesting that the stated activities associated with currency crisis are not efficient. The results of the impulse responses implies that these variables impact on output growth and have been volatile over time, suggesting that currency crisis due to the levels of inefficiencies in the financial sector threaten growth and strong financial distortions are imminent.

Keywords: Financial regulation, Monetary system, Macro-economy, Policy consistency, VAR

JEL Code: C32, E42, E44, E52, E61, G28

1. Introduction

This study relates several connected perspectives in literature over the concepts, theories and empirical views that concern currency crisis, monetary policy stability and output growth (Boyd, DeNicolo and Smith 2003). Most research works considered in this study reveals that the levels of uncertainties in monetary policy implementation, especially when such policies are implemented where authorities tend to be careful because of speculated uncertainties which bother on the efficiency of such policies may aggravate currency crises (Carpenter 2004, Eijffinger and Hoeberichts 2000). A close examination of data shows that currency uncertainties within the macro-economy have not been strategically supervised. Also, its effect on the financial system in particular and output growth in general has been given less attention due to policy inefficiencies and a malfunctioning financial system, hence

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the need for this study. Therefore, this study examines the relationship between currency crisis and output growth by analyzing the behavior of some fundamental macroeconomic indicators over one hundred and twenty quarters. This study became necessary because the economy keeps recording reasonable levels of growth despite the prevailing levels of exchange rate uncertainties, persisting high rates of inflation, currency uncertainty, monetary policy inefficiency and a weak banking sector. To examine currency crisis and output growth in the Nigeria economy, we followed the traditional method of Krugman (1979) where currency crisis impact generates a gradual loss in reserves and speculative attack on the domestic currency due to exchange rate difficulties and expansion in domestic credit. We linked these facts in a VAR model and included other policy measure that may instigate currency instability (Odstfeld 1994, Krugman 1996, Pesenti and Tille 2000). In our research work, we evaluated the shock effect of changes in reserves representing government policy in currency situation and volatility in the rate of exchange which captures market driven financing due to currency uncertainty. In order to ascertain the impact of currency crisis on output growth by taking into consideration other forms of shock effects from monetary policy overhang, monetary policy stability measures and fiscal policy pressure.

The results of the VAR analysis revealed that these indicators of currency crisis disclosed impressive outcomes, such that the shock effect of exchange rate volatility was negatively associated with growth, changes in reserve shock impact produced positive association with the levels of output growth. The output of the impulse response depicted that these effects have been increasingly volatile over time, suggesting that currency crisis due to the levels of inefficiencies in the financial sector may be mitigated and financial distortions alleviated where the recursive nature of these variables are closely checked with the most appropriate policies measures.

Following the introduction is the literature review, which is the second section of the study. It neatly associated theoretical views with empirical issues in other to effectively examine policy consistency associated with currency crisis. The third section deals with the structural composition of the model that guides the research work. The forth section discussed extracted facts from the output of the empirical test, while the fifth section stated the conclusion.

2. Literature Review

In this section, we express the definition of currency crisis by examining thoughts from previous theoretical literature and linking such thoughts with views from empirical literature. We expressed most of the variables used in other studies and showed their relevance in the model and accounted for their impact on currency situation as reported. Also, we associate these views in accordance with policies as must as it related to studies coved under this section. Currency crisis is often associated with depreciation in a country's currency. This has been known to cause an asymmetry in the prevailing rates of exchange that negatively affects output growth. To correct this uncertainty, monetary authority uses the reserve as a substitute to meet the excess demand and cushion the effect of the downward pressure on the domestic currency. Relatively, some scholars believe that an adjustment of the rate of interest followed by a gradual reduction of the money supply may be more effective (Qin, Quising, He and Liu 2005, WAMA 2009). Often

where this process is not properly handed, it leads to the devaluation of the domestic currency which has been noticed to increase the levels of aggregate demand and output. To control its associated ills, monetary authorities still have to contend with finding the most appropriate increase ratio for the rate of interest in other to ameliorate the increase in the real money supply and the levels of adjustment in reserves (Palley 1994, Parliamentary Budget Office 2011, ECA 2011). Consequently, currency crisis could be viewed as a phenomenon that occurs due to an attack on the domestic currency that leads to significant reserve losses, and a sharp depreciation of the domestic currency (Krugman 1979, Kaminsky and Reinhart 1998, Evans, Leone, Gill and Hilbers 2000, Glick and Hutchison 2011). Also, they confirmed that currency crisis could be ex-post in nature and are often indicated by exchange rate market pressure which is often captured by the weighted average of the rates of exchange and change in the total levels of reserves. Other scholars associate it with unhealthy bank practices that lead to liquidity shocks and uncertainty in capital flows (Chang and Velasco 2001, Calvo, Izquierdo, and Talvi 2002).

The likelihood of a crisis is found to increase with the extent to which the real exchange rate rises above its trend, faster growth in broad money relative to the levels of the international reserve, larger currency account, budget deficit, lower real gross domestic growth rate (RGDPG) and if a neighboring country has a crisis (Licchetta 2009). To test these facts, Kaminsky and Reinhart (1998) predicted currency crises by monitoring the behavior of a set of macroeconomic variables in other to ascertain some forms of irregularities in their conducts before currency crisis. Their results held that a proposed threshold is necessary, to ascertain the unhealthy behaviors of trends in the macroeconomic indicators in order to monitor the warning signals before the advent of a currency crisis. Also, they proposed that where key indicators like the levels of exports and the deviations of the real exchange rate from trend, the ratio of broad money to gross international reserve, output and equity prices where noticed to be volatile. Therefore, currency crises will most likely take place twenty four months after. Supporting these views, Duttagupta and Cashin (2011) suggested that the vulnerability of these form of crises increased in economies where there are, very high inflation, highly dollarized bank deposits, combined with nominal depreciation or low bank liquidity and low bank profitability. Often in countries were these persisted; they degenerate into foreign currency risk, poor financial soundness, and macroeconomic instability which in turn lead to currency crises and banking system failures.

Relatively, where the scope of policies been implemented are diverse, it may make the task of the monetary authorities difficult and implementation becomes vulnerable to shocks because monetary policy cannot react to internal idiosyncratic shocks (Hefeker, 2006). Subsequently, policy makers must put in place flexible policies that are realizable and that monetary policies should be considered alternative adjustment instruments. In order to explain the connection between currency crises and the real economy, Apanard (2008) introduced a set of dummy variable and evaluated their impacts on output gap approach, in an attempt to verify the magnitude of output reductions. He stated that the estimated output losses of the financial system, is stimulated by the nature of the institutional structure and crisis-response policies. He advised that this may reduce the severity of the output losses. For a similar course, Giovanni and Farina (2000) selected several explanatory variables by theoretical deductions and added them to their analysis. This set of

theoretically deduced variables included current account deficit/GDP, foreign debt/exports, budget deficit/GDP, yield curve, output, oil price, the rate of interest, Morgan Stanley Capital Index (MSCI), US GDP forecasts, the Emerging Markets Bond Index (EMBI).

This was a variation from the original traditional model variables, which included real exchange rate, reserves, M2/reserves, real interest rate, exports, commercial deposits, M2 Multiplier, Index of equity prices, imports, output, real interest differential, lending to deposit ratio (Kaminsky and Reinhart 1998). They stated clearly that various methods were used to assess potential indicators of currency crises and these methods were adapted to analyze macroeconomic indicators that were most reliable. This is mainly because currency crises are preceded by a variety of economic problems (Goldstein 1998). Apanard (2009) with the aid of the cross sectional time series data analysis, considered the relationship between banking regulation, supervision and the financial rigor of related crises in over twenty eight countries which he measured by the magnitude of output loss in the economy. His results revealed that a financial system that allows comprehensive deposit insurance coverage and enforce strict bank capital adequacy requirements experience minimal output cost of crises. Also, he noticed that financial restrictions in policies influence the severity of related currency crises in the financial secotor. But he could not associate these impacts to the output cost of the crises and the extent of banks financial intermediation in these countries.

Kaminsky and Reinhart (1998) used the signal approach while Berg and Pattillo (1999) used the mixed approach, in their results, they both agreed that the exposure to crisis becomes certain when these explained factors deviate from the realized 'normal' positions and are beyond their obtained threshold levels. Also, Duttagupta and Cashin (2011) constructed a binary classification tree (BCT) analysis to examine financial system sustainability in times of currency crises and noticed that crises increase where the prevailing rates of inflation are high. They suggested that financial system policies will serve the banking sector appropriately, where the sector is highly productive with a nominal depreciation, bank liquidity are low and the financial system notice low bank profitability. They indicated that foreign currency risk, poor financial soundness and macroeconomic instability may occur where the financial sector fails to put in place efficient policies to monitor the system. Further, they revealed that currency crisis are ex-post in nature and are indicated by exchange rate market pressure which is captured by the weighted average of the rates of exchange and changes in the total levels of reserves (Duttagupta and Cashin 2011). With a random effect Probit model, in a panel of 40 countries with monthly data for over twenty four years, Licchetta (2009) reveal that the size and composition of a country's external balance sheet are important indicators of currency crises and economic fundamentals are essential in explaining currency crises. Serwa (2007) computed the macroeconomic cost of currency crisis in an attempt to check the downward effects of crises on the financial system and economic growth. He disclosed productive insights which proposed that the magnitude of crisis has serious negative impact on the levels of growth since it was noticed to lower credit, demand deposit and money supply growth. Although most studies have conflicting results on its impact on output growth, there are no strong conclusions to guide this study, if monetary policy stabilization methods used by monetary authorities are channeled effectively to control currency crisis either by adjusting reserves or the domestic rates of interest.

Investigating real output losses association with fundamental crisis, they agreed that crises are not linked with reduction in the levels of economic growth, per capita GDP in developed countries (Duttagupta. and Cashin 2011). For developing countries, they noticed that output losses due to non-systemic banking crises are extremely large. While Boyd, Sungkyu and Smith (2005) expose the fact that post-crises economic slowdown and the shocks persist longer after the crises are formally assessed as over. These interactions suggest that the economy needs sometime to assess the preferences of policy makers (Goldberg and Klein 2005). It is necessary to note that some scholars agreed that to prevent currency uncertainties, these proposed key macroeconomic variables should be targeted and these targets should be built around functional conditional thresholds (Guariglia and Poncer 2006, Duttagupta and Cashin 2011).

3. Methodology

Considering the traditional method of estimating currency crisis (Krugman 1979, and Sims (1992)), we selected the VAR method to evaluate the size and nature of the effects of monetary policy aggregates on currency crisis in Nigeria. From literature, currency crisis is represented by uncertainties exhibited by the prevailing rates of exchange and change in reserves (Duttagupta and Cashin 2011). Consequently, we followed the traditional method where currency uncertainty impact generates a gradual loss in reserves and speculative attack on the domestic currency due to exchange rate difficulties and expansion in domestic credit (Krugman 1996). We represented currency crises by the levels of uncertainties in the rates of exchange and changes in reserve levels. This view was supported by Flood and Garber (1984) with a little modification while Odstfeld (1994), Pesenti and Tille (2000) transformed the model to include other key macroeconomic variables. Therefore, we added the monetary overhang variable to consider the impact of the existing levels of disequilibrium in the monetary system and represented monetary policy stability through the money supply-reserve channel and the rate of interest while fiscal policy pressure was captured by the ratio of budget deficit to GDP.

Subsequently, the study considered quarterly data from the central bank of Nigeria (CBN), it span from 1980Q1 to 2009Q4. To evaluate the movements of these variables overtime, we constructed the trends of these macroeconomic variables from 1980Q1 to 2009Q4, as reported in appendix A, on page 16. The data set used for this illustration was collected from the Central Bank of Nigeria (CBN) statistical bulletin, 2009. We noticed changes in the levels of international reserves (RESV), which increased significantly between the first quarters of 1995. This increase persisted with fewer fluctuations from 1995Q1 to 2003Q4 and in 2004Q1; reserves witness a sporadic increase until 2007Q2. In 2007Q3, we witnessed a steep decline between 2007Q3 to 2009Q2. This decline was only 8.2 percent of the total increase since 2004Q1. The rate of exchange (EXRTV) became volatile from 1998Q3. The rate of volatility was astronomic in 1998Q3 with over 38 percent from previous levels in 1998Q2. This increase became persistent until 2007Q1. In 2007Q2 to 2007Q4, it witnessed a shallow slum which picked up in 2007Q3 and increase with over 56 percent of previous levels from 2007Q2 to 2009Q1. The rate of interest (LINRT) was at its peak between 1991Q2 to 1993Q4. Although 2003Q2 witnessed a slight decrease which has persisted over the observation from 1992Q2 to 2001Q3, it witnessed a slight increase that has persisted until 2009Q4 with little fluctuations between 2006Q1 and 2006Q2. This event reoccurred in 2007Q4 and 2008Q1.

In addition, the money supply as a ratio of reserve (M2RESV) was at its peak between 1982Q2 to 1984Q3 and after a steep decline, it hit a trough in 1986Q3. This has been noticed to persist till 2009Q4, although increases were noticed between 1993Q2 and 1998Q3, this increase were low and not very significant. The budget deficit as a ratio of RGDP variable (BDRGDP), from 1981Q1 to 2003Q2 only increased and subsequently declined with a 3 to 8 percent margin on the average. Between 2003Q3 and 2007Q4, we witnessed consistent increase of over 52 to 75 percent over previous levels, although significant reductions have been noticed since 2008Q1, from 2008Q2 to 2009Q4. We have noticed a steep decline of over 60 percent of the sporadic increase from 2003Q3. Real Gross Domestic Product growth (RGDPG) witnessed serious fluctuations over the years with its most significant peak at 2004Q1 and 2008Q1. From 2008Q3 to 2009Q4 growth remains low and inconsistent. Considering the money supply as a ratio of real gross domestic product variable (M2RDGP), we noticed an increase in 1991Q1. This increase remains stead till 2003Q4, after which we witnessed continuous sporadic increase and it witnessed a decline in 2007Q2. Form these illustration, we noticed that tactics put in place by monetary authority to stabilize the desired changes were frail.

To effectively understand the nature of the impact of currency crisis, we evaluated the previous shock impacts of these variables in order to determine how it will most likely influence the present state of these variables.

Therefore, to state the proposed VAR model, we followed the identification process of a dynamic simultaneous equation model (Khan and Senhadiji 2001).

$$\varepsilon_t = \delta^*_{\varepsilon\varepsilon}(L)\varepsilon_t + \delta^*_{\varepsilon R}(L)R_t + U_{\varepsilon t} \quad - \quad - \quad - \quad - \quad (equ.1)$$

$$R_t = \delta^*_{R\varepsilon}(L)\varepsilon_t + \delta^*_{RR}(L)\varepsilon_t + U_{Rt} \quad - \quad - \quad - \quad - \quad (equ.2)$$

From the equations above, $\delta^* = \Gamma^{-1}\delta$ and the $U = \Gamma^{-1}\mathrm{e}$. Considering the results of the lag length criteria, if we arrive at a specified lag length of Φ, the stated reduced form equations will have four Φcoefficient (Green 2008, Favero 2001). Variables in these equations can be represented as follows:

Currency Crisis ≡ EXRV: $\Pi = (M2RSEV, BDRGDP, EXRTV, LINTR, M2GDP, RGDPG)'$

Currency Crisis ≡ RES_N: $\Pi = (M2RSEV, BDRGDP, RES\_N, LINTR, M2GDP, RGDPG)'$

From the function above, pi, Π constitute the ratio of money supply to reserve (M2RSEV) represents monetary policy stabilization measures. Money supply-RGDP ratio (M2GDP) symbolizes monetary overhang which indicates the existing levels of disequilibrium in the monetary system. Budget deficit-RGDP ratio (BDRGDP) captures the impact of fiscal policy pressure, LINT is the lending rate; which shows the levels of monetary policy control. RGDPG stands for real gross domestic product growth, which represents growth in the proposed market size, while the deviation of the rates of exchange (EXRTV) and changes in total international reserves were used to represent currency crisis.

Equation one and two above, is a simple bi-variate model which embodied, the deviation of the rate of exchange away from its normal (ε) and change in reserve (R)

in relation to other macroeconomic variables. Both models are proposed monetary control strategies in time of currency crisis, the first equation show strong elements of monetary control while the second equation illustrates currency crisis shocks from the money supply intervention strategy for the economy via the international reserves channel. Consequently, the structures of the model propose that the monetary authorities anticipate bands for aggregate liquidity in line with the reactions from the feedback mechanism of other macroeconomic variables in the economy. These other reactions are captured by the Us'.

To obtain the VAR we will estimate the following equation:

$$\Pi = \beta_o + \beta_1\Pi_{t-1} + \beta_2\Pi_{t-2} + \beta_3\Pi_{t-3} + \cdots + \beta_\alpha\Pi_{t-\alpha} + \mu_o\gamma_t + \mu_1\gamma_{t-1} + \mu_2\gamma_{t-2} + \cdots + \mu_\alpha\gamma_{t-\alpha} + U_t \quad Equ.3$$

Where; Πis a k-dimensional vector of endogenous variables, β_o is a K-dimensional vector of constants and $\beta_1 - \beta_\alpha$ are k x k-dimensional autoregressive coefficient matrices. $\gamma_t - \gamma_{t-\alpha}$ was used to represent k-dimensional vector of the exogenous variables, $\mu_o - \mu_\alpha$ are k-dimensional coefficients vectors. U_t is a k-dimensional vector of normal distributed variables that are serially uncorrelated error terms with constant variance.

4. Discussion of Results

This section analyzes the results of the descriptive statistics of the variables in the model by expressing their mean, standard deviation (Std. Dev.), Skewness, Kurtosis and Jarque-Bara statistics outcomes to justify the null hypothesis that the variables in the model follow a normal distribution process. We made use of the Augmented Dickey Fuller statistics to determine the order of integration, to justify the null hypothesis that the variables in the model have a unit root. We obtain the VAR lag length by the Lag order selection criteria test, with this result; we estimated the VAR and obtained the impulse responses

Table 4.1: Descriptive Statistics of Variables in the model

	M2RESV	RESV	M2RGDP	LINTR	EXRTV	BDRGDP	RGDPG
Mean	817.1848	-12.86847	992.3620	18.02939	-2.867183	9.664426	-63.19870
Median	188.8681	6.770919	424.3274	18.43667	-33.84342	6.699466	-47.85538
Maximum	11527.94	85.71950	5568.730	34.86667	95.18671	37.80760	2828.944
Minimum	69.05841	-610.5647	25.69718	8.833333	-55.17905	0.361309	-3777.922
Std. Dev.	1646.606	101.0374	1313.199	5.572725	55.72952	8.940016	581.5094
Skewness	3.748409	-4.322363	1.699937	0.153499	0.529738	1.546535	-1.582564
Kurtosis	20.21673	23.15092	5.227767	3.087510	1.449704	4.734014	23.13912
Jarque-Bera	1704.321	2323.823	79.85673	0.492544	17.04188	60.77375	2008.744
Probability	0.000000	0.000000	0.000000	0.781710	0.000199	0.000000	0.000000
Sum Sq.Dev.	3.12E+08	1173984.	1.98E+08	3571.356	357164.6	9191.247	38887613
Observations	116	116	116	116	116	116	116

Source: Authors estimation, E-view 7, May 2012.

Table 4.1 above, depicts the descriptive statistics of the variables in the model. The statistical outcomes shows positive skewness for all the variables in the model but the real gross domestic product growth (RGDPG) variable has a negatively skewed

outcome. These variables exhibited reasonable levels of standard deviations and their kurtosis were positive and relatively normal. To justify the null hypothesis of normality, we considered the Jarque-Bera test (1980). It reveals that these variables were positive and statistically significant at one percent, but with the exception of the LINTR (interest rate) variable which was not statistically significant at ten percent. Consequently, we fail to accept the null hypothesis that the distribution follows a normal process.

4.1 Unit Root Test for the Variables

To ascertain if the variables in the model are stationary, we used the Augmented Dickey Fuller (ADF) test to obtain the order of integration of each series. The results of the unit root test in table 4.2 below shows that most of the variables in the model were virtually non-stationary at levels, with the exception of M2RESV, M2 and RGDPG. This indicates that they were mainly of the 1(1) series. In this case, we fail to reject the null hypothesis that the series has a unit root. To achieve stationarity, we difference the variables in the model.

Table 4.2: The Result of the Unit Root Test

Variables	At level			At First Difference			At Second Difference		
	ADF Test	Critical Value	Order of Integration	ADF Test	Critical Value	Order of Integration	ADF Test	Critical Value	Order of Integration
M2RESV	-14.5690 (0.0001)	-3.4944	Accept	-4.8252 (0.0001)	-3.4957	Accept	-4.3006 (0.0008)	-3.4950	Accept
BDRGDP	-2.3918 (0.1464)	-3.4902	Reject	-3.3001 (0.0172)	-3.4902	Reject	-20.6036 (0.0001)	-3.4902	Accept
EXRTV	0.2178 (0.9727)	-3.4881	Reject	-9.6087 (0.0001)	-3.4886	Accept	-10.0249 (0.0001)	-3.4902	Accept
LINTR	-2.1771 (0.2158)	-3.4881	Reject	-10.1123 (0.0001)	-3.4886	Accept	-10.5343 (0.0001)	-3.4902	Accept
M2RGDP	2.5411 (1.0000)	-3.4944	Reject	-4.7105 (0.0002)	-3.4902	Accept	-8.0470 (0.0001)	-3.4931	Accept
RESV	12.7884 (0.0001)	-3.4881	Accept	-11.2955 (0.0001)	-3.4902	Accept	-8.3483 (0.0001)	-3.4938	Accept
RGDPG	-10.8789 (0.0001)	-3.4881	Accept	-10.3359 (0.0001)	-3.4897	Accept	-8.9543 (0.0001)	-3.4919	Accept

Source: Authors estimation, E-view 7, May 2012.
Note: The figures in parenthesis are the p-values of the ADF test. The stated critical values are at one percent level.

At the first difference, the M2RESV, EXRTV, LINTR, RESV and RGDPG variables were of the 1(0) series but BDRGDP and M2 remain non-stationary. These inconsistent results will most likely lead to spurious results and unstable conclusion (Adams 1992). Consequently, we difference again and obtained stable results. The M2RESV, BDRGDP, EXRTV, LINTR, RES_N, and the RGDPG variables hves ADF statistic values of -4.3006, -20.6036, -10.0249, -10.5343, -33.9675 and -8.9548 which pass the test at one percent level while the M2 variable passed at five percent. This result made it evident to reject the null hypothesis that the series has a unit root.

4.1.1 VAR Lag Length Selection Criteria

Table 4.3: The VAR Lag Order Selection Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4283.396	-	3.38e+26	80.95087	81.12676	81.02216
1	-4141.008	263.2835	5.82e+25	79.18883	80.59593	79.75913
2	-4000.287	241.6153	1.04e+25	77.45824	80.09656*	78.52757
3	-3898.946	160.6156	4.00e+24*	76.47068*	80.34021	78.03902*
4	-3850.391	70.54180*	4.27e+24	76.47908	81.57982	78.54644
5	-3818.591	42.00093	6.51e+24	76.80360	83.13555	79.36997
6	-3778.33	47.85299	8.92e+24	76.96856	84.53172	80.03395
7	-3736.947	43.72873	1.28e+25	77.11221	85.90659	80.67662
8	-3696.844	37.07666	2.09e+25	77.28008	87.30566	81.34350

Source: Authors estimation, E-view 7, May 2012.
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The most appropriate VAR lag length was selected by considering the based automatic bandwidth parameter methods as recommended by (Newey-West 1994; Andrews 1991). The result shows that the Schwarz information criterion (SC) assigned the second lag length, while the Final prediction error criterion (FPE), the Aakaike information criterion (AIC) and the Hannan-Quinn information criterion (HQ) assigned third lag length while the sequential modified LR test statistic at five percent level of significance, selected the seventh lag order (see Appendix B1, page 17). We used the FPE, AIC and HQ result and accepted the third lag as the most appropriate lag order for the VAR process.

4.2 Testing the Impact of Currency Crisis on Macroeconomic Variables in Nigeria

The sets of results obtained from the unit root test and VAR lag length selection process made it possible for us to estimate a VAR at the third lag with the stated macroeconomic variables at the second difference. Subsequently, this section report the parameter estimates for the entire model specified by the equation proposed in section three.

4.2.1 Specification Tests

In this section, we consider the tests on the basis of specification adequacy in accordance with residual covariance. It was detected that the estimates of the determinant residual co-variance is 1.61. Also, the reasonably high and positive outcomes of the AIC and SC which are approximately, 103.71 and 107.47, confirms that the coefficients are jointly and individually significant. In accordance with the hypothesis of diagonal co-variance, the estimated coefficients are jointly significant in most cases at the one, five and ten percent levels. Obviously, the insignificance of the non diagonal estimates may increase the persistence of the conditional variance as observed by the estimates of the residual covariance with a reasonable degree of adjustment of approximately 7.58, which is basically higher than the results obtained from the determinant residual co-variance process. In essence, the significance of the analogous coefficient obtained at their various lags in each series may likely

have similar degree of change in impact on the conditional variance of the other series.

Therefore, the hypothesis of a symmetric co-variance process suggests that the coefficient of the estimates may be significant from the results obtained. The results obtained shows that most of the elements are individually statistically significant and the basic model indicates a high R-square value and their associated F-test value were significant at the one percent level (see Appendix B2, page 20).

4.2.2 Result of the VAR Process

The empirical results of the VAR test at the third lag as specified by the FPE, AIC and HQ criteria indicated that exchange rate volatility as a measure of currency crisis, exhibits own variance asymmetry. This implies that, a positive shock in one period lags leads to a slow increase in subsequent lag levels but in a different direction. It is important to note that this variable was statistical significant at the one and five percent (see Appendix B2, page 18). This impact sent weak negative signals to the M2RESV, BDRGDP, RESV, M2RGDP and RGDPG but LINTR was resilient and remain positive. Relatively, these negative signals reduced the effect of a positive increase in economic growth to consistently increasing negative impacts over the lagged periods. This effect remains resolute for M2RGDP and BDRGDP in similar variations but with difference in the magnitude of impacts. The estimates of M2RESV considering its impact on exchange rate volatility shows that a positive change in M2RESV gives strong mix and inconsistent impact to the level of exchange rate volatility. This implies that the M2RESV monetary policy stability measure is inconsistent in stabilizing currency uncertainties via the exchange rate uncertainty link in Nigeria. The outcomes of the LINTR variable shows that an increase generated weak positive signals which lead to further inconsistencies in the levels of exchange rate uncertainty in the economy (see Appendix B2, page 19). This indicates that the interest rate policy ensures a reasonable amount of pressure on the rates of exchange that aggravates the currency situation in the economy. This result suggests that the monetary policy stabilization measure put in place to check currency crisis are weak. Also, the adjustment of the interest rate to stabilize currency crisis as a results of increase levels of uncertainties in the rate of exchange is not a suitable measure to curtail such macroeconomic difficulty for Nigeria.

Subsequently, the results of the changes in the rate of reserves, exhibited own variance asymmetry. This indicates that a positive shock increase generates weak negative inconsistent shocks in the present levels of reserves and the level of output growth weakens. Relatively, a positive shock on economic growth generates weak mix inconsistent variations in changes in reserves; degenerate the levels of actual reserves, increase the negative shock impact of exchange rate volatility and weakens the rates of interest. This suggests that the use of reserves to check fluctuations during currency crisis hampers growth. This is as a result of unstable fiscal policies guiding budget deficit impact on output growth, ill effects emanating monetary policies to drive growth and sustainable monetary policies to achieve an equitable level of international reserve. We detected that M2RESV, BDRGDP and M2RGDP variables generate positive impacts that influence the negative shock impacts of the levels of change in reserves in different variants in the economy.

The output growth variable depicts own variance asymmetry with negative shock impacts. This implies that a positive shock in one period lag will influence the subsequent levels of output growth negatively. These results were statistically significant at the one and five percent levels. The spontaneous effect from the negative shocks or output growth weakens positive shock impacts from the rates of interest and in turn generated further weak negative shock impact for output growth. Subsequently, the levels of reserves, BDGDP and M2RGDP generated further inconsistent shocks that heightened the possibility of currency crisis. The M2RESV variable positive shock signals were not strong enough to curtail the strong negative shock impacts from economic growth due to strong currency fluctuations. This suggests that the money supply reserve adjustment policy meant to drive output in currency crisis situations is not favourable.

4.2.3 Impulse Responses

To ascertain the impact of the stated shocks obtained from the VAR analysis, we consider the results of the impulse response process, with a Cholesky adjusted degree of freedom, one standard deviation innovation response at 95 percent confidence intervals (see Appendix B3, page 21). We find that exchange rate reacts strongly to self impose shocks and begin to decline in the second period. The decline witnesses a swift recovery that was consistent over the observation with positive and negative low shock variations after every two subsequent observations. Therefore, shock impacts for the changes in reverses were extremely low with quick successive negative and positive variations in the first and second periods. This shock impact was noticed to recall after every three to four period. These shocks transmit stronger impacts on the levels of growth in the economy. It distorts the levels of growth every two periods in most cases, it reveal a rebound at the third period.

Relatively, monetary policy impacts guiding changes in reserve as a result of currency crisis disclose stronger distortive shock impacts that reveal high inconsistencies every two lags. This shock impact on currency crisis as a result of exchange volatility shows weak shock variations that replicated every two quarters and they ensure weak permanent signals. Considering this shock impacts on the level of output growth, we detect that it yield strong inconsistent variations that are permanent over time. This has implication for financial sector sustainability since these policies could not curtail such strong inconsistent variations which are permanent over time.

In accordance with these views, the output growth shock impact on currency crisis indicates increasing shocks that witness a slow decline after four periods and weak persistent shocks that replicates every two periods. Output growth response to changes in reserve shows decreasing permanent shocks that increase after every two period. This shows that output growth rebounds with weak impact after every two observation and that present policies are weak to stabilize growth as a result of shocks from currency fluctuations either as a result of changes in the rate of reserves or volatility in the rates of exchange.

5. Conclusion

The study analyzes currency crisis and output growth in Nigeria. It centered on disclosing shock impacts that are generated from currency uncertainties as a results of exchange rate uncertainties and the use of reserves to reduce the effect of such anticipated shocks on economic growth. To accomplish this aim, we employed the vector autoregression (VAR) model, obtained a lag as specified by the final prediction error (FPE) and the Akaike information criterion (AIC) and examine the test of the adequacy of the specification.

The VAR estimates disclose that to control currency crisis due to volatility in the rate of exchange, it is important to define and monitor an appropriate threshold, for the levels of money supply and budget deficit in the economy. Secondly, monetary policies in association with money supply and growth, money supply and reserves and budget deficit and growth are not properly fractioned to meet the desired goal of currency crisis control. Thirdly, we disclosed that to enhance growth in currency uncertainty situations, the rate of interest has not been a functional tool to check such economic inconsistencies. Also, the BDRGDP, M2RGDP and M2RESV variables were weak. They did not enhance growth as a consequence of currency uncertainties. The results of the impulse response show that shock impacts from currency uncertainty has distorting impacts on the rates of change in reserves every three or four quarters. Economic growth was noticed to return weak after every two periods and that present policies cannot stabilize growth as a result of shocks from currency fluctuations either as a result of changes in the rate of reserves or volatility in the rates of exchange. These suggest that currency crisis due to misplaced priorities in policy implementation, hurt the financial sector and threaten output growth. Consequently, the monetary policy through the interest rate channel show signs of financial distortions that make output growth inconsistent over time.

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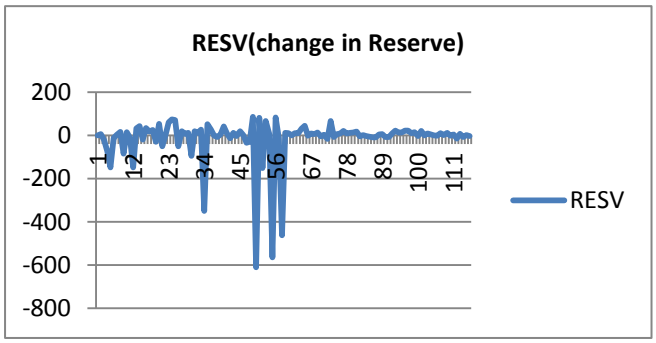
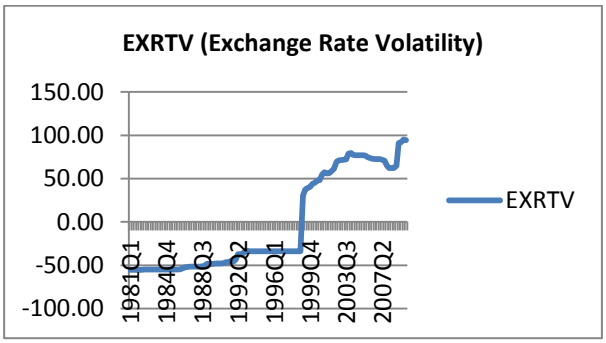
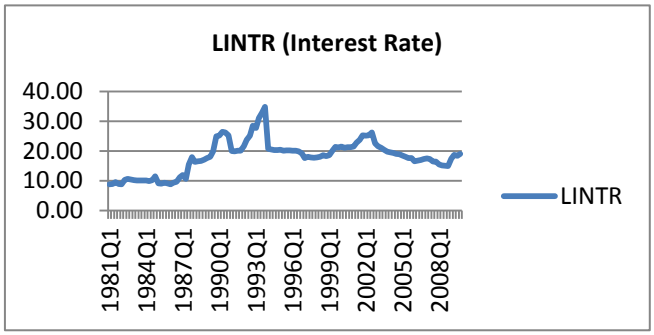
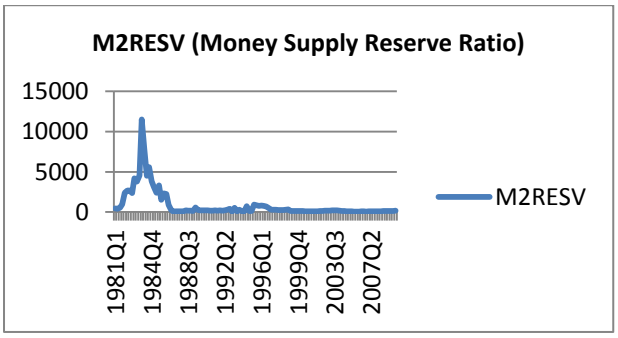
Appendix A1: Trend lines of RESV and EXRTV



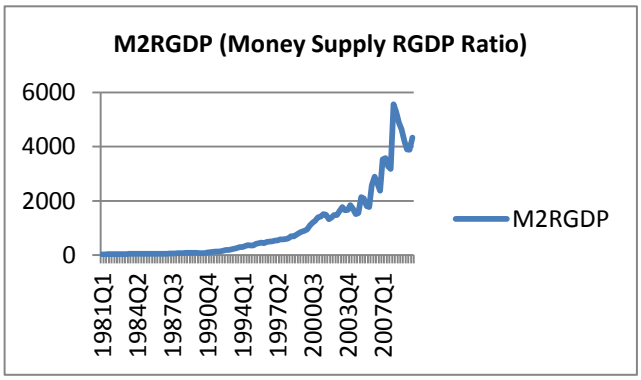


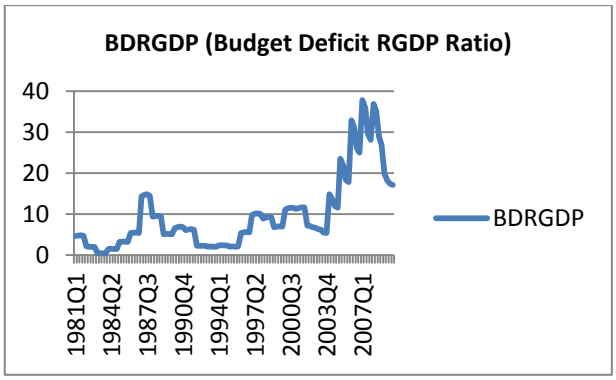
Appendix A2: Trend lines of LINTR and M2RESV



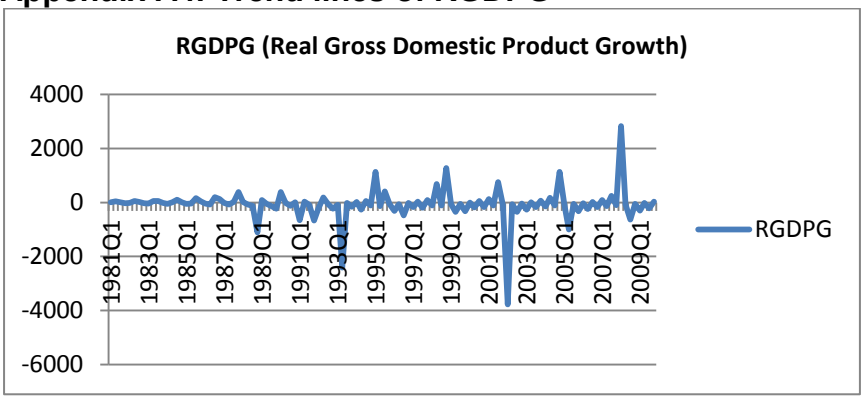


Appendix A3: Trend lines of M2RGDP and BDRGDP





Appendix A4: Trend lines of RGDPG



Appendix B1

VAR Lag Order Test

VAR Lag Order Selection Criteria
Endogenous variables: D(EXRTV,2) D(M2RESV,2) D(BDRGDP,2) D(LINTR,2) D(RESV,2) D(M2RGDP,2) D(RGDPG,2)
Exogenous variables: C
Date: 05/13/12 Time: 21:55
Sample: 1981Q1 2009Q4
Included observations: 106

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4283.396	NA	3.38e+26	80.95087	81.12676	81.02216
1	-4141.008	263.2835	5.82e+25	79.18883	80.59593	79.75913
2	-4000.287	241.6153	1.04e+25	77.45824	80.09656*	78.52757
3	-3898.946	160.6156	4.00e+24*	76.47068*	80.34021	78.03902*
4	-3850.391	70.54180*	4.27e+24	76.47908	81.57982	78.54644
5	-3818.591	42.00093	6.51e+24	76.80360	83.13555	79.36997
6	-3778.333	47.85299	8.92e+24	76.96856	84.53172	80.03395
7	-3736.947	43.72873	1.28e+25	77.11221	85.90659	80.67662
8	-3696.844	37.07666	2.09e+25	77.28008	87.30566	81.34350

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix B2

VAR results of the variables in the model at the second difference and 3rd lag

Vector Autoregression Estimates

Date: 05/13/12 Time: 22:17
Sample (adjusted): 1982Q2 2009Q4
Included observations: 111 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(EXRTV,2)	D(M2RESV,2)	D(BDRGDP,2)	D(LINTR,2)	D(RESV,2)	D(M2RGDP,2)	D(RGDPG,2)
D(EXRTV(-1),2)	-0.588405	-0.900513	-0.034093	0.030526	-0.956778	-4.908527	-11.60227
	(0.10225)	(14.0747)	(0.03563)	(0.02498)	(1.85097)	(3.46489)	(11.6543)
	[-5.75443]	[-0.06398]	[-0.95691]	[1.22188]	[-0.51691]	[-1.41665]	[-0.99553]
D(EXRTV(-2),2)	-0.445938	0.196635	-0.041511	0.020066	-1.305789	-5.764509	-3.337656
	(0.11200)	(15.4171)	(0.03903)	(0.02737)	(2.02751)	(3.79535)	(12.7659)
	[-3.98141]	[0.01275]	[-1.06365]	[0.73326]	[-0.64404]	[-1.51883]	[-0.26145]
D(EXRTV(-3),2)	-0.283503	-0.285128	-0.041122	0.000632	-0.372176	-0.462695	-4.392210
	(0.10383)	(14.2912)	(0.03618)	(0.02537)	(1.87944)	(3.51817)	(11.8336)
	[-2.73058]	[-0.01995]	[-1.13672]	[0.02490]	[-0.19802]	[-0.13152]	[-0.37116]
D(M2RESV(-1),2)	-0.000126	-0.852949	9.24E-05	-3.82E-05	0.009324	0.006198	-0.007712
	(0.00079)	(0.10843)	(0.00027)	(0.00019)	(0.01426)	(0.02669)	(0.08979)
	[-0.15972]	[-7.86619]	[0.33678]	[-0.19865]	[0.65386]	[0.23220]	[-0.08590]
D(M2RESV(-2),2)	6.97E-05	-0.759422	4.57E-05	-0.000252	0.012977	0.003010	-0.012713
	(0.00085)	(0.11686)	(0.00030)	(0.00021)	(0.01537)	(0.02877)	(0.09676)
	[0.08206]	[-6.49867]	[0.15443]	[-1.21603]	[0.84440]	[0.10463]	[-0.13139]
D(M2RESV(-3),2)	-4.09E-05	-0.179871	1.26E-05	-2.55E-06	0.013069	0.001882	0.021176
	(0.00080)	(0.10974)	(0.00028)	(0.00019)	(0.01443)	(0.02702)	(0.09087)
	[-0.05127]	[-1.63906]	[0.04551]	[-0.01308]	[0.90558]	[0.06965]	[0.23304]
D(BDRGDP(-1),2)	0.196704	-2.426632	-0.875693	-0.023819	-0.555286	-6.229986	-45.37469
	(0.28403)	(39.0951)	(0.09896)	(0.06940)	(5.14142)	(9.62436)	(32.3721)
	[0.69256]	[-0.06207]	[-8.84854]	[-0.34323]	[-0.10800]	[-0.64731]	[-1.40166]
D(BDRGDP(-2),2)	0.221302	3.681195	-0.870377	0.027188	-1.764047	-31.29701	-6.911442

	(0.33777)	(46.4935)	(0.11769)	(0.08253)	(6.11438)	(11.4457)	(38.4981)
	[0.65518]	[0.07918]	[-7.39534]	[0.32944]	[-0.28851]	[-2.73440]	[-0.17953]
D(BDRGDP(-3),2)	0.227035	-15.47401	-0.852164	0.053373	1.101831	-51.25127	7.174720
	(0.28702)	(39.5067)	(0.10001)	(0.07013)	(5.19554)	(9.72567)	(32.7129)
	[0.79102]	[-0.39168]	[-8.52109]	[0.76110]	[0.21207]	[-5.26969]	[0.21932]
D(LINTR(-1),2)	-0.184581	-1.093675	0.138680	-0.554174	13.19079	6.507693	84.59535
	(0.42017)	(57.8355)	(0.14640)	(0.10266)	(7.60597)	(14.2378)	(47.8897)
	[-0.43930]	[-0.01891]	[0.94724]	[-5.39811]	[1.73427]	[0.45707]	[1.76646]
D(LINTR(-2),2)	0.059294	-40.11988	-0.133346	-0.400344	34.31814	-10.90181	39.59645
	(0.40133)	(55.2418)	(0.13984)	(0.09806)	(7.26488)	(13.5993)	(45.7421)
	[0.14774]	[-0.72626]	[-0.95358]	[-4.08277]	[4.72384]	[-0.80164]	[0.86565]
D(LINTR(-3),2)	0.268093	1.156114	-0.052713	-0.209176	12.33103	-3.195033	45.63527
	(0.37421)	(51.5091)	(0.13039)	(0.09143)	(6.77398)	(12.6804)	(42.6512)
	[0.71642]	[0.02244]	[-0.40427]	[-2.28780]	[1.82035]	[-0.25197]	[1.06996]
D(RESV(-1),2)	-0.006157	0.365066	0.001660	-0.000242	-1.406629	0.090187	-0.123143
	(0.00589)	(0.81142)	(0.00205)	(0.00144)	(0.10671)	(0.19975)	(0.67188)
	[-1.04439]	[0.44991]	[0.80799]	[-0.16793]	[-13.1818]	[0.45149]	[-0.18328]
D(RESV(-2),2)	-0.003873	0.295656	0.002747	-0.003818	-1.134871	0.148811	-0.358927
	(0.00743)	(1.02326)	(0.00259)	(0.00182)	(0.13457)	(0.25190)	(0.84730)
	[-0.52095]	[0.28894]	[1.06065]	[-2.10176]	[-8.43333]	[0.59075]	[-0.42362]
D(RESV(-3),2)	-0.002594	0.187636	0.001872	-0.000219	-0.420715	0.066778	0.190439
	(0.00602)	(0.82893)	(0.00210)	(0.00147)	(0.10901)	(0.20406)	(0.68638)
	[-0.43066]	[0.22636]	[0.89236]	[-0.14879]	[-3.85933]	[0.32724]	[0.27746]
D(M2RGDP(-1),2)	-0.005500	-0.029369	0.000609	-5.69E-05	0.015684	-0.772521	-0.273210
	(0.00334)	(0.45906)	(0.00116)	(0.00081)	(0.06037)	(0.11301)	(0.38012)
	[-1.64918]	[-0.06398]	[0.52365]	[-0.06983]	[0.25979]	[-6.83578]	[-0.71875]
D(M2RGDP(-2),2)	-0.003344	-0.013774	8.90E-05	-0.000291	0.001214	-0.514485	-0.916106
	(0.00395)	(0.54373)	(0.00138)	(0.00097)	(0.07151)	(0.13385)	(0.45023)
	[-0.84666]	[-0.02533]	[0.06469]	[-0.30150]	[0.01698]	[-3.84361]	[-2.03476]
D(M2RGDP(-3),2)	-0.006516	0.110638	0.001995	-0.001369	-0.019231	-0.245608	-0.897214
	(0.00335)	(0.46108)	(0.00117)	(0.00082)	(0.06064)	(0.11351)	(0.38179)
	[-1.94515]	[0.23995]	[1.70931]	[-1.67312]	[-0.31715]	[-2.16382]	[-2.35004]
D(RGDPG(-1),2)	0.001484	0.034353	0.000155	-0.000211	-0.016110	-0.022679	-1.194313
	(0.00094)	(0.12925)	(0.00033)	(0.00023)	(0.01700)	(0.03182)	(0.10702)

	[1.58072]	[0.26579]	[0.47456]	[-0.92143]	[-0.94775]	[-0.71275]	[-11.1594]
D(RGDPG(-2),2)	-0.000645	0.026515	0.000613	-0.000726	0.002202	0.006929	-0.794544
	(0.00122)	(0.16833)	(0.00043)	(0.00030)	(0.02214)	(0.04144)	(0.13938)
	[-0.52741]	[0.15752]	[1.43857]	[-2.42852]	[0.09947]	[0.16721]	[-5.70059]
D(RGDPG(-3),2)	-0.000532	0.015186	0.000737	-0.000231	0.008457	0.055638	-0.254352
	(0.00094)	(0.12955)	(0.00033)	(0.00023)	(0.01704)	(0.03189)	(0.10727)
	[-0.56504]	[0.11723]	[2.24696]	[-1.00251]	[0.49640]	[1.74462]	[-2.37119]
C	0.062486	-17.02524	-0.032322	0.012390	1.209835	-1.826220	-4.091199
	(0.72645)	(99.9928)	(0.25312)	(0.17749)	(13.1501)	(24.6160)	(82.7974)
	[0.08602]	[-0.17026]	[-0.12770]	[0.06981]	[0.09200]	[-0.07419]	[-0.04941]
R-squared	0.428142	0.553654	0.726762	0.579327	0.805839	0.696340	0.717260
Adj. R-squared	0.293209	0.448337	0.662290	0.480067	0.760026	0.624690	0.650546
Sum sq. resids	5204.016	98598438	631.8075	310.6631	1705260.	5975413.	67602935
S.E. equation	7.646704	1052.543	2.664388	1.868314	138.4204	259.1129	871.5409
F-statistic	3.173002	5.256999	11.27252	5.836462	17.58967	9.718610	10.75128
Log likelihood	-371.0471	-917.6877	-254.0197	-214.6216	-692.5054	-762.0988	-896.7417
Akaike AIC	7.081929	16.93131	4.973328	4.263452	12.87397	14.12791	16.55391
Schwarz SC	7.618953	17.46833	5.510352	4.800476	13.41100	14.66493	17.09093
Mean dependent	-0.008627	-12.47699	0.020811	0.006126	0.636439	4.052903	2.043540
S.D. dependent	9.095548	1417.108	4.584850	2.591052	282.5649	422.9546	1474.324

Determinant resid covariance (dof adj.)	7.88E+23
Determinant resid covariance	1.68E+23
Log likelihood	-4070.503
Akaike information criterion	76.11718
Schwarz criterion	79.87634

Appendix B3

Impulse Responses results of the variables in the model at the second difference and 3rd lag