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Abstract

The study employed the GARCH (1, 1) and VAR models to ascertain the relationship between volatilities in the monetary policy variables and volatilities in the stock market returns in Nigeria between 1980 and 2010.The study showed that only exchange rate policy variable have an influence on the stock market volatility with a negative coefficient but statistically significant indicating that higher volatility in the exchange rate dampens stock market activities. This means that an increase in exchange volatility will lead to a fall in stock market volatility. Additionally, result showed that M1granger causes very significantly M2 and vice versa. Implicitly, it shows that there is "bi-directional causality" or a "bi-directional feedback" between M1 andM2.What this implies is that stabilizing interest rate will reduce the volatility in the stock market. The study also observed that there is no effect of international factor and influence on the stock market returns implying that international volatilities is not transmitted across national stock markets in Nigeria. Finally, there is the presence of volatility shocks. The study therefore suggested that government policy should focus on exchange rate to stabilize the stock market. Investors are also advised to consider the nature of volatility in exchange rate before making investment decisions.

Keywords: Monetary policy volatility, stock market volatility, GARCH (1, 1), VAR

Introduction

Financial literature is awash with researches dealing on stock market returns and monetary policy. Despite this, scholars have continued the search for variables that affect stock returns and their volatility. The growing globalization of financial markets and adoption of more flexible monetary and exchange regimes may explain the extensive search on the linkages between stock market behavior and monetary policy. Also the recent global financial turmoil must have been an added impetus because it is assumed that global transmission of stock prices can have an impact in the real economy even in remote countries. The importance of the stock market in any economy can be seen in its vital role in assessing economic conditions. The stock market basically serves a vital role of mobilizing individual resources and channeling same to investors. Performing this role can cause volatility in stock prices thereby affecting the performance of the financial sector and of course the entire economy. Volatility measures the intensity of unpredictable changes in assets return by determining security prices. Investors and agents normally perceive this variation as a measure of risk. Market estimate of volatility is used by policy makers as a tool to measure vulnerability of the stock market. Given the importance of volatility in financial theory it becomes very essential to understand the behavior and nature of stock market volatility.

Monetary policy on the other land is anchored on a monetary targeting framework, and price stability represents the overriding objective of monetary policy. The trust of price stability is derived from the overwhelming empirical evidence that sustainable growth cannot be achieved in the midst of price volatility. It is therefore of great concern to policy makers that monetary policy permeates deeply into the real sector to promote economic growth. This therefore calls for an investigation into the link between monetary policies variables and the stock market. Studying this link is an ongoing exercise of monetary economists. The researcher therefore tries to apply the similar kind of experiment in Nigerian capital market which commenced operation in 1980. Research on such linkages remains relatively an unexplored area for developing and emerging markets while a lot of studies on this issue have been done for developed markets. Pertinent questions this study will address is finding the extent the explanatory power of monetary policy variables can explain the stock market volatility, and secondly the extent the volatility in the international monetary policy can be transmitted across national stock markets. That is the purpose of this paper.

The reminder of the work is planned thus. Section 2 discuses the theoretical framework. Section 3 reviews the literature; section 4 deals with the research methodology while Section 5 discuses the results and interpret. Section 6 finally summarizes and concludes.

Theoritical Framework

Most literature focus on three theoretical paradigm namely the Arbitrage Pricing Theory (APT) developed by Ross (1976), the Capital Asset Pricing Model (CAPM), and the Simple Discount Present Value Model (SDPVM) to explain the relationship between stock market volatility and macroeconomic volatility. The Arbitrage Pricing Theory (APT) is based on the law of one price we states that two otherwise identical assets cannot sell at different prices. It assumes that assets return are linearly related to a set of indexes, each representing a factor that influences the return of an asset. Asset returns are randomly generated according to an n-factor model.

$$R_i=E(R_t)+\beta i_1\partial_1+\beta_{i2}\partial_2+\ldots.+\beta_{in}\partial_n+e_i \qquad (1)$$

Where R_i is the actual (random) rate of return on asset *i* in any given period, *E(R)* is the expected return on asset *i*, ∂_n is a common factor with a zero mean that influences the returns on all assets, β_{in} is sensitivity of asset *i* to factor *n*, and e_i is random error term, unique to asset *i*. The suggestion from ATP literature is that macroeconomic variables can proxy for pervasive risk factors and that multiple risks factors can explain asset returns (see Burmeister and McElroy (1988), Priestly (1996) Kryzanowski et al (1997)). The sensitivity measure β_{in} in ATP has similar interpretation as β_i in Capital Asset Pricing Model (CAPM). They are measures of the relative sensitivity of an asset's return to a particular risk factor. The Capital Asset Pricing Model (CAPM) theory, on the other hand is also a useful tool in explaining the magnitude of an asset's risk premium which is the difference between the asset's expected return and the risk-free interest rate (Mishkin and Eakins, (1977). It means that the model has only one explanatory variable, market premium. Although the capital asset pricing model is a useful tool for explaining the source of a systematic risk it only focuses on the source of risk available in the market portfolio. Lastly, the Simple Discount Present Value Model (SDPVM) is yet another tool for explaining the relationship between the stock market volatility and economic volatility. It states that stock prices are determined by the future cash flow to the firms and the discounted rates. The premise is that volatilities in two factors could be affected by volatility in macroeconomic variables which in turn affect the stock market volatility (Liljeblom and Stenius, 1997; Ibrahim, 2002; Ibrahim and Jusoh 2001; and Md. Isa 1989). The import of this is that a change in the level of uncertainty about future macroeconomic conditions would possibly result in a proportionate change in stock return volatility on the assumption of a constant discount rate.

Review of Literature

Several researchers have investigated this linkage between monetary policy and stock market though with varying results. For example, on the causes of volatility, Officer (1973) examined the effects of volatility in business circle variables. Black (1976) and Christie (1982) relate stock market volatility to financial leverage. Poterba and Summers (1986) investigated the relationship between stock market volatility and volatility of expected returns. Schwert (1989), on his own part conducted an extensive array of tests on the macroeconomic causes of stock market volatility over long runs of monthly data for United States economy. The issue of whether the world's financial and capital markets are now transmitting volatility more quickly has been examined by Koch and Koch (1991), Malliaris and Urrutia (1992) , Chan et al (1992) and Rahman and Yung (1994). Thorbecke (1997) examined the relation between monetary policy and stock returns. He showed that expansionary monetary policy increases stock returns. Booth and Booth (1997) using federal funds rate and discount rate have confirmed this result. They showed that a restrictive monetary policy stance lowers monthly results of both large and small stock portfolio. They concluded that monetary policy has expansionary power in forecasting stock portfolio returns. Patelis (1998) confirmed these findings by estimating a VAR model to study the impact of the Federal Reserve monetary policy on US markets. Rizwan and Khan (2007) examined the role of macroeconomic variables and global factors on the volatility of the stock returns. Mohd et al (2007) explored the extent to which the conditional volatilities of both conventional and Islamic stock markets in Malaysia are related to the conditional volatility of monetary policies variables.

In Nigeria, our literature search revealed that Soyode (1993) was the first to test the relationship between stock prices and macroeconomic variables. He implored dataset like exchange rate, inflation, interest rates in Nigeria and observed that these macroeconomic variables are statistically associated with the aggregate stock price. The study therefore concluded that the macroeconomic variables significantly explained stock market behavior in Nigeria. Emenuga (1996) in his paper x-rayed the role of macroeconomic variables in estimating stock prices and observed that all the macroeconomic factors (exchange rate, money supply, changes in the rate of inflation, expected rate of inflation and the unexpected rate of inflation are not significantly different from zero. This means that none of these economic variables is important in explaining stock performance in Nigeria. Nwokoma (2002) improving on previous studies in Nigeria conducted unit root and co-integration test. He used macroeconomic policy and stock market performance from 1988-2002. Results from the study revealed that only industrial production and the level of interest rates seem to have long run relationship with the stock market. Osuagwu (2009) using ordinary least squares, co-integration and error- correction specification, he estimated a linear combination of stock market index and monetary policy variables to determine the impact of monetary policy variables on the performance of the stock market in Nigeria for a twenty four years (1984-2007) quarterly data. Monetary policies aggregates employed include broad money (M2), exchange rate, consumer price index, minimum rediscount rate, interest rate.

Observations from the reviewed studies revealed that there is agreement on the existence of volatility in the stock market, but conflicting results abound on the right variables that significantly cause this volatility, hence the continued search for the linkage. This paper therefore adds to the search for this linkage. The novelty of this paper is the inclusion of an international factor such as the United States monetary policy variable measured by the Federal Funds Rate (FFR) which is the rate at which depository institutions borrow and lend reserves to and from each other overnight. This is included to ascertain the international influence of stock markets in Nigeria. No other study in Nigeria to the best knowledge of the author has incorporated this factor. It therefore aims to fill this gap by testing the statistical effects of the monetary policy variables in controlling stock market volatility in Nigeria. Moreover most of the studies in Nigeria did not examine the volatility per se but used just the macroeconomic variables.

Research Methodology

Yearly data for the period 1980 – 2010 was utilized for the study. The dataset is obtained from several issues of the Central Bank of Nigeria 'Annual Report' and the 'Factbook' of the Nigeria Stock Exchange. The data consists of Nigeria All-Share Index (ASI) which stands as the measure of stock market; the two measures of money-the narrow money (M1) and broad money (M2), Interest Rate (INT), and Exchange Rate (EX-R), which represent monetary policy variables for the study. Industrial Production Index (IPI) which is used as a proxy for real output, and Federal Funds Rate (FFR) which reflects an international factor, are also used for the study.

The GARCH (1, 1) and VAR models were adopted to estimate stock market volatility and monetary policy volatility. The predictive power of monetary policy volatility on stock market volatility and vice versa will be determined by the VAR model. The GARCH (1, 1) and VAR models require that the variables used for the study are stationary. The data was therefore subjected to the Dickey-Fuller 'Unit Root' test for stationarity.The study therefore generates the volatility estimates for stock returns and monetary policy variables growth rates based on the following standard GARCH (1, 1) model using M1:

$$\Delta(ASI_t) = \alpha_0 + \alpha_1 \Delta(\log M1_t) + \alpha_2 \Delta(IPI_t) + \alpha_3 \Delta(EX\_R_t) + \alpha_4 \Delta(INT_t) + \alpha_5 FFR_t + U_t; \quad t = 1, 2, ..., 31 \tag{1}$$

$$\sigma^2_{1t} = \alpha_{10} + \alpha_{11} U^2_{1t-1} + \beta_1 \sigma^2_{1t-2} \tag{2}$$

Then, using M2:

$$\Delta(ASI_t) = \delta_0 + \delta_1 \Delta(\log M2_t) + \delta_2 \Delta(IPI_t) + \delta_3 \Delta(EX\_R_t) + \delta_4 \Delta(INT_t) + \delta_5 FFR_t + e_t; \quad t = 1, 2, ..., 31 \tag{3}$$

$$\sigma^2_{2t} = \delta_{10} + \delta_{11} e^2_{1t-1} + \beta_2 \sigma^2_{2t-2} \tag{4}$$

The VAR model is estimated using ASI, M1 and M2 in the following equation:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 Y_{t-3} + \beta_4 Y_{t-4} + \beta_5 Y_{t-5} + U_t \tag{5}$$

Where:

$$Y_t = \begin{bmatrix} ASI_t \\ M1_t \\ M2_t \end{bmatrix}; \quad \beta_0 = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix}; \beta_1 = \begin{bmatrix} \beta_{11} & \alpha_{11} & \delta_{11} \\ \alpha_{21} & \beta_{21} & \delta_{21} \\ \alpha_{31} & \delta_{31} & \beta_{31} \end{bmatrix}; \beta_2 = \begin{bmatrix} \beta_{12} & \alpha_{12} & \delta_{12} \\ \alpha_{22} & \beta_{22} & \delta_{22} \\ \alpha_{32} & \delta_{32} & \beta_{32} \end{bmatrix}$$

$$\beta_3 = \begin{bmatrix} \beta_{13} & \alpha_{13} & \delta_{13} \\ \alpha_{23} & \beta_{23} & \delta_{23} \\ \alpha_{33} & \delta_{33} & \beta_{33} \end{bmatrix}; \beta_4 = \begin{bmatrix} \beta_{14} & \alpha_{14} & \delta_{14} \\ \alpha_{24} & \beta_{24} & \delta_{24} \\ \alpha_{34} & \delta_{34} & \beta_{34} \end{bmatrix};$$

$$\beta_5 = \begin{bmatrix} \beta_{15} & \alpha_{15} & \delta_{15} \\ \alpha_{25} & \beta_{25} & \delta_{25} \\ \alpha_{35} & \delta_{35} & \beta_{35} \end{bmatrix}; U_t = \begin{bmatrix} U_{1t} \\ U_{2t} \\ U_{3t} \end{bmatrix}$$

The lag length was chosen using the Information Criteria Method (Brooks, 2008:294).

Stationary Test

Stationary test was carried out on the variables. In applying the Augmented Dickey-Fuller (ADF) test to the variables, FFR was found to be stationary at level. However, IPI, ASI, EXR, and INT were all non-stationary. But they attained stationarity after the first differencing. We discover that M1 and M2 are still non-stationary even after taking their first differences. Subsequent differences did not improve the situation. We therefore conducted the unit root tests on log (M1) and log (M2). The result showed that log (M1) and log (M2) are non-stationary; but their first differences are. Regression could now be run without any spurious results. This is therefore, how equations (1) and (3) were arrived at.

Interpretation of Results

GARCH (1,1) and VAR were the main models for the study. In other to determine the nature of stock market volatility and monetary policy volatility, a GARCH (1.1) was employed to estimate the mean and conditional variance of these variables. Also the predictive power of monetary policy volatility on stock market volatility and vice versa was determined using the VAR model. The results are presented on tables 2 and 3, while that of VAR is on table 4.

Using GARCH (1,1) the results shown in Table 2 indicated that in the mean equation, it is only Exchange Rate (EX-R) that is significant with a negative coefficient indicating that higher volatility dampens stock market activities. This means that an increase in exchange rate volatility will lead to a fall in stock market volatility. In the variance equation, it is also only the GARCH coefficient that is significant even at 1% level of significance. The estimates of the ARCH and GARCH coefficients are also positive which agrees with the assumptions of the model since ‘variance’ can never be negative. But the ARCH and GARCH coefficients sum up to less one which also is in accordance with the GARCH model and it implies that the shocks to the conditional variance will be highly persistent. The above results show the outcome of the estimation of Model 1 where M1 was introduced as seen in Equation 1 and 2.

In Table 3, the results show that in the mean equation (equation 3) none of the predictors of the stock market is significant when broad money (M2) is used as one of the predictors. However, the coefficients on both the lagged squared residual and lagged conditional variance terms in the conditional variance equation (equation 4) are highly statistically significant. These coefficients are also positive which implies that the conditions of the model are met. Moreover, the sum of these coefficients, like in Table 2, is approximately unity which also implies that the shocks to the conditional variance will be highly persistent. In both Tables 2 and 3, the Durbin-Watson statistic is approximately 2 implying that the errors in the models are not autocorrelated.

Coming to the VAR results, before the VAR analyses were conducted, a test to find out the number of lags to use in the VAR model was carried out. The result showed that five lags were appropriate for the model which is shown in equation 5.The results of the VAR analyses are shown in Tables 3 and 4.

In a VAR model, it is usually difficult to see which sets of variables have significant effects on each dependent variable and which do not. In order to address this issue, tests are carried out that restrict all of the lags of a particular variable to zero (Brooks, 2008:297). In this study, such tests will answer such questions as:

(a) Do lags of ASI_t explain current $M1_t$?
(b) Do lags of ASI_t explain current $M2_t$?
(c) Do lags of $M1_t$ explain current ASI_t?
(d) Do lags of $M1_t$ explain current $M2_t$?
(e) Do lags of $M2_t$ explain current ASI_t?
(f) Do lags of $M2_t$ explain current $M1_t$?

The answers to these questions are usually answered by carrying out the following Granger-Causality tests as shown in table 5. The result of the analysis shows that M1 granger-causes very significantly M2 and vice versa. This therefore shows that there is a "bi-directional causality" or "bi-directional feedback" between M1 and M2.

Summary and Conclusion

This study aimed at establishing a link between the monetary policy volatilities with the volatility of stock returns in the stock markets in Nigeria from 1980-2010 using annual data. The dataset utilized include All-share index, narrow money, broad money, interest rate, exchange rate, industrial production index, and Federal Funds Rate. The link of monetary policies volatility to stock returns volatility in Nigeria stock market is examined using GARCH (1,1) and VAR models. The GARCH model shows that in the presence of M1 only the Exchange Rate (EX-R) affects the stock market prices in the conditional mean equation. The coefficient of the lagged conditional variance in the conditional variance equation is highly significant.

In the presence of M2 none of the predictors affect the stock market prices in the Conditional Mean equation. The coefficients on both the lagged squared residual and lagged conditional variance terms in the conditional variance equation are highly statistically significant.
The VAR model shows that there is a "bi-directional causality" between M1 and M2. In equations (1) and (3), we observe that there is no effect of the international factor and influence (FFR) on the stock returns.

The results of the study provided some important policy implications. The study has been able to draw out the fact that exchange rate is the only factor that affects the stock market. It then appears to be the target for the government to affect stock market in Nigeria during the period of analysis. In other words government policy should focus on exchange rate to stabilize the stock market. Stabilizing the exchange rate will reduce volatility in the stock market in Nigeria. There is the persistence of shocks in the conditional variance. The presence of the volatility shocks of the exchange rate on stock returns also gives an indication that changes in the trade-off between risk and return is predictable thus serving as a useful guide for risk management.

Table-1: ADF Stationarity tests for the variable

Variables	Level	1st Difference	Log
ASI	-1.490348	-2.775757***	-
IPI	-1.889722	-6.065662*[3]	-
EX-R	-1.901623	-4.803082**	-
INT	-2.613758	-6.491066*[3]	-
FFR	-5.460687**	-	
M1	-2.022432	-	-3.591064*
M2			-3.411707*

Note: * Stationary at 1%
** Stationary at 5%
*** Stationary at 10%
*[4] Stationary at both 1% and 5%
*[3] Stationary at 1%, 5%, and 10%

Table-2: Dependent Variable: D(ASI)
Method: ML - ARCH (BHHH) - Normal distribution
Date: 03/27/12 Time: 06:49
Sample (adjusted): 7 31
Included observations: 25 after adjustments
Failure to improve Likelihood after 7 iterations
Variance backcast: ON

GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)				
	Coefficient	Std. Error	z-Statistic	Prob.
C	643.2134	3289.112	0.195558	0.8450
D(LOG(M1))	-1214.183	4423.958	-0.274456	0.7837
D(IPI)	-55.91884	105.3258	-0.530913	0.5955
D(EX-R)	-95.78019	36.74871	-2.606355	0.0092
D(INT)	-290.3503	230.5803	-1.259215	0.2080
FFR	234.4823	433.6570	0.540709	0.5887
	Variance Equation			
C	-1259263.	430120.8	-2.927697	0.0034
RESID(-1)^2	0.293380	0.161169	1.820326	0.0687
GARCH(-1)	1.107968	0.042053	26.34719	0.0000

R-squared	0.036462	Mean dependent var	824.1332
Adjusted R-squared	-0.445307	S.D. dependent var	8183.763
S.E. of regression	9838.594	Akaike info criterion	20.40055
Sum squared resid	1.55E+09	Schwarz criterion	20.83935
Log likelihood	-246.0069	F-statistic	0.075684
Durbin-Watson stat	2.249442	Prob(F-statistic)	0.999526

Table-3: Dependent Variable: D(ASI)
Method: ML - ARCH (BHHH) - Normal distribution
Date: 03/27/12 Time: 06:55
Sample (adjusted): 7 31
Included observations: 25 after adjustments
Failure to improve Likelihood after 8 iterations
Variance backcast: ON
GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	525.4629	2337.369	0.224810	0.8221
D(LOG(M2))	-908.5979	7276.936	-0.124860	0.9006
D(IPI)	-20.83245	91.07616	-0.228737	0.8191
D(EX-R)	-111.1462	81.11952	-1.370154	0.1706
D(INT)	-233.7154	285.5472	-0.818483	0.4131
FFR	377.5447	229.8764	1.642381	0.1005
	Variance Equation			
C	-2202036.	573889.5	-3.837038	0.0001
RESID(-1)^2	0.345984	0.030776	11.24194	0.0000
GARCH(-1)	1.021202	0.170243	5.998499	0.0000
R-squared	0.050638	Mean dependent var		824.1332
Adjusted R-squared	-0.424043	S.D. dependent var		8183.763
S.E. of regression	9765.953	Akaike info criterion		20.61653
Sum squared resid	1.53E+09	Schwarz criterion		21.05533
Log likelihood	-248.7067	F-statistic		0.106678
Durbin-Watson stat	2.233810	Prob(F-statistic)		0.998373

Table-4

Vector Autoregression Estimates
Date: 03/27/12 Time: 07:25
Sample (adjusted): 12 31
Included observations: 20 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(ASI)	D(LOG(M1))	D(LOG(M2))
D(ASI(-1))	-0.466891	1.96E-07	1.74E-06
	(0.83099)	(4.9E-06)	(3.8E-06)
	[-0.56185]	[0.04000]	[0.45402]
D(ASI(-2))	0.509479	-1.99E-06	3.31E-06
	(0.69422)	(4.1E-06)	(3.2E-06)
	[0.73389]	[-0.48505]	[1.03388]
D(ASI(-3))	-1.213934	-9.40E-06	-1.73E-08

	(1.73737)	(1.0E-05)	(8.0E-06)
	[-0.69872]	[-0.91782]	[-0.00216]
D(ASI(-4))	5.576666	5.36E-06	7.56E-06
	(4.89566)	(2.9E-05)	(2.3E-05)
	[1.13910]	[0.18558]	[0.33462]
D(ASI(-5))	-4.934430	2.89E-06	-2.40E-07
	(3.16174)	(1.9E-05)	(1.5E-05)
	[-1.56067]	[0.15528]	[-0.01645]
D(LOG(M1(-1)))	98644.66	-0.664393	-0.260024
	(133834.)	(0.78898)	(0.61776)
	[0.73707]	[-0.84209]	[-0.42091]
D(LOG(M1(-2)))	-62715.28	-0.311374	-0.060761
	(89704.5)	(0.52883)	(0.41406)
	[-0.69913]	[-0.58880]	[-0.14674]
D(LOG(M1(-3)))	47274.09	1.477231	1.151744
	(92862.5)	(0.54745)	(0.42864)
	[0.50908]	[2.69840]	[2.68697]
D(LOG(M1(-4)))	-41252.49	0.521809	0.567479
	(77088.4)	(0.45445)	(0.35583)
	[-0.53513]	[1.14821]	[1.59480]
D(LOG(M1(-5)))	20957.59	0.885756	0.661370
	(68707.2)	(0.40504)	(0.31714)
	[0.30503]	[2.18681]	[2.08540]
D(LOG(M2(-1)))	-149130.2	0.573710	0.166644
	(211133.)	(1.24468)	(0.97456)
	[-0.70633]	[0.46093]	[0.17099]
D(LOG(M2(-2)))	62698.87	0.368052	0.084979
	(101517.)	(0.59847)	(0.46859)
	[0.61762]	[0.61499]	[0.18135]
D(LOG(M2(-3)))	-43002.23	-1.770309	-1.459850
	(83913.7)	(0.49469)	(0.38733)
	[-0.51246]	[-3.57862]	[-3.76896]
D(LOG(M2(-4)))	10672.66	-1.152284	-1.254697
	(89896.3)	(0.52996)	(0.41495)
	[0.11872]	[-2.17429]	[-3.02373]
D(LOG(M2(-5)))	-60566.52	-1.300021	-1.029422
	(123700.)	(0.72924)	(0.57098)
	[-0.48962]	[-1.78271]	[-1.80289]
C	31425.22	0.570807	0.569465
	(37560.7)	(0.22143)	(0.17338)
	[0.83665]	[2.57783]	[3.28458]

R-squared	0.682860	0.950988	0.956891
Adj. R-squared	-0.506414	0.767192	0.795231
Sum sq. resids	5.09E+08	0.017678	0.010837
S.E. equation	11276.65	0.066479	0.052052
F-statistic	0.574182	5.174166	5.919154
Log likelihood	-198.8942	41.93314	46.82602
Akaike AIC	21.48942	-2.593314	-3.082602
Schwarz SC	22.28600	-1.796728	-2.286016
Mean dependent	1010.842	0.242520	0.253981
S.D. dependent	9187.725	0.137779	0.115027
Determinant resid covariance (dof adj.)		202.2084	
Determinant resid covariance		1.617667	
Log likelihood		-89.94616	
Akaike information criterion		13.79462	
Schwarz criterion		16.18437	

Table-5

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 03/27/12 Time: 07:29
Sample: 1 31
Included observations: 20

Dependent variable: D(ASI)			
Excluded	Chi-sq	Df	Prob.
D(LOG(M1))	0.956387	5	0.9660
D(LOG(M2))	0.700301	5	0.9830
All	1.952473	10	0.9967
Dependent variable: D(LOG(M1))			
Excluded	Chi-sq	Df	Prob.
D(ASI)	4.265002	5	0.5119
D(LOG(M2))	30.26448	5	0.0000
All	58.80864	10	0.0000
Dependent variable: D(LOG(M2))			
Excluded	Chi-sq	Df	Prob.
D(ASI)	4.354943	5	0.4995
D(LOG(M1))	19.69068	5	0.0014
All	28.51082	10	0.0015

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