Has the Change in Central Bank Autonomy Legislation Altered the Monetary Transmission Channels in Nigeria?

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Abstract: The transmission process has been observed to vary over different economies of different financial structure and Central Bank autonomy. This study examines the various monetary transmission channels in Nigeria; brief allusion is 1998 CBN Act as a source of changes in the channels. The study then goes ahead to compare the transmission process in the period when the 1991 CBN Act is operational and the period when the 1998 CBN Act is implemented, the latter period been the one when the bank has higher autonomy. Preliminary analysis shows a rising trend for all variables but interest rate and net export. The results of the VAR analysis and variance decomposition tests show that there is no significant change in the monetary transmission channels between the two periods. The major channel identified is the credit channel and although this channel becomes stronger in the second period, researchers cannot statistically distinguish the process of monetary transmission based on the autonomy granted the Central Bank of Nigeria.

Key words: Central Bank autonomy, monetary transmission mechanism, channel, economic variables, interest rate, Nigeria

INTRODUCTION

While the battle for superiority between the Keynesians and their age long opponent in the field of economics, the Monetarists remains partially resolved due to restricted information available to the past and present generations of economists, some facts had been laid to rest. One of such issues is the fact that monetary policy affects the real economic variables and in fact, goes a long way in determining their magnitude, at least in the short run. This is why, Mishkin (1995, 1996) succinctly states that both economists and politicians have been heard to advocate in recent years that the stabilization of output and inflation be left to monetary policy.

According to him, monetary policy is now at the centre stage in discussions about how to promote sustainable growth and low inflation in the economy. Fiscal policy has lost its luster since its heydays in the 1960s, partly because of concern over persistently large budget deficits and partly because of doubts that the political system can make tax spending decisions in a timely way to achieve desirable stabilization outcomes. Meanwhile, monetary policy has been ever more at the centre of macroeconomic policymaking. Long before this statement, Mann (1969) concluded based on his observations on empirical studies that money matters in handling macroeconomic problems and that financial variables play importants role in the economy. Monetary policy involves credit and financial policies used in changing money supply and/or interest rate so as to regulate or modify the economic affairs of a country in keeping with certain objectives. Like other broad macroeconomic policies, the sector non-specific feature of monetary policy implies that it can affect several sectors of the economy in varying directions and magnitude. Given the dynamic complexity of the contemporary economies; knowledge of the channels and outcomes of monetary policy change is necessary (BIS, 1998). In other words, the abilities to characterize these channels and outcomes give impetus to the formulation of appropiate relevant monetary policy, understand the likely channels of operation, determine the optimal magnitude of policy change and effective coordination of these channels to achieve desired objectives.

Several channels through which monetary policy permeates the economy have been identified and established in the literature (Mishkin, 1995). Also identified is the fact that monetary transmission mechanism depends among others on changes in the structure of an economy, future policy expectation, objective and independence of the Central Bank (BIS, 1998). Uncertainty about monetary transmission mechanic may make way for misapplication of monetary policy thereby ultimately leading to the notion of

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multiplication of uncertainty (Brainard, 1967). The idea that a complete story of the monetary transmission mechanism should include a description of the central banks' policy rules (Taylor, 1995) is plausible as this allows us to examine the efficiency of policy regimes. It should be recalled that the Central Bank of Nigeria, CBN (Amendment) Decree No. 37 of 1998 and Banks and other Financial Institution, BOFI (Amendment) Decree No. 38 of 1998 allows the CBN more autonomy than ever before in carrying out its operations. This law amendment was necessitated given the large macroeconomic instability witnessed under the former CBN Decree No. 24 of 1991 (Ojo, 1999; CBN, 1999).

There is a growing body of literature trying to validate the hypothesis that Central Bank's autonomy engenders macroeconomic stability (Pollard, 1993). In other words if Central Bank autonomy has the potential of changing the macroeconomic stability structure and monetary policy instrument is in the hands of the Central Bank (Ojo, 1999), it may then imply that the channels through which monetary policy transmits to other sectors of the economy are altered.

From the foregoing, this research sets out to identify the monetary transmission channels in Nigeria and examine if and how higher independence of the CBN has any impact on the channels. There is the need to carry out the research because other researches in this direction do not explicitly document the effect of policy change on monetary channels. The approach in this study differs from previous researches in that researchers consider the impact of a change in policy directed at CBN as against a policy change like Structural Adjustment Programme (SAP) which is general.

Background to the study: In this background, researchers examine issues like monetary policy, exchange rate policy and laws guiding the operations of the Central Bank of Nigeria. Researchers also discuss the effect of these factors on the behaviour of some monetary variables over time.

Monetary policy in Nigeria: Monetary policy involves the use of interest rates or controls on the money supply to influence the economy in terms of desired level or rate of growth in real activity, the price level, the exchange rate or the balance of payments (Black, 2002). Monetary policy in Nigeria is the prerogative of Central Bank of Nigeria (CBN) and it does so through its annual memorandum having analysed the current economic situations and projecting into the future (Nnanna, 2002). In the pre-SAP era (before 1986), direct monetary instruments like fixed interest and exchange rates, credit ceilings selective credit controls and special deposits were mainly used by the

monetary authority (Odusola and Akinlo, 2001). As time went on, it became evident that the CBN could not sustain its objective of maintaining internal and external balance due to these facts among others:

- Implementation of credit ceilings became less effective
- Fixed interest rates were low and therefore this encourages monetary expansion and also stunted private savings
- Fixed exchange rate also encouraged importation and discouraged exports and this led to balance of payments deterioration especially in the face of falling oil revenue

The above as well as other imperfections in the economy, led to the adoption of the Structural Adjustment Programme (SAP) in July, 1986. Although, this has not significantly altered the role of the CBN, emphasis on the appropriate monetary instruments has markedly changed to those engendering a market-oriented financial system. Table 1 shows a summary of some important policy steps taken by the monetary authority durin the period.

Review of literature: Monetary transmission mechanism can be defined as dynamic adjustments of output and other macroeconomic variables to monetary policy. The identification of channels through which these adjustments operate is crucial for relevant policy making. In an open-macroeconomic framework, channels like interest rate, exchange rate, equity price and credit are identified in the literature. The discussions here draw from Mishkin (1995) and this serves as the theoretical framework for the present study.

Theoretical review
Interest rate channels: Following a monetary expansion, real interest rate falls which in turn lowers the cost of capital, causing a rise in investment spending, thereby leading to an increase in aggregate demand and a rise in output. This schematic linkage is shown as:

$$M\Delta \rightarrow r\nabla \rightarrow I\Delta \rightarrow Y\Delta$$

Where:
m = Money supply
r = Real interest rate
I = Investment
Y = Output

Exchange rate channel: Monetary expansion leads to a fall in interest rate which in turn makes capital inflow less

Table 1: Monetary and exchange rate policies over time

Purposes	Measures
Liquidity management	The reduction in the maximum ceiling on credit growth allowed for banks
	The recall of the deposit requirement against outstanding external payment arrears to CBN from banks
	Abolition of the use of foreign guarantees/currency deposits collaterals for naira loans
	Withdrawal of public sector deposits from banks to the CBN
	Increase in commercial bank cash reserve requirement in 1990, 1992, 1996 and 1999
Efficiency and flexibility in banks credit operations	Sector specific credit distribution targets were compressed into 4 sectors in 1986, 2 in 1987 and none in 1996
Re-capitalisation	Increase in minimum paid-up capital of commercial and merchant banks in 1990 to N50 million and N40 million from N20 million and N12 million respectively and to N500 in 1997
	Enforcement of risk-weighted measure of capital adequacy recommended by the Basle committee of the Bank of International settlement in 1990
	CBN encourages merger and acquisitions
	In 1998, the paid-up capital of banks was increased to N500 million, N26 billion in 2001 and N256 in 2004
Open market operation	3 discount houses were opened in March, 1993, one in 1995 and another one in 1996 on 30th June 1993, the CBN commenced OMO in treasury securities with banks through discount houses on a weekly basis
Exchange rate policies	In September, 1986, a flexible exchange rate mechanism was adopted with the floating of the naira in the Second-Tier Foreign Exchange (SFEM) market
	The 1st and 2nd-tier markets were merged into an enlarged Foreign Exchange Market (FEM) in July, 1987
	In 1988, the inter-bank market where banks transact official foreign exchange was separated from official market and an autonomous market for privately sourced foreign exchange emerged with its independent rates
	To further reduce exchange rate instability, the CBN modified the inter-bank procedure in December 1990 when the DAS was re-introduced while in August 1991 the bank introduced the modal weighted average method of exchange rate determination
	As a result of high premium accrued to the parallel market, a completely deregulated system of foreign exchange was introduced in 1992
	In 1994, the naira exchange rate was fixed at N21.9960 to the US dollar
	Dual exchange rate policy was introduced in 1995
	In 1997, the policy thrust of guided deregulation through the AFEM was retained with some adjustments
	To deepen the market the Inter-Bank Foreign Exchange Market (IFEM) was introduced in 1999
	Failure of foreign exchange to impact adequately on the real sector of the economy, among others, led to the re-introduction of DAS in 2002 and this is still in use. Since its introduction, DAS has succeeded in narrowing the arbitrage premium from and ensure relative stability of the naira

CBN annual reports and statement of accounts (Various issues)

attractive, thus leads to the depreciation of the domestic currency value. Depreciation raises exports but reduces imports, thereby causing a rise in net exports and hence aggregate output:

$$M\Delta \rightarrow r\nabla \rightarrow E\nabla \rightarrow NX\Delta \rightarrow Y\Delta$$

Where:
M = Money supply
r = Real interest rate
E = Exchange rate
NX = Net exports
Y = Output

Equity price channels: There are two important channels here; the first is the Tobin's q Theory: Tobin's q measures the market value of firms as a ratio of the replacement cost of capital if q is high, the market price of firms is high relative to the replacement cost of capital and new plant is cheap relative to the market value of business firms. Thus, investment spending will rise because firms can buy a lot of new investment goods with a small issue of equity. In the monetarist explanation, a rise in money supply raises the public demand for commodities, equity inclusive and this raises equity prices.

$$M\Delta \rightarrow P_e\Delta \rightarrow q\Delta \rightarrow I\Delta \rightarrow Y\Delta$$

A higher money supply leads to increase in demand for equity which in turn raises equity prices. A higher equity prices raises Tobin's q, investment and ultimately aggregate output. The higher stock prices can also work through the second channel known as the wealth effect. Here, higher stock prices lead to rise in the financial wealth, thus increasing the lifetime resources of consumers, consumption rises and so also is output:

$$M\Delta \rightarrow P_e\Delta \rightarrow W\Delta \rightarrow C\Delta \rightarrow Y\Delta$$

Where:
P_e = Equity prices
q = Tobin's q
W = Wealth
C = Consumption

Credit channels: This works mainly via the bank lending channel. An expansionary monetary policy which raises bank reserves and bank deposits will eventually increase loanable funds. This in turn raises investment and aggregate output:

$$M\Delta \rightarrow D\Delta \rightarrow L\Delta \rightarrow I\Delta \rightarrow Y\Delta$$

Where:
D = Bank deposit
L = Loans

Empirical review: This study reviews some researches in the area of monetary transmission mechanism. The result of Bernanke and Blinder (1992) using VAR Model on monthly data of the US economy provides support for credit channel which affects aggregate spending through bank loans (Philip *et al.*, 2003) using Vector Error Correction on the economy of Ghana, finds the relevance of exchange rate channel (Agha *et al.*, 2005) concluded by means of VAR Model on data from Pakistan that bank lending to private sector affects aggregate spending and prices (Table 2).

The data from Table 2 shows that studies from several economies identified various channels through which monetary policy transmits to the economy. Some of these findings are similar while others are different. Another feature of the studies is that Vector Autoregressions Method is usually employed in studies of this nature. Finally, Table 2 shows a dearth of studies in this area on Nigeria and none has actually attempted to document changes in monetary transmission mechanism as a result of changes in a Central Bank's autonomy status which is the justification for the present study.

Study scope and data sources: This study utilises macroeconomic variables like broad money supply (M_2), minimum rediscount rate (r), total credit advancement to the private sector (Credit), exchange rate (E), net exports (NX) and real GDP (GDP). Quarterly data of all these variables are extracted from Central Bank of Nigeria statistical bulletin and annual reports and statement of account of various years.

The study covers the period of 1988-2007. This period sufficiently captures the two periods of 1991 and 1998 CBN Acts. All variables are used in their level forms in descriptives to enable easy comparisons. However in analytical procedures, all variables, except rates are expressed in their natural log forms prior to estimation.

Table 2: Summary of empirical literature

Refrences	Methodology, type of data and scope	Variables used	Major finding
Philip *et al.* (2003)	Vector error correction Quarterly data 1969:4. Ghana	Inflation, real GDP, credit to private sector, treasury bill rate	Strong evidence of monetary policy real exchange rate and broad money instrument affecting price and real GDP. Supports exchange rate channel
Kevin (2006)	VAR Model. Monthly data: 1997-205. Kenya	Real GDP, CPI, money stock, short-term interest rate and nominal effective exchange rate	Increase in interest rate leads to a fall in prices and an appreciation of exchange rate but accounting little for output fluctuation
Helmut and Jurgen (2001)	Macroeconomic Model (OLS Estimation Technique) Quarterly data. Germany	M3, GNP, inflation rate, long term interest rate, import price index	Permanent increase in instrument interest rate reduce inflation and output
Uanguta and Ikhinde (2006)	VAR Model. Monthly data: 1990-1999. Namibia	Private investment, credit to the private sector, money supply, consumer price index and lending rate	Contractionary monetary policy increase lending rate which decreases private investment and output. The result also provide support for the bank lending channel
Agha *et al.* (2005)	VAR Model. Monthly data: July, 1996-March, 2004. Pakistan	Credit to private sector, CPI, real effective exchange rate, 6 months treasury bill rate, industrial production index and Karachi stock exchange rate	Their result provides support for the bank lending channel through lending to private sector which affects aggregate spending and prices
Bernanke and Gertler (1995)	VAR Model. Monthly data 1965:1-1984: IV Seasonally adjusted. USA	Real GNP, GNP price deflator, real defence spending, MI money stock, the monetary base, commercial bank loans	First, it appears that credit shocks are important for output and second, however money and credit are approximately equal important forces in the monetary transmission mechanism
Dabla-Noris and Floerkemeier (2006)	VAR Model. Monthly data, 2000:5-2005:12 Armenia	Interest rate, exchange rate, money supply, output inflation	Shock to monetary aggregate affect output but interest rate channel is weak
Anil *et al.* (1993)	Structural model quarterly data, 1963: 1-1989: IV. USA	Commercial paper; commercial bank loans; bank loans as a fraction of total short-term external finance; the spread between prime commercial paper rates and TBR; Investment and inventory data: business cycle indicators	The study finds that tighter monetary policy leads to a shift in firms' mix of external financing: commercial paper issuance rises while bank loans fall. This suggests that contractionary policy reduce loan supply, thus affect investment, interest rates and output
Bernanke and Blinder (1992)	VAR Model monthly data 1959:7-1989:12. USA	Log of CPI; log of M1 and M2; federal funds rate; 3 months TBR; 10 years treasury bond rate; non borrowed reserves of depository institutions	Monetary policy works in part by affecting the composition of bank asset, i.e., tight monetary policy affects the supply of bank loans

Tarawalie (2008)

MATERIALS AND METHODS

Descriptive analysis showing trend and structure and interdependence of monetary channels variables are initially explored. Given the interdependence among economic variables, connectivity among them can be represented by:

$$y_t = A_i y_{t-i} + ... + A_p y_{t-p} + Bx_t 1 + \varepsilon_t \qquad (1)$$

Where:

y_t	=	K vector of endogenous variables
x_t	=	d vector of exogenous variables
$A_i, ..., A_p$ and B	=	Matrices of the coefficient to be estimated
ε_t	=	A vector of innovations

Equation 1 is usually estimated using Vector Autoregression (VAR) estimation which is commonly used in forecasting system of interrelated time series and for analysing the dynamic impact of random disturbances on the system of variables. It sidesteps the need for structural modelling by treating every endogenous variable in the system as a function of lagged values of all of the endogenous variables in the systems.

Variance Decomposition Method is also employed. It separates the variation in an endogenous variable into component shocks to the VAR. Since VAR estimates are subject to the lag length, researchers employ some criteria like FPE (Final Prediction Error), AIC (Akaike Information Criterion), Schwarz and Hannan-Quinn Information Criterion to choose the optimal lag length, also consider the presence of serial correlations in the choice model. Equation 1 is estimated as the monetary transmission mechanism model for the period 1988-2007; researchers also break the period into two judging by the 2 laws operational in these periods.

Further, Eq. 1 is estimated separately for each of the periods and the Hausman specification test is used in determining whether there is really a difference in the monetary channels between this two regulation regimes.

RESULTS AND DISCUSSION

The study presents the trend analyses of the variables of interest, comparison are made between the periods under which each of the laws operates in terms of the variables absolute values, ratios and their growth rates. Therefore, the VAR estimation of the monetary transmission mechanisms is estimated and discussions are made based on the VAR results and the Variance Decomposition test.

Trend analysis: Figure 1 shows a rising trend for most of the variables; except for interest rate and net export; also for most of these series, the period of sharp increase coincides with the period of the new Act of 1998. Interest rate is observed to oscillate between some high and low values during the period of study and the peak is around 1995 and a fall in its values is recorded in the latter part of the period during which the 1991 CBN Act was operational.

Just after the 1998 Act, interest rate continues to rise gradually, however a declining trend is observed recently. Net export on the other hand, records the all period highest values in the 1st years of transition to new political governance.

Macroeconomic performance differential following CBN autonomy: In capturing the macroeconomic performance changes following the change in CBN autonomy status (Table 3-5). From Table 3, it is observed that the average money supply in the 1991 Act period (N110.9b) is lower than that of 1998 Act period (N12522.5b) interest rate is lower in the second period, this is expected since money supply in this period is higher. Other variables like credit advancement to private sector, exchange rate, net export and real GDP are higher in the period of 1998 Law.

This does not necessarily imply better performance in the 1998 Act period as this period also witnessed higher average CPI level of 85.32. Thus, Table 4 and 5 on growth rates and ration analysis may be more informative. In Table 4, the mean growth rate of M_2 is actually higher (8.61%) under the 1991 Law compared with 5.76% under 1998 Law. Less for real GDP and net export growth rate, the growth rates of other variables are also higher under the 1991 Law.

Hence, researchers can conclude that the higher growth rate of money supply under 1991 Act feeds into higher price level which simultaneously raises nominal interest rate and exchange rate, thereby leading to a poorer current account balance and consequently, the period's lower RGDP status.

Finally, Table 5 on ratio analysis and their growth rates corroborates the earlier findings as the ratios of money and credit to GDP are higher under 1998 CBN Act but their growth rates are higher under the 1991 Act.

Channels of monetary policy: The study presents the result of estimated equation for the entire period of 1988-2007 using quarterly data. This allows the identification of significant channels over the entire period. Also explored is the variance decomposition mechanics.

To address the second objective of this study, researchers break the period into 2, according to the span of each CBN Act which therefore yields 10 years apiece and given the frequency of the data quarterly; these
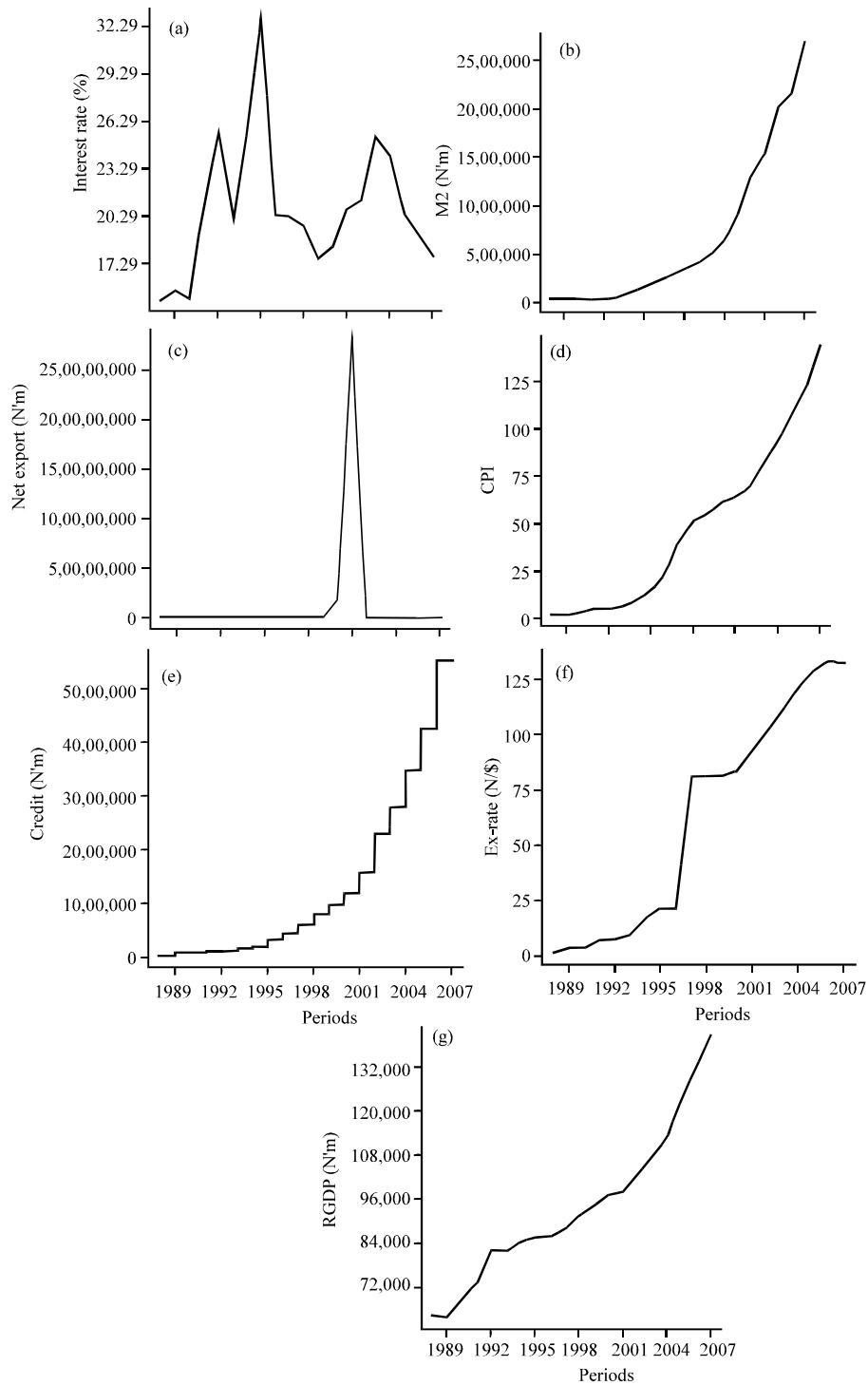
Fig. 1: Trend analysis

translate to 40 data points for each period. The results of the 2 periods are then juxtaposed for differences. VAR estimations are observed to be sensitive to their order of lags, thus prior to estimations. Table 6 is computed and it suggests through various criteria order 1 is the optimal lag length. Table 7 also justifies the choice of lag 1 as the LM test at this lag length suggests that there is no serial correlation.

Table 8 therefore presents the VAR estimates for the entire period. The results of an increase in money supply

Table 3: Change in CBN Act and macroeconomic variables

Regime	Units	M2 (N'm)	Interest rate (%)	Credit (N'm)	CPI	Ex-rate (N/$)	Net export (N'm)	RGDP (N'm)
Under 1991 Law	Minimum	15328.1	15	42073.4	1.9	1	-20211.6	63338.69
	Maximum	318763.5	37.8	541364.2	45	83.6	95286.6	89248.21
	Mean	110911.8	21.1345	167548	11.455	17.82	14582.37	77980.46
	Median	67317.45	20.3	111278.3	5.85	8.85	5880	82093.91
	N	40	40	40	40	40	40	40
	SD	89260.24	5.7271	132117.5	11.9781	22.4763	23788.12	9027.653
Under 1998 Law	Minimum	328714.7	16.3	545563.5	47.4	79.1	-6387986	90593.06
	Maximum	2814846	29.9	5975953	153.9	134.7	4.36E+08	159193.4
	Mean	1252544	20.48	2354555	85.315	106.725	30613283	110170.5
	Median	1149620	19.85	1911233	74.6	106.95	424476.1	105499.2
	N	40	40	40	40	40	40	40
	SD	790429.7	2.8052	1593896	30.1288	20.6634	94213092	17538.16
Total	Minimum	15328.1	15	42073.4	1.9	1	-6387986	63338.69
	Maximum	2814846	37.8	5975953	153.9	134.7	4.36E+08	159193.4
	Mean	681728	20.8073	1261052	48.385	62.2725	15313933	94075.47
	Median	323739.1	20.2	543463.9	46.2	80.15	64947.5	89920.64
	N	80	80	80	80	80	80	80
	SD	801451.3	4.4928	1572792	43.5895	49.6107	67962554	21316.87

Table 4: Change in growth rates

Regime	Units	GR M2 (%)	GR intr (%)	GR credit (%)	GR CPI (%)	GR ex-rt (%)	GR net-expt (%)	GR RGDP (%)
Under 1991 Law	Minimum	-63.65	-42.66	-10.95	-4.55	-9.17	-1094.46	-1.97
	Maximum	180.1	30.34	40.62	29.17	268.04	7123.61	5.16
	Mean	8.6126	1.4929	7.2049	8.7878	16.7864	153.2943	0.8531
	Median	6.7793	0	4.9025	6.0606	3.7234	7.4136	0.5162
	N	39	39	39	39	39	39	39
	SD	32.2697	11.5537	10.2639	8.7685	46.844	1181.8482	1.2128
Under 1998 Law	Minimum	-6.61	-21.37	-2.67	-5.98	-3.77	-1652.25	-18.27
	Maximum	22.97	27.23	15.37	10.97	8.27	68745.59	19.55
	Mean	5.7596	-4.34E-02	6.2493	3.042	1.1562	1707.3695	1.599
	Median	5.0264	-0.4963	6.2287	3.2629	0.6007	2.0961	1.1452
	N	40	40	40	40	40	40	40
	SD	6.0262	7.4945	3.6845	4.0638	2.7018	10875.85	5.3889
Total	Minimum	-63.65	-42.66	-10.95	-5.98	-9.17	-1652.25	-18.27
	Maximum	180.1	30.34	40.62	29.17	268.04	68745.59	19.55
	Mean	7.1681	0.715	6.7211	5.8785	8.8724	940.1678	1.2308
	Median	5.6758	0	5.8206	4.4146	1.2658	4.0837	0.8667
	N	79	79	79	79	79	79	79
	SD	22.9681	9.6806	7.6382	7.3534	33.683	3.9214	3.9214

Table 5: Change in some macroeconomic ratios

Regime	Units	M2/GDP (%)	M2/GDP (%)	Credit/ GDP (%)	GR credit/ GDP (%)	Net expt/ GDP (%)	GR net-expt /GDP(%)
Under 1991 Law	Minimum	19.08	-65.43	65.48	-11.26	-23.51	-1091.01
	Maximum	357.17	174.72	606.58	39.99	109.29	7093.04
	Mean	134.7033	7.7657	203.0247	6.3067	17.398	151.7514
	Median	88.76	5.8618	134.715	2.884	7.81	6.4906
	N	40	39	40	39	40	39
	SD	97.3954	31.7303	143.4087	10.157	27.0056	1176.9854
Under 1998 Law	Minimum	362.85	-11.32	602.21	-8.67	-6532.6	-1660.45
	Maximum	2139.18	38.81	4157.35	30.21	438196.81	68102.47
	Mean	1065.8075	4.4545	1989.4238	4.8484	31006.418	1689.2691
	Median	1083.535	3.6992	1810.93	4.5054	376.46	0.4886
	N	40	40	40	40	40	40
	SD	545.086	9.2257	1074.8083	6.4551	95314.844	10774.5397
Total	Minimum	19.08	-65.43	65.48	-11.26	-6532.6	-1660.45
	Maximum	2139.18	174.72	4157.35	39.99	438196.81	68102.47
	Mean	600.2554	6.0892	1096.2243	5.5683	15511.908	930.2414
	Median	360.01	4.6359	604.395	3.9806	72.98	2.2531
	N	80	79	80	79	80	79
	SD	608.9697	23.148	1178.2835	8.4636	68761.031	7701.8641

confirms with some of the theoretical explanation in terms of direction of impact. For instance, monetary expansion reduces interest rate, raises credit advancement as well as the price level. Contrary to the exchange rate channels, money expansion raises exchange rate, reduces net export and consequently lowers output. Researchers

Table 6: VAR lag order selection criteria (Endogenous variables: LNM R LNCR LNCPI E LNNX LNGDP; Exogenous variables: C; Date: 02/20/03 Time: 18:00; Sample: 1988:1 2007:4; Included observations: 76)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-738.3800	NA	0.778905	19.61526	19.82994	19.70106
1	-232.2988	905.6189	4.68E-06*	7.586810	9.304193*	8.273159*
2	-200.7945	50.57262	7.65E-06	8.047225	11.26732	9.334129
3	-134.7309	93.87989*	5.30E-06	7.598182	12.32098	9.485642
4	-84.28677	62.39144	6.02E-06	7.560178*	13.78569	10.04819

*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

Table 7: VAR residual serial correlation LM tests (H_0: No serial correlation at lag order h; Date: 02/20/03; Time: 18:09; Sample: 1988:1, 2007:4; Included observations: 79

Lags	LM-stat	Probability
1	51.62537	0.3716
2	98.08524	0.0000
3	32.08425	0.9705
4	142.5944	0.0000

Probability from Chi-square (χ^2) with 49 df

Table 8: Vector autoregression estimates (Date: 02/20/03; Time: 18:08; Sample (adjusted): 1988:2, 2007:4; Included observations: 79 after adjusting endpoints. Standard errors in ( ) and t-statistics in [ ]

	LNM	R	LNCR	LNCPI	E	LNNX	LNGDP
LNM(-1)	0.742571	-0.458923	0.088646	0.030720	4.165247	-3.080369	-0.019315
	(0.08113)	(1.12668)	(0.02850)	(0.02844)	(2.83882)	(1.46024)	(0.01716)
	[9.15264]	[-0.40732]	[3.10998]	[1.07999]	[1.46724]	[-2.10949]	[-1.12546]
R(-1)	0.002829	0.810840	0.001323	-0.001406	-0.264137	-0.136713	0.000439
	(0.00555)	(0.07714)	(0.00195)	(0.00195)	(0.19436)	(0.09998)	(0.00117)
	[0.50934]	[10.5113]	[0.67809]	[-0.72196]	[-1.35898]	[-1.36743]	[0.37350]
LNCR(-1)	0.159228	0.466873	0.845712	0.041144	4.552639	2.796603	0.078439
	(0.14552)	(2.02082)	(0.05112)	(0.05102)	(5.09174)	(2.61911)	(0.03078)
	[1.09421]	[0.23103]	[16.5422]	[0.80645]	[0.89412]	[1.06777]	[2.54829]
LNCPI(-1)	0.031972	0.544785	0.032180	0.998067	3.575577	0.527780	-0.022048
	(0.07089)	(0.98449)	(0.02491)	(0.02485)	(2.48057)	(1.27596)	(0.01500)
	[0.45099]	[0.55337]	[1.29203]	[40.1559]	[1.44143]	[0.41363]	[-1.47027]
E(-1)	0.000882	-0.035547	0.000724	-0.001906	0.690447	0.056189	-0.000304
	(0.00225)	(0.03126)	(0.00079)	(0.00079)	(0.07876)	(0.04051)	(0.00048)
	[0.39173]	[-1.13718]	[0.91559]	[-2.41484]	[8.76638]	[1.38694]	[-0.63886]
LNNX(-1)	-0.004034	0.179216	0.001703	-0.001572	0.176465	0.087531	0.000222
	(0.00663)	(0.09208)	(0.00233)	(0.00232)	(0.23201)	(0.11934)	(0.00140)
	[-0.60831]	[1.94629]	[0.73105]	[-0.67612]	[0.76059]	[0.73344]	[0.15856]
LNGDP(-1)	0.290190	1.950838	0.113413	-0.119960	-14.33472	-4.765303	0.788710
	(0.40615)	(5.64020)	(0.14269)	(0.14239)	(14.2113)	(7.31006)	(0.08591)
	[0.71449]	[0.34588]	[0.79481]	[-0.84245]	[-1.00869]	[-0.65188]	[9.18048]
C	-2.287930	-20.07244	-0.519931	0.671224	65.00026	63.91411	1.718984
	(3.71463)	(51.5849)	(1.30504)	(1.30233)	(129.976)	(66.8573)	(0.78574)
	[-0.61592]	[-0.38911]	[-0.39840]	[0.51540]	[0.50010]	[0.95598]	[2.18772]
R^2	0.985687	0.706985	0.998351	0.998025	0.984772	0.454300	0.970728
Adj. R^2	0.984276	0.678096	0.998188	0.997830	0.983271	0.400499	0.967842
Sum sq. resids	2.371062	457.2538	0.292659	0.291443	2902.923	768.0863	0.106089
SE equation	0.182744	2.537754	0.064202	0.064069	6.394235	3.289091	0.038655
F-statistic	698.5075	24.47260	6140.662	5124.903	655.9362	8.444028	336.3621
Log likelihood	26.39519	-181.4499	109.0326	109.1971	-254.4552	-201.9371	149.1143
Akaike AIC	-0.465701	4.796199	-2.557787	-2.561951	6.644434	5.314863	-3.572513
Schwarz SC	-0.225757	5.036144	-2.317843	-2.322007	6.884378	5.554807	-3.332569
Mean dependent	12.58765	20.88076	13.12751	3.221660	63.04810	10.60165	11.43246
SD dependent	1.457337	4.472870	1.508410	1.375376	49.43712	4.247964	0.215557

Determinant residual covariance: 1.96E-06; Log likelihood (df adjusted): -265.5339; Akaike information criteria: 8.140098; Schwarz criteria 9.819706

will attempt to explain this later. In terms of significance, the credit channel is validated as increase in money supply raises credit and the latter in turn impacts positively and significantly of output.

The traditional interest rate channel is in validated as monetary expansion does not significantly lower interest rate. This presents a justification for the change in sign observed under the exchange rate channels. In other words if many supply fails to impact on interest rate yet it affects net exports, it implies that it does so by increasing the price level and via the wealth effect; this raises consumption of imported goods thereby reducing net export and output. Figure 2 shows the variance decomposition charts of the variables panel
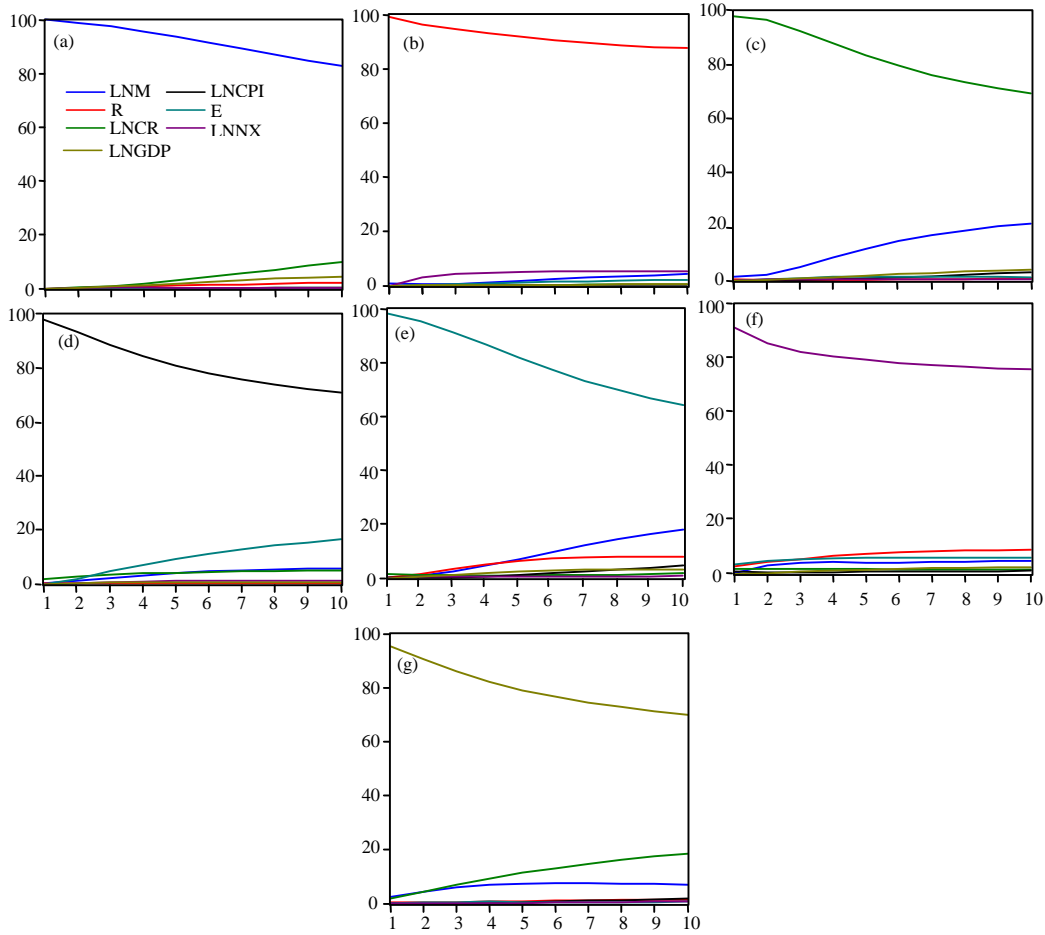
Fig. 2: Variance decomposition variance decomposition; a) LNM, b) R, c) LNCR, d) LNCPI, e) E, f) LNNX and g) LNGDP (All period)

Table 9: Vector autoregression estimates (Date: 02/20/03; Time: 18:19; Sample (adjusted): 1988:2 1997:4; Included observations: 39 after adjusting endpoints; Standard errors in ( ) and t-statistics in [ ]

	LNM	R	LNCR	LNCPI	E	LNNX	LNGDP
LNM(-1)	0.747016	-0.217273	0.091509	0.028066	2.853068	-2.753422	-0.016217
	(0.12308)	(1.47480)	(0.04005)	(0.03155)	(4.05410)	(1.50226)	(0.00491)
	[6.06913]	[-0.14732]	[2.28490]	[0.88964]	[0.70375]	[-1.83286]	[-3.30400]
R(-1)	-0.005795	0.752775	0.002978	0.001159	-0.578895	-0.240442	0.000414
	(0.01325)	(0.15879)	(0.00431)	(0.00340)	(0.43650)	(0.16175)	(0.00053)
	[-0.43731]	[4.74071]	[0.69066]	[0.34121]	[-1.32622]	[-1.48654]	[0.78308]
LNCR(-1)	0.322128	-5.019682	0.767963	0.499424	-17.58978	-1.925307	-0.003535
	(0.52326)	(6.26968)	(0.17026)	(0.13412)	(17.2348)	(6.38641)	(0.02087)
	[0.61562]	[-0.80063]	[4.51058]	[3.72382]	[-1.02059]	[-0.30147]	[-0.16942]
LNCPI(-1)	-0.267018	5.433459	0.117013	0.650120	27.39659	0.605590	0.028028
	(0.42943)	(5.14546)	(0.13973)	(0.11007)	(14.1445)	(5.24126)	(0.01712)
	[-0.62179]	[1.05597]	[0.83743]	[5.90654]	[1.93691]	[0.11554]	[1.63669]
E(-1)	0.004451	-0.071694	0.000304	-0.000255	0.562724	0.100297	-0.000186
	(0.00461)	(0.05527)	(0.00150)	(0.00118)	(0.15194)	(0.05630)	(0.00018)
	[0.96492]	[-1.29708]	[0.20245]	[-0.21527]	[3.70355]	[1.78140]	[-1.01250]
LNNX(-1)	-0.014007	0.362459	0.006964	0.005628	0.205710	-0.199904	0.000688
	(0.01745)	(0.20913)	(0.00568)	(0.00447)	(0.57490)	(0.21303)	(0.00070)
	[-0.80251]	[1.73313]	[1.22629]	[1.25806]	[0.35782]	[-0.93839]	[0.98795]
LNGDP(-1)	1.531329	3.532691	-0.049672	-0.259132	-30.12696	15.96456	0.887896
	(1.22735)	(14.7061)	(0.39936)	(0.31458)	(40.4260)	(14.9799)	(0.04894)
	[1.24767]	[0.24022]	[-0.12438]	[-0.82373]	[-0.74524]	[1.06573]	[18.1409]
C	-17.43006	14.70137	1.963724	-2.559185	479.6907	-114.3005	1.428819
	(13.1506)	(157.571)	(4.27897)	(3.37064)	(433.150)	(160.505)	(0.52442)

Table 9: Continue

	LNM	R	LNCR	LNCPI	E	LNNX	LNGDP
	[-1.32542]	[0.09330]	[0.45892]	[-0.75926]	[1.10745]	[-0.71213]	[2.72456]
R²	0.910806	0.753802	0.988380	0.995721	0.881103	0.234251	0.993582
Adj. R²	0.890665	0.698209	0.985757	0.994755	0.854256	0.061340	0.992133
Sum sq. resids	2.127431	305.4316	0.225237	0.139761	2308.014	316.9110	0.003383
SE equation	0.261967	3.138890	0.085239	0.067145	8.628560	3.197333	0.010447
F-statistic	45.22224	13.55929	376.6991	1030.484	32.81868	1.354752	685.5911
Log likelihood	1.380005	-95.47280	45.16759	54.47335	-134.9099	-96.19226	127.0352
Akaike AIC	0.339487	5.306297	-1.906030	-2.383249	7.328714	5.343193	-6.104370
Schwarz SC	0.680730	5.647541	-1.564787	-2.042005	7.669958	5.684436	-5.763127
Mean dependent	11.32707	21.29179	11.79059	2.024367	18.25128	7.887179	11.26214
SD dependent	0.792259	5.713775	0.714219	0.927089	22.60178	3.300151	0.117779

Determinant residual covariance: 3.83E-07; Log likelihood (df adjusted): -99.24486; Akaike information criteria: 7.961275; Schwarz criteria: 10.34998
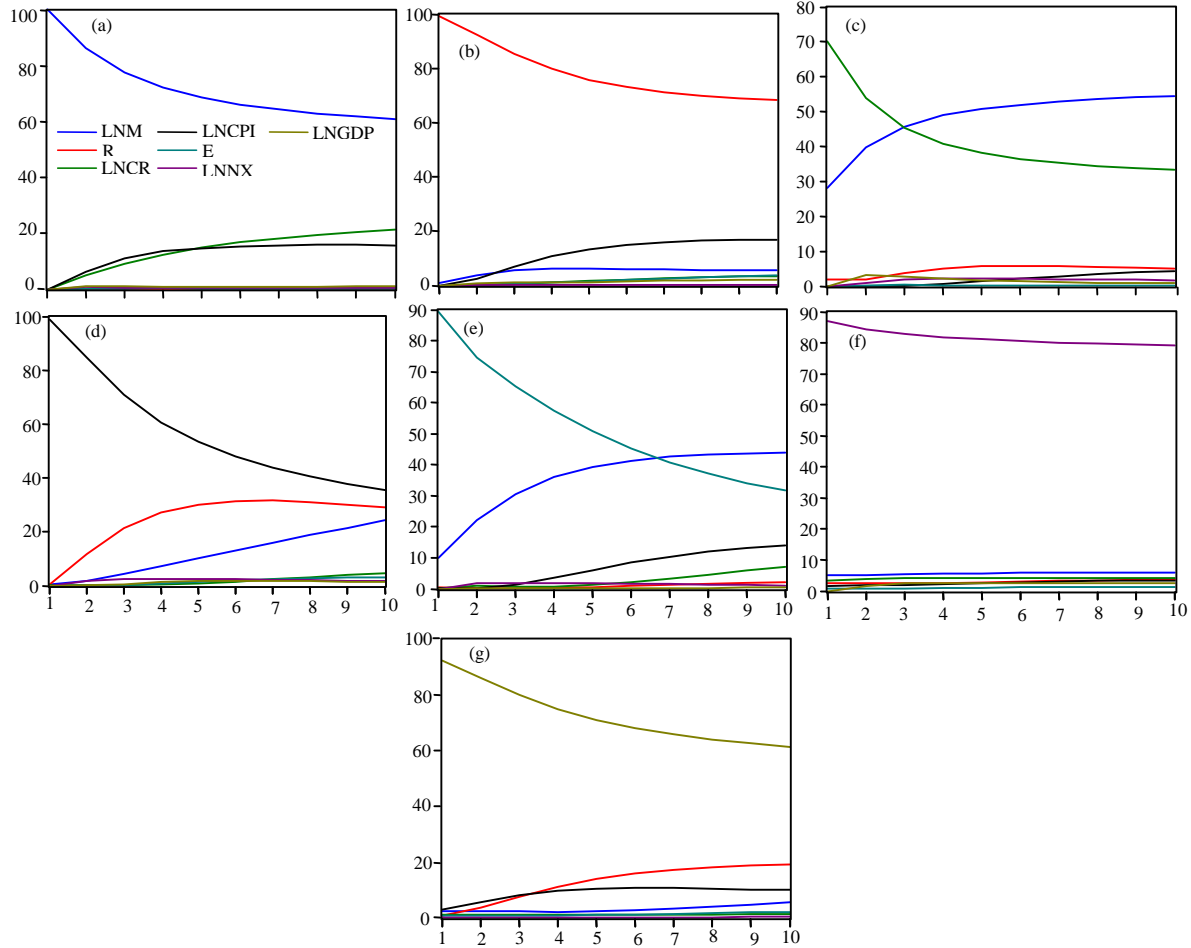

Fig. 3: Variance decomposition; a) LNM, b) R, c) LNCR, d) LNCPI, e) E, f) LNNX and g) LNGDP (1991 Act period)

shows that the change of interest rate variance responsible for by the other six variables are very small, none explain up to 10%, meanwhile net export appears to dominate the other six in terms of explained variance and this percentage rises just up to period 3 after which it stabilize. In panel (c), money supply is the only variable that is gaining explanation credit which tends towards 20% as the approach 10th period.

The path of CPI variance explained by exchange rate (panel d) is similar to that of exchange rate explainable by money supply (e) hence, we can infer that money supply influences exchange rate via its impact rather than through its impact on interest rate. In panel (g) credit advancement increasingly explained real output which underscores the credit channel of monetary transmission mechanism.

Table 10: Vector autoregression estimates (Date: 02/20/03; Time: 18:25; Sample: 1998:1 2007:4; Included observations: 40; Standard errors in ( ) and t-statistics in [ ]

	LNM	R	LNCR	LNCPI	E	LNNX	LNGDP
LNM(-1)	0.681622	4.853665	0.234761	0.183651	15.30544	-10.57106	-0.041620
	(0.16608)	(5.38178)	(0.10355)	(0.11163)	(8.02243)	(10.7891)	(0.15219)
	[4.10407]	[0.90187]	[2.26717]	[1.64510]	[1.90783]	[-0.97979]	[-0.27347]
R(-1)	-0.003171	0.623512	-0.005261	-0.007442	0.042891	-0.147242	-0.004712
	(0.00417)	(0.13513)	(0.00260)	(0.00280)	(0.20143)	(0.27090)	(0.00382)
	[-0.76037]	[4.61414]	[-2.02352]	[-2.65513]	[0.21293]	[-0.54352]	[-1.23318]
LNCR(-1)	0.504585	1.424610	0.821098	-0.015979	-5.784144	14.96951	0.084847
	(0.17746)	(5.75034)	(0.11064)	(0.11928)	(8.57184)	(11.5279)	(0.16261)
	[2.84340]	[0.24774]	[7.42138]	[-0.13397]	[-0.67478]	[1.29854]	[0.52177]
LNCPI(-1)	-0.599953	-8.142683	0.039949	0.638645	-1.913532	-2.616908	0.195755
	(0.19789)	(6.41256)	(0.12338)	(0.13302)	(9.55899)	(12.8555)	(0.18134)
	[-3.03168]	[-1.26980]	[0.32379]	[4.80125]	[-0.20018]	[-0.20356]	[1.07949]
E(-1)	0.001692	-0.056861	-0.001104	0.000362	0.712056	-0.052322	0.000622
	(0.00230)	(0.07459)	(0.00144)	(0.00155)	(0.11118)	(0.14952)	(0.00211)
	[0.73493]	[-0.76236]	[-0.76910]	[0.23429]	[6.40441]	[-0.34992]	[0.29478]
LNNX(-1)	-0.001950	0.014975	-0.001506	-0.001908	0.146532	0.101035	3.63E-05
	(0.00260)	(0.08414)	(0.00162)	(0.00175)	(0.12542)	(0.16867)	(0.00238)
	[-0.75095]	[0.17798]	[-0.93059]	[-1.09332]	[1.16836]	[0.59901]	[0.01526]
LNGDP(-1)	0.178347	-4.082274	-0.186939	0.008301	-1.326627	-9.150505	0.243617
	(0.21556)	(6.98513)	(0.13440)	(0.14489)	(10.4125)	(14.0034)	(0.19753)
	[0.82735]	[-0.58442]	[-1.39094]	[0.05729]	[-0.12741]	[-0.65345]	[1.23331]
C	-2.353358	8.996946	1.635936	-0.649585	-75.04695	68.22880	7.307135
	(2.28491)	(74.0400)	(1.42457)	(1.53582)	(110.369)	(148.431)	(2.09377)
	[-1.02996]	[0.12151]	[1.14838]	[-0.42296]	[-0.67996]	[0.45967]	[3.48995]
R²	0.995405	0.694876	0.998302	0.990991	0.987504	0.116798	0.913195
Adj. R²	0.994400	0.628131	0.997931	0.989020	0.984770	-0.076402	0.894206
Sum sq. resids	0.089184	93.64367	0.034667	0.040293	208.0843	376.3521	0.074886
SE equation	0.052792	1.710662	0.032914	0.035484	2.550026	3.429432	0.048376
F-statistic	990.3483	10.41079	2688.006	502.8442	361.2592	0.604545	48.09167
Log likelihood	65.36123	-73.76989	84.25963	81.25181	-89.73881	-101.5905	68.85573
Akaike AIC	-2.868062	4.088494	-3.812981	-3.662591	4.886941	5.479523	-3.042787
Schwarz SC	-2.530286	4.426270	-3.475206	-3.324815	5.224717	5.817299	-2.705011
Mean dependent	13.81672	20.48000	14.43101	4.389021	106.7250	13.24825	11.59852
SD dependent	0.705469	2.805233	0.723571	0.338638	20.66338	3.305483	0.148729

Determinant residual covariance: 9.78E-10; Log likelihood (df adjusted): 17.59824; Akaike information criteria: 1.920088; Schwarz criteria: 4.284519; Meanwhile for ease of exposition, relevant deductions are extracted and shown in Table 11

Regulation versus monetary transmission channels: The results of analysis on the period when the CBN operates under the 1991 Act are shown in Table 9 and Fig. 3. On the other hand, those within the 1998 Act are shown in Table 10 and Fig. 4. Panel A of Table 11 compares the VAR results in terms of coefficient, magnitude, significance and conformity with a prior expectation panel B on the other hand compares the magnitude, relation contribution and trend of variance each of the relevant path.

From panel A, the interest rate channel is unobserved in both periods, also the nature of relationship expected is violated. Nonetheless from the coefficients magnitude, this channel is stronger in the 2nd period. Aside from the link between exchange rate and net export in the 1st period, exchange rate channel is also not validated. The equity price channel is partly validated in both periods and with higher influence in the second period. The latter is also true of the credit channel.

The Hausman Specification Test evaluates the superiority of second period channels against that of 1st period, its insignificance depicts no difference between the two periods in terms of monetary transmission mechanism. From panel B, it is observed from the transmission from money supply to interest rate that higher variance is explained by money supply in the 1st period, however the converse holds in the case of the transmission to output.

In the exchange rate channel, higher variance is explained in the 1st period. Equally, an examination of the equity price channel depicts that it is more relevant the 2nd period. This is also applicable to the credit channel. The results from the credit channel using the variance decomposition corroborate what we find out under the VAR in point A.

From the foregoing, researchers can conclude that the credit channel is the most relevant of monetary transmission mechanisms in Nigeria. That through other channels are not really significant, researchers can document a change in their relevance as a result of a change in the autonomous status of the Central Bank of Nigeria.
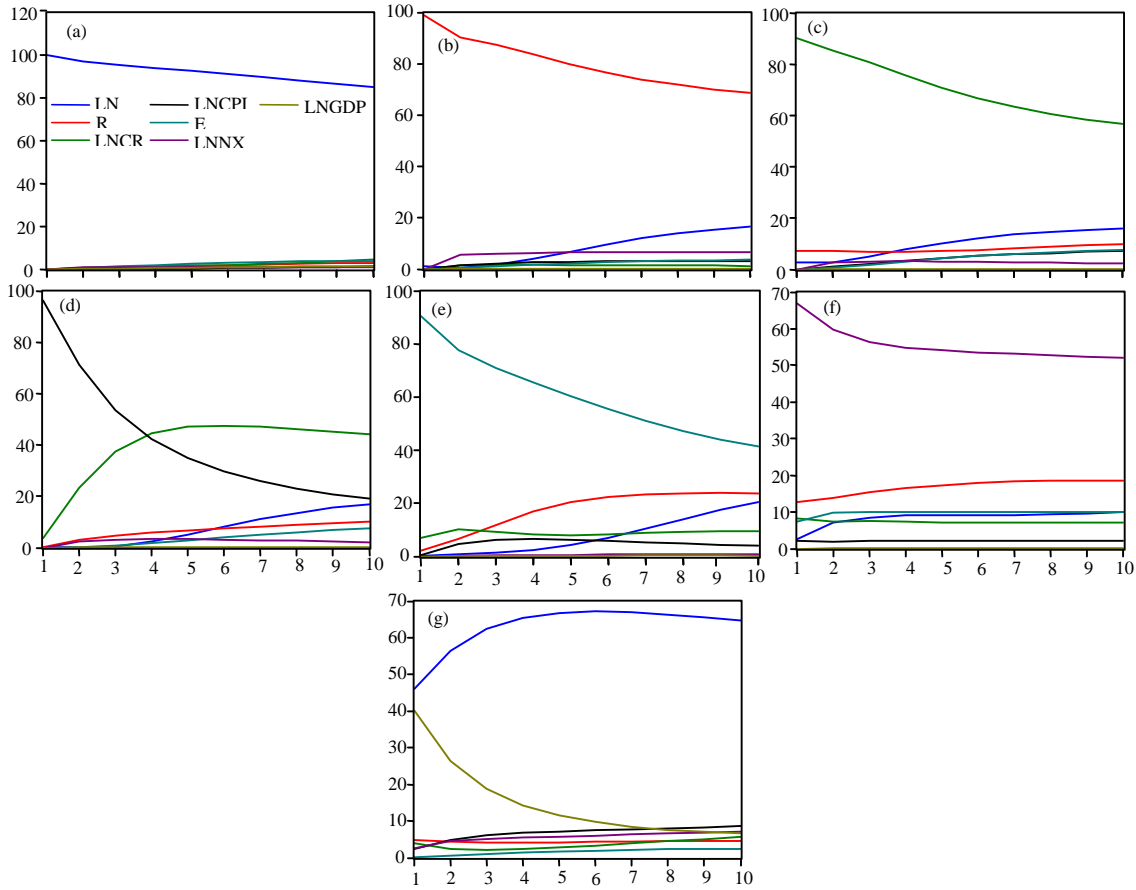
Fig. 4: Variance decomposition; a) LNM, b) R, c) LNCR, d) LNCPI, e) E, f) LNNX and g) LNGDP (1998 Act period)

Table 11: The summary table

Path	A. Coefficient 1991	1998	B. Magnitude 1991	1998	Trend 1991	1998	Relative importance 1991	1998
M→R	-0.22⁺	4.85⁻	Tends to 20%	Tend to 5%	Above others	As others below CPI	Rising	Rising and stable at 5%
R→Y	0.0004⁻	-0.01⁺	Tend to 5%	Tend to 20%	As others below M	Above others	Stable	Rising
R→E	-5.58⁻	0.04⁻	Tends to 25%	1%	Above others but M is closing up	Below others	Rising and stable at 25%	Stable
E→NX	0.10*⁻	-0.05⁺	10%	1%	As others below R	As others	Stable	Stable
NX-Y	0.001⁺	0.0001⁺	5%	1%	As others below M	below	stable	Stable
M→CPI	0.03⁺	0.18*⁺	Tends to 15%	Tends to 25%	As others	Above and closing on R	Rising	Rising
CPI→Y	0.03*⁺	0.20⁺	5%	10%	As others below M	Above others except R	Stable	Rising and stable
M→CR	0.09**⁺	0.24**⁺	Tends to 15%	Tends to 55%	As others rises above	Above others in period 4	Rising	Rising and stable
CR→Y	-0.004⁻	0.09⁺	Tends to 5%	1%	As others	Below R and CPI	Rising	Stable

Hausman χ^2 (Prob.): 6.38 (0.547); *Significant; ⁺Conform to a priori; ⁻Not conform

CONCLUSION

Monetary policy instruments are usually employed in the achievement of some macroeconomic objectives. The usage of such policy instrument requires that the monetary authority possesses and adequate knowledge of how it affects various aspects of the economy (Oyejide, 2002). In this wise, the concept of monetary transmission mechanism studies the description of the means by which the changes in monetary policy transmits into the domestic economic activities. The transmission process has been observed to vary over different economies of

different financial structure and Central Bank autonomy. This study examines the various monetary transmission channels in Nigeria; brief allusion is 1998 CBN Act as a source of changes in the channels. The study then goes ahead to compare the transmission process in the period when the 1991 CBN Act is operational and the period when the 1998 CBN Act is operational, the latter period been the one when the bank has higher autonomy.

Preliminary analysis shows a rising trend for all variables but interest rate and net export. The results of the VAR analysis and variance decomposition tests show that there is no significance change in the monetary transmission channels between the 2 periods. The major channel identified is the credit channel which supports the findings of Raheem (2008) and Uanguta and Ikhinde (2002). Although, this channel becomes stronger in the second period, we cannot statistically distinguish the process of monetary transmission based on the autonomy granted the Central Bank of Nigeria.

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