

Testing for Unit Roots and Structural Breaks: Evidence from Banking Sector Reforms in Nigeria

Okoi Innocent Obeten^{1*}, Effiong Charles¹ and Offem Iekam^{2,3}

¹Department of Banking and Finance, University of Calabar, Cross River State, Calabar, Nigeria

²Department of Business Management, University of Calabar, Cross River State, Calabar, Nigeria

³Department of Economics, University of Calabar, Cross River State, Calabar, Nigeria

Abstract

This paper examines the structural breaks dates for capital base, interest rates, exchange rates, corporate governance and economic growth in Nigeria using annual banking reform variables data spanning from 1970 through 2015. The theory used in the research was Balance growth theory. The study applied conventional unit root test of Augmented Dicker Fuller (ADF). Time series properties of the data are analyzed using Chow test approach to examine the more likely time of structural breaks in banking reform variables of the Nigerian economy. The study has established that structural breaks exist in all banking reform variables employed in the study. We therefore, conclude that structural change is pervasive in banking sector reform and it can be quite dangerous to ignore. It was recommended that given that structural breaks are associated with regime changes, there is need for the potential use of regime switching models in Nigeria.

Keywords: Banking reform • Structural break • Corporate governance

Introduction

Banking sector reforms are the totality of regulatory actions, policies, strategies, directives and incentives designed to ensure a diversified, strong and reliable banking which will ensure the safety of depositors' money, play active developmental roles and become competent and competitive players within the committee of nations. Reforms are proactive measures to strengthen the banking system as well as prevent systemic crisis. Basically, there were numerous banking reforms that took place in the financial sector; consolidation through merger and acquisitions (absorption and consolidation) of banks were part of the reforms implemented in Nigeria [1]. Others are insurance reform, stock market reform, pension reform, cashless policy reform, corporate governance reform, interest rate reform, foreign exchange reform and a lot of others to mention. The corporate restructuring through mergers and acquisitions was encouraged by regulatory authorities because of the overarching pursuit of corporate managers and regulators to increase the company value.

In Nigeria, the major elements of the reform agenda was the requirement for Nigerian banks to increase their shareholders' fund to minimum of 25 billion by the end of December 2005 and consolidation through mergers and acquisitions.

Unsurprisingly, interests in unit root properties of economic series have attracted many researchers. Other macroeconomic aggregates such as unemployment rate, current account balance, money demand, price level, inflation, consumption expenditure, investment, savings, stock prices, government revenue and expenditure have also been investigated for unit root. In each case the unit root properties of the variable investigated is shown to have important implications not only for economic theories, but also for econometric modelling and in the evaluation of any programme intended to bring about structural change.

It is worthy of note that studies that have considered banking sector reforms and economic growth at best, without taking into consideration the relevance of structural breaks in their modelling structure. Therefore, this study begins with the general objective of examining the unit root test and structural breaks for banking reforms for 47 years. More specifically, this study aims at giving a comprehensive and systematic examination on banking reforms variables denominated in Nigeria using different endogenous structural break ADF-type unit root tests [2,3]. This paper applied the multiple break point estimation of Bai and Perron (1998, 2003). We made use of this approach on a set of annual data for Nigeria. Lastly, the timing of possible structural breaks can be determined endogenously. The paper aligns itself with periods where there were unknown breaks as a result of policy paradigm especially in 1986.

***Address to Correspondence:** Dr. Okoi Innocent Obeten, Department of Banking and Finance, University of Calabar, Cross River State, Calabar, Nigeria; Tel:07038148249; E-mail: Okoku3@gmail.com

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other period where deregulation of interest rate and exchange rate policies were noticeable in Nigeria. This paper aims to fill the gap by attempting to identify break dates for banking reforms data and policy implications in Nigeria. The study looks into banking sector reforms and economic growth using banking reform variables from 1970-2015. In the light of the above, the study maintains that there is still an inconclusive evidence and a gap in understanding the structural breaks (if any) between banking sector reforms and economic growth in developing economy like Nigeria since they are subject to macroeconomic changes and fluctuations as well as policy shift in Nigeria.

Materials and Methods

The theory upon which this paper anchored is balanced growth theory. It was proposed initially by John Von Neumann in 1945. The theory stipulates that goods are produced not only from "natural factors of production", but in the first place from each other. These processes of production may be circular, that is, 'Good one' is produced with the aid of 'Good two' and 'Good two' with the aid of 'Good one'. The theory was presented for the first time as hypothesis in the winter of 1932 at the mathematical seminar of Princeton University. It was first published in German. The translation was made in English by G. Morgenstern. Another name for the model was known as Von Neumann's "Expanding Economic Model". It represented a controversial source of many strands of research in economic theory, from general equilibrium models, to linear models of production based on input-output analysis, to structural models of reproduction. The model presented by von Neumann is the first complete and mathematically rigorous formulation of a fully circular view of the economic system, in which neither original resources nor final consumption play an important role. This assumption implies that there are no limits on natural resources needed for expansion. Moreover, conditions of perfect competition in the long run are assumed; and finally that consumption of goods takes place only through the processes of production which include necessities of life consumed by workers and employees [4]. This assumption implies that all income from property in excess of necessities of life is saved and reinvested. The theory is therefore, relevant to the present study because it represents the structural changes of economic phenomenon through a natural state and fluctuations of economic variables.

Over the last two decades, few authors have shown a growing body of new empirical approaches to investigating the unit root tests and structural breaks. The literature depicts an intricate play between unit roots and structural breaks. Most tests that attempted to distinguish between a unit root and a (trend) stationary process will favour the unit root model when the true process is subject to structural changes. Nevertheless, the process could be (trend) stationary within regimes specified by the break dates. Moreover, most tests trying to assess whether a structural change is present will reject the null hypothesis of no structural change when the process has a unit root component. There is scanty literature on testing for a unit root under structural breaks [5].

Another study was carried out by Nyong and Udah (2012) on structural breaks and industrial time series in Nigeria within 1970 to 2009. The major objective was to test the unit roots in the presence of multiple endogenous structural breaks. Adopting the Lee and

Strazicich (2003) minimum Lagrange Multiplier (LM) approach to test the null hypothesis of unit roots against the break stationary alternative, the authors found that the fall in the price of oil in 1981, introduction of SAP in 1986, tariff policy reform as well as policy shift towards measures to promote capacity utilization and grant tax concession were the major causes of structural breaks in the variables under review. They therefore concluded that there should be a policy shift towards measures to promote capacity utilization, increase manufacturing output and grant tax concessions to exporters.

It was discovered that there is a stable money demand function for Nigeria and concluded that CBN has effectively used money supply as a monetary policy instruments. By using ADF unit root tests and cointegration approach, the study identified structural breaks which coincide with identifiable climatic, economic and political shocks within the period under study. They concluded that care must be taken to tackle these macroeconomic fluctuations in Kenya so that it may not lead to model misspecification and spurious results of model parameters.

This thesis departs from others by focusing on four major banking reforms in Nigeria, namely, interest rate reform, exchange rate reform and recapitalization reform and corporate governance reform proxied by interest rate spread, exchange rate fluctuation, capital base and corporate governance index respectively. Moreover, in this study, gross domestic product growth rate (GDPGR of current year minus GDPGR of preceding year) was used as proxy for economic growth.

Estimation procedure

This procedure enables us to detect unknown break dates in the variables by testing the null hypothesis of 'M' breaks against an alternative of 'M+1' number of breaks in a sequential order. The test is appropriate for detecting breakpoints if the break date in a model is unknown. Therefore, the study employed Chow test for structural break test with unknown date to test for the existence of policy shift between banking sector reforms and economic growth in Nigeria.

Results

The regression for the period 1970-2015 assumes that there was no structural breaks or parameter instability. The Chow test model in equation 1, 3, 4, 5 and 6 were used. The paper noted that in analyzing the unit root given many economic crises: changes in institutional arrangements, regime shift as well as policy shift in Nigeria, banking sector reform variables such as interest rate spread, exchange rate, banks capital base and corporate governance disclosure index were subjected to structural breaks and the LM unit root test using Augmented Dicker Fuller (ADF) statistics was considered biased towards not rejecting the unit root at the first difference. However, the banking reforms variables were first examined using the LM unit root test for the period 1970- 2015. The null hypothesis of the unit root in all the variables under investigation cannot be rejected at 5 per cent significant level. This is because tests statistics values at level for each variable using the ADF test was below the critical values at 1%, 5%, and 10% levels of significant. Moreover, when the variables were differenced once, they were stationery. This was because the test statistic for both tests were found to be greater than the critical values at 1%, 5% and

10% levels of significant. That is, all variables having the same order of intergration except GDPGR and BCAB that integrated in See Table 3.

Table 1. Unit root test using the Augmented Dickey-Fuller (ADF) statistics without structural break.

Variables	At level	At 1st or 2nd Difference
GDPGR	-5.6541	-
INRS	-0.6173	-8.0195
EXR	0.9478	-5.7882
BCAB	-8.7871	-
CGDI	0.0334	-7.4804

The findings in Table 1 revealed the existence of three break periods in Interest Rate Spread (INRS). Being a F-stat test, the result showed that, the F-statistics calculated, 0 vs. 1* (187.01), 1 vs. 2* (22.93) and 2 vs. 3* (17.10) were found to be greater than their corresponding critical values of 8.85, 10.13 and 11.14 respectively for the periods, 1998, 1989 and 1976 at five per cent level of significance.

Estimation procedure Chow Test

The central focus of this study anchors on the different reforms associated with this study. The success or failure of these reforms met with some form of unexpected shift in time series of a relationship between variables. With this in mind, a structural breakpoint test was conducted on the specific of each reform. A structural break occurs when there is an unexpected shift in time series of a relationship; between two or more time series data. Since we may not theoretically or empirically determine the exact breaks associated with each of the reforms, the multiple breakpoints test is most suitable. This test is efficient when there are more multiple breaks in the time series and when the breaks is are unknown [6].

Table 1. Unit INRS multiple breakpoints test.

Sequential F-statistic determined breaks			
		Scaled	Critical
Break Test	F-statistic	F-statistic	Value*
0 vs. 1 *	187.0177	187.0177	8.58
1 vs. 2 *	22.93374	22.93374	10.13
2 vs. 3 *	17.10045	17.10045	11.14
3 vs. 4	0.578457	0.578457	11.83

Note : * Significant at the 0.05 level.

The findings in Tables 2 and 3 The structural break which took place in 1998 coincided with the period of re- introduction of regulations. The banking sector, during this period, suffered deep financial distress which necessitated another round of reforms designed to manage the distress. The banking sector experienced moderate inflation rate during that period of guided deregulation (re-regulated) era. This set the pace for the structural break in interest rate spread. During this period the banking sector witnessed cut-throat competition with many adopting all kinds

of strategies to outwit each other, ostensibly because of the proliferation of banks' branches. The banks created risk assets at incredible low interest rate with or without collateral or adequate cover. The interest rate (INRS) between 1998 and 1999 ranges from 12.80 and 15.99 respectively.

Table 3. Unit Break dates.

	Sequential	Repartition
1	1998	1976
2	1989	1989
3	1976	1998

During 1989 break, the last quarter of the year witnessed a souring lending and deposit interest rates with lending rates rising up as high as 60 per cent per annum in the early nineties. Deposit rate rose to about 25%–30% per annum, in a rather self-defeating cut throat competitive manner that spelt the doom or collapse of some banks and many finance houses called the “wonder banks”. It was also noted that in 1989, the Central Bank of Nigeria (CBN) raised Monetary Policy Rate (MPR) to 13.25% in order to curb the growth of money supply. In a competitive bid to mobilize depositors, banks charged different deposit rates which forced the rate to increase [7,8]. In order to curb excessive rise in interest rates, the CBN fixed the spread between savings and lending rate at seven per cent points and the margin between prime and maximum lending rates for banks at 4 per cent points. However, the measure did not help to solve the desired objectives, rather, the year 1989 also witnessed an introduction of paying interest rate on current account deposit which was made mandatory in 1989/1990. Subsequently, the year 1991 and 1994 witnessed a policy reversal of interest rate management. The policy position in 1991 was the re – introduction of maximum interest rate of 21 percent while saving rate was allowed a minimum rate of 13.5 per cent. The cap on interest rate was removed in 1992. A combination of all these factors caused a structural breaks in 1989.

The breaks in 1976 was caused by financial repression. There were interest rate administration, selective credit controls, ceiling on credit expansion and direct monetary control instrument. The era created an enabling economic environment for interest rates on financial assets to adjust competitively to its market level. This could be one of the reason why interest rate margin became narrower in size. There was rigid interest rate coupled with other anti-market devices which produced financial repression rather than financial deepening.

Table 4. Unit INRS multiple breakpoints test

Sequential F-statistic determined breaks:			
		Scaled	Critical
Break Test	F-statistic	F-statistic	Value*
0 vs. 1 *	442.0738	442.0738	8.58
1 vs. 2 *	474.9774	474.9774	10.13
2 vs. 3 *	32.17653	32.17653	11.14
3 vs. 4 *	21.40183	21.40183	11.83

4 vs. 5	1.527555	1.527555	12.25
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Note : * Significant at the 0.05 level.

Table 5. Unit Break dates:

	Sequential	Repartition
1	1999	1986
2	1992	1992
3	2009	1999
4	1986	2009

The findings in Tables 4 and 5 revealed the existence of four break periods in Exchange rate (EXR). Being a F-stat test, the result showed that, the F-statistics calculated, 0 vs. 1* (442.07), 1 vs. 2* (474.97), 2 vs. 3* (32.17) and 3 vs. 4* (21.40) were found to be greater than their corresponding critical values of 8.85, 10.13, 11.14 and 11.83 respectively for the periods, 1999, 1992, 2009 and 1986 at five per cent level of significance.

The breaks of 1999 was as a result of abolishment of the fixed exchange rate system at the official segment of the market in 1999 and the period where Autonomous Foreign Exchange Market (AFEM) rate was introduced which remained the only recognized exchange rate as at the period. The foreign exchange rate of the naira depreciated in all segments of the foreign exchange market prior to the introduction of Inter-bank Foreign Exchange Market (IFEM) which commenced operation on October 25, 1999. Within this period the exchange rate depreciated to N97.42 to US\$1.00. Within the period under review, the foreign exchange market was further liberalized in October, 1999 with an introduction of an inter-bank foreign exchange market.

In the same vein, on 5th March 1992, the government had to further deregulate the exchange rate system by depreciating the naira exchange rate at the Inter-bank Foreign Exchange Market (IFEM). This was the period that coincided with full deregulated exchange rate system.

The structural break of 2009 coincided with the period of sharp depreciation in the naira – dollar exchange rate arising from the 2008/2009 global financial crises. In addition, the Nigeria economy faltered and was hit by the second round effect of the crises as the stock market collapsed by 70 percent in 2008/2009 and many Nigerian banks sustained huge losses, particularly as a result of exposure to capital market and depreciation of exchange rate in Nigeria [9].

The last periodic break coincided with a new exchange rate introduced in 1986; and the period of Structural Adjustment Programme (SAP). The country operated a fixed exchange rate system up to 1985. A market based exchange rate system, that is, a liberalized system was introduced in the context of Structural Adjustment Programme (SAP). One of the major objectives of exchange rate management was to maintain a market exchange rate and restructure the production pattern along the country's consumption tendencies. The presence of Second-tier Foreign Exchange Market (SFEM) helped foreign exchange transaction to be

liberalized. With the introduction of SAP, in July, 1986, the major aim was to adjust exchange rate towards an optimum level and liberalized the export system.

Discussion

The study conducted the multiple structural breakpoints test. The results revealed that, INRS had three breaks, EXR had four breaks, BCAB had five breaks, and CGDI had three breaks. On the whole, the entire model revealed four breaks in the periods, 1999, 1992, 2009 and 2004 as the case maybe. The breaks was as a result of policy or paradigm shift in the Nigerian economy within the period under review.

The result also showed that structural break points occurred in our model. The break points in the model for 1999, 1992 and 2009 corresponds with exchange rate break points 1999, 1992 and 2009 respectively. The could be caused by the depreciation of exchange rate to the naira in all segment of the foreign exchange market. The breaks of 1992 coincided with the government in furtherance to exchange rate deregulation by depreciating the naira exchange rate of the inter-bank foreign exchange market. This was done in a bid to improve the efficiency of the forex market by reducing the parallel market premium. Furthermore, the 1999 breaks coincided with the sixth consecutive period of increase in the minimum paid up capital of money deposit banks in February, 1990.

In the same vein, the 2009 breaks coincided with the Nigeria economy that witnessed banking distress as a result of global financial crises. The period revealed that at least 10 out of 24 deposit money banks were found in grave liquidity problem. This also witnessed eroded capital base due to non-performing loans and banks credit risk management. Multiple Structural breaks also occurred in each of the exogenous variables used for this study. Therefore, we concluded that the model is statistically significant, while the exogenous variables explain the endogenous variables for the maximum number of lags identified as well as structural breaks that were noticeable in the model.

The main thrust of this study was to examine the impact of banking sector reforms on economic growth in Nigeria using the annual data points for 46 years. The study focused on four major banking reforms in Nigeria: interest rate reform, exchange rate reform, recapitalization reform and corporate governance reform. Consequently, the following major findings were made:

This further explains that EXR has greater influence or impact on economic growth than other variables in the model. The structural breaks in interest rate spread revealed that four breaks were noticeable within the period as a result of unexpected policy shift. Moreover, there were five structural breaks that capital base of banks revealed.

The break came as a result of continual policy paradigm in capital base of banks over time. For Corporate governance disclosure index, the result showed that break point occurred in three period: 2003, 1986, and 2008.

Conclusion

The study took into account the possibility of structural breaks in its analysis. Therefore, it has established that structural breaks exist in all banking reform variables employed in the study. We therefore, concluded that structural change is pervasive in banking sector reform and it can be quite dangerous to ignore. This implies that the structural adjustment programme of 1986 affected these variables in significant ways. Furthermore, the breaks were associated with unstable political, economic and trade liberalization. Besides, the unit root tests in the absence of structural breaks for exchange rate, interest rate, banks 'capital base and corporate governance show that the ADF unit root tests without accounting for the breaks could also be used as a pre-condition for testing for structural breaks and failure to account for the presence of structural breaks in banking reforms data may lead to spurious results. The break in exchange rate had a greater wiggling effects on the economy within the period under review than any other variable because of its coincidental nature with the general model. It is recommended that given that structural breaks are associated with regime changes, there is need for the potential use of regime switching models in Nigeria.

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