# DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN NIGERIA: A MARKOV REGIME-SWITCHING APPROACH

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## ABSTRACT

*Several studies have analyzed the movement of foreign direct investment in Nigeria using linear approach. In contrast with all existing studies in Nigeria, this paper runs several non linear FDI equations where the main determinants of FDI are determined using Markov-Regime Switching Model (MSMs). The approach enables us to observe structural changes, where exist, in FDI equations through time. Asides, where FDI regression equation is truly nonlinear, MSMs fit data better than the linear models. The paper adopts maximum likelihood methodology of Markov-Regime Model (MSM) to identify possible structural changes in level and/or trends and possible changes in parameters of independent variables through the transition probabilities. The results show that FDI process in Nigeria is governed by two different regimes and a shift from one regime to another regime depends on transition probabilities. The results show that the main determinants of FDI are GDP growth, macro instability, financial development, exchange rate, inflation and discount rate. This implies liberalization that stems inflation and enhance the value of domestic currency will attract more FDI into the country.*

## 1. INTRODUCTION

Over the years, several studies have examined various related issues on foreign direct investment (FDI) in both developed and developing countries. The steady stream of theoretical and empirical research on FDI has to do with the impulses and responses it generates in an economy. FDI enhances growth through technology diffusion, human capital development, export promotion, employment generation and productivity growth (Li and Liu, 2005; Liu *et al*. 2009, Alfaro *et al*. 2010, Lee *et al*. 2012, de Mello Jr. 1999, Yao 2006, Ramirez, 2006). In view of the benefits of FDI, the dominant theme of research has been on factors influencing FDI. Early studies have focused on firms and industry specific variables in trying to explain FDI movement. However, in recent time, attention has shifted to spatial aspect of FDI and the subsequent consequences on the expansion of multinational enterprises into foreign markets. The shift of attention to the locational aspect of FDI can be attributed to the realization that countries compete with each other to attract a major share of FDI inflows thereby making changes in domestic policies key factors in attracting FDI. No doubt, location variables are major factors influencing FDI; however, their influence has continued to wane.

This explains the recent emphasis on the role of macroeconomic policies in the host country on FDI inflows (Dunning 2009; Vasconcellos and Kish 1998). It is not surprising therefore that several macroeconomic policy changes were made in most developing countries in the 1980s. These macroeconomic policy reforms were implemented in most developing countries not only to enhance domestic investment but also to foster increased foreign direct investment. Nigeria, in particular, introduced a comprehensive adjustment reforms in mid 1980s to promote increased foreign direct investment and economic growth. Moreover since early 1990s, many macroeconomic policies targeted at fostering increased foreign direct investment into the economy have been implemented. However in spite of all these measures, the share of aggregate FDI inflows in Nigeria relative to the GDP is still low when compared to some other African counties. Also, in aggregate terms, the amount FDI inflows to Nigeria compared to those of the Asian countries is relatively low[1]. Given the various macroeconomic reforms implemented in Nigeria and the aggregate FDI trends over time, it is quite instructive to understand the role of macroeconomic factors on FDI inflows into the country. Surprisingly, only few studies have focused on the effects of macroeconomic factors on inward FDI in Nigeria. Most existing works have focused on the effects of inward FDI on economic growth (Oyinlola 1995, Ekpo 1997, Akinlo 2004, Ekperware 2011, Omonkhanlem 2011 and Oyatoye *et al*. 2011). The few existing research works that examine the impact of macroeconomic vari-

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1    As an illustration in 2002, the aggregate FDI inflows to Malaysia, Indonesia, India and Thailand were $23,823.0m, $11,641.0m, $20,326.0m and $308, 180.0m respectively. However, Nigeria received only $1005.0m. The pattern has not change significantly over the years.

ables on inward FDI in Nigeria are faced with some limitations. First, they all failed to consider potential shifts in constant, trend and parameters of FDI function as they applied either co-integration or error correction modeling approach or vector error correction methodology. Second, all the known studies in Nigeria on the determinants of FDI only modeled a linear function without any formal test of its appropriateness. Therefore, this paper fills these gaps.

The remainder of the paper is organized as follows. In section 2, some stylized facts on FDI inflows into Nigeria are provided. Section 3 gives a capsule summary of literature review. Section 4 describes the methodology and the data. Section 5 presents the results and section 6 contains the conclusion.

## 2. FOREIGN DIRECT INVESTMENT TO NIGERIA: SOME STYLIZED FACTS

This section provides some stylized facts about FDI that motivates my analysis. The supporting data are presented in Tables 1 and 2.

Over the years, Nigerian Government has adopted several policies to attract FDI. In particular, government implemented the structural adjustment programme in mid 1986s. The programme entailed liberalization of the various sectors of the economy, attraction of foreign investors to the manufacturing sector through tax incentives, privatization of several government owned enterprises, and liberalization of the interest and exchange rate. These programmes were implemented in order to provide enabling environment for increased FDI inflows into the economy.

Aggregate FDI inflows into the country increased from ₦1003.2m in 1970 to N9313.6m in 1986. Following the structural adjustment reforms introduced in mid 1986, aggregate FDI inflows increased to N10,436.1m and N119,391.6m in 1990 and 1995 respectively. However, as a result of the nullification of general election in 1993 and the attendant crisis, FDI inflows into the economy experienced downward trend from the year 1996 to 1999. However, the institution of democratic governance in late 1999 coupled with the introduction of various financial and economic reforms in the country, aggregate FDI inflows increased to N157,508.6m in year 2000 and further up to N324,129.3m in 2005 and N482,448.5m in 2006. The aggregate FDI inflows into the country maintained upward trend to attain the peak of N463, 329.3m in 2011. However, aggregate FDI inflows dropped slightly to N459,397.1m in 2012. Although, aggregate FDI inflows into the economy increased for most years between 1970 and 2012, it is important to note, that, the country has not fared well in attracting FDI when compared to other Asian countries as China, Malaysia, Indonesia, Thailand and India.

**Table 1.:** FDI inflows in Nigeria: Some selected Years

| Year | FDI (Nm) |
|------|----------|
| 1970 | 1003.2 |
| 1975 | 2287.5 |
| 1980 | 3620.1 |
| 1985 | 6804.0 |
| 1990 | 10436.1 |
| 1995 | 119391.6 |
| 2000 | 157508.6 |
| 2005 | 324129.3 |
| 2006 | 482448.5 |
| 2007 | 552498.6 |
| 2008 | 399841.3 |
| 2009 | 441271.1 |
| 2010 | 440136.1 |
| 2011 | 463239.3 |
| 2012 | 459397.1 |

*Source:* CBN Statistical bulletin (various years)

In terms of sectoral distribution of FDI in Nigeria, some diversification particularly into the manufacturing sector has occurred over the years. As shown in table 2, unlike the traditional notion that FDI has concentrated more on the primary sector and particularly the extractive sub sector, the trend analysis of capital inflows into the country reveals that other sub sectors like manufacturing and service have benefitted from FDI inflows. Table 2 clearly shows that the mining and quarrying received the highest share of inward FDI in the 70s but the percentage share for the subsector declined in the 80s and early 90s. It however increased phenomenally in the late 1990s and early 2000s only to stabilize at 22 per cent from 2005 through 2012. The share of manufacturing FDI increased from average of 25.1 per cent between 1970-74 to average of 43.7 per cent between 1990 and 1994. The average share FDI to the manufacturing sub sector remained over 40 per cent between 2005-2009 and 2010-2012. The share of trading and business sub sector which was high in the early 70s declined to about 8.2 percentage average between 2005 and 2012.

**Table 2.:** Sectoral Composition of FDI in Nigeria: 1970—2012 Percentage

| Year | Mining & Quarrying | Manufac-turing | Agriculture | Transport & Commu-nication | Building & Construc-tion | Trading & Business | Miscella-neous |
|---|---|---|---|---|---|---|---|
| 1970-1974 | 51.2 | 25.1 | 0.9 | 1.0 | 2.2 | 16.9 | 2.7 |
| 1975-1979 | 30.8 | 32.4 | 2.5 | 1.4 | 6.4 | 20.4 | 6.1 |
| 1980-1984 | 14.1 | 38.3 | 2.6 | 1.4 | 7.9 | 29.2 | 6.5 |
| 1985-1989 | 19.3 | 35.3 | 1.4 | 1.1 | 5.1 | 32.6 | 5.2 |
| 1990-1994 | 22.9 | 43.7 | 2.3 | 1.7 | 5.7 | 8.3 | 15.4 |
| 1995-1999 | 43.5 | 23.7 | 0.9 | 0.4 | 1.8 | 4.5 | 25.3 |
| 2000-2004 | 33.7 | 28.8 | 0.7 | 1.2 | 2.4 | 7.7 | 25.6 |
| 2005-2009 | 22.5 | 40.7 | 0.4 | 2.1 | 2.2 | 8.2 | 23.9 |
| 2010-2012 | 22.3 | 40.4 | 0.4 | 2.1 | 2.2 | 8.2 | 24.3 |
| 1970-2012 | 27.3 | 36.0 | 0.6 | 1.7 | 2.3 | 7.9 | 24.3 |

*Source:* CBN Statistical Bulletin (various years)

In general, the share of FDI inflows into the country is still low. The country needs more FDI inflows given her low income and low domestic savings. External capital is needed for investment and development. This explains why identifying various factors that drive FDI inflows into the country becomes imperative.

## 3. LITERATURE REVIEW

Several theories have been propounded to provide logical foundation on the determinants of FDI in the 1930s. These include the internationalization, monopolistic competition and market structure theories. However, realizing the inadequacies of each of the existing traditional theories in explaining FDI, Dunning (1977, 1981, 1993 and 1988) provided the eclectic paradigm. The eclectic paradigm synthesizes already existing theories on MNEs into what is popularly referred to OLI framework. The OLI framework argues that what determine a country decision to invest abroad are three sets of advantages namely; Ownership (O), Location (L), and Internationalization. The ownership advantages encompasses all the technological, managerial, and marketing assets that allow a firm to compete with others in the markets it serves irrespective of the disadvantages of being foreign. The locational advantages consist of tangible and intangible resources that make the chosen country attractive business environment. Internalization advantages are attributed to own production as against producing through a partnership arrangement such as licensing or a joint venture. They arise from exploiting imperfections in external markets. This includes reduction of uncertainty and transaction costs for more efficient knowledge generation and reduction of state generated imperfections including tariffs, control of foreign exchange and subsidies.

It is argued that the three advantages (ownership, locational and internalization) work together to influence the flow of FDI (Dunning, 2009). However, considering the fact that most firms that intend to invest abroad often possess ownership and internalization advantages; location factor therefore remains the critical consideration. This explains why emphasis, particularly in developing countries, is placed on country specific factors that tend to reduce business risk and enhance market potentials. As pointed by Kiymaz (2009) and Boateng *et al*. (2014), macroeconomic factors including GDP, exchange rate and inflation among several others, provide the means for assessing market potentials and market risk. Indeed, it is contended that internal influences are intricately linked to a firm's assets, competencies and competitive advantages (Hawawini and Schill, 1994). All the same, the role of external or environmental factors in determining decision to investment cannot be completely waved off. As such, FDI would move to a country where it could benefit from a new market that provides a favourable economic environment, reduces cost and risk and enhances firms' competitive advantage (Boateng *et al*. 2015).

Empirically, several studies in both developed and developing economies indicate that FDI depend largely on economic fundamentals such as the degree of macroeconomic and political stability and growth prospects. Most existing studies equally identify good infrastructure, skilled labour force, natural resources endowment, market size, financial development as major determinants of FDI. Few recent studies on the determinants of FDI include Ramirez (2006), Ang (2008), Jeon and Rhee (2008), Buckley et al (2007), Oladipo (2008), Mohamed and Sidiropolous (2010), Feils and Rahman (2008), Bukley et al. (2015) . However, empirical findings from existing studies are inconclusive. While some studies found positive relationship between FDI and some of its determinants; others reported negative. Moreover, most of the existing studies have adopted linear methods of analyzing the linkage between FDI and its determinants[2].

With specific reference to Nigeria, few studies have examined FDI and its determinants. These studies include Obadan (1982), Aremu (1997), Anyanwu (1998), Ajakaiye (1995, 1997), Chette (1998), Wafure and Nurudeen (2010), Thaddeus and Yadirichukwu (2013), Abubakar and Abdullahi (2013) and Akenbor and Tennyson (2014). Several of the studies identify market size, exchange rate and natural resources availability as major determinants of FDI in Nigeria (Obadan 1982, Wafure and Nurudeen 2010, Abubakar and Abdullahi 2013 and Akenbor and Tennyson 2014). Some other factors identified in Nigeria as determinants of FDI are trade policies (Obadan 1982 and Anyanwu1998), interest rate, domestic credit and legal system (Akenbor and Tennyson, 2014) and stock market development (Wafure and Nurudeen, 2010). Few other factors identified by some Nigerian empirical evidences

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2    As argued in the literature, the ambiguity of the findings of these studies may be due to the use of different models, and the models may de sensitive to the samples selected and nonlinearity may be important. If the nonlinearities are not statistically controlled for, any relationship between FDI and its determinants might be questionable as the correlation between them might be wrongly specified, and thence erroneous inferences might be drawn.

with negative effects on FDI are corruption, political risk and trade openness (Akenbor and Tennyson 2014). Thaddeus and Yadirichukwu (2013) show that interest rate, exchange rate and inflation rate have negative effect on FDI while Wafure and Nurudeen (2010) show that openness, inflation and infrastructural development do not have significant effect on FDI inflows in Nigeria.

There are few observations from the studies on FDI determinants in Nigeria. First, controversies still surround the impact of many of the variables on FDI. For example, while some found positive relationship between exchange rate and FDI, few others obtained negative effect. The same applies to such factors as openness, interest rate, infrastructure amongst others. Second, none of the studies has looked at the role of oil reserves on FDI inflows. Finally, all the existing studies on FDI determinants follow constant parameter (linear) time series. None of them consider regime changes or regime shift. There is the need to fill these gaps in the literature. Hence, the main goal of the paper is to determine the statistically significant parameters on FDI in Nigeria taking cognizance of structural changes in parameters by employing Markov-Regime Switching Model (MSM).

## 4. METHODOLOGY

The study utilizes state space model (SSM) based on two main reasons. One, it allows unobserved variables within an observed model. Two in estimation procedure, SSM uses robust algorithm to reach strong optimization (convergence) through iterations in a dynamic system. As pointed out by Kim and Nelson (2000), in a SSM with Markov-Switching, the state variable is an unknown parameter evolving through stochastic difference equation. Following the seminal paper of Hamilton (1988) on regime switching, the shifts in regime or cycles in variables are estimated by MSM. Indeed, several advantages that are associated with SSMs have been noted in the literature. For one, MSM is capable of taking care of asymmetry and persistence in extreme observations in data. For another, it can attain solution in a nonlinear context (Anas *et al*. 2004)[3]. In short, Markov Switching-Regime model has become an alternative to linear models such as autoregressive (AR), moving average (MA) or (autoregressive integrated moving average (ARIMA) model, as it allows change in parameters in a stochastic process[4]. MSM are capable of handling non-

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3    Several studies have used this methodology particularly in the developed economies. These include Hamilton (1989), Durland and McCurdy (1994), Ghysels (1994), Chauvet (1998), Smith and Summers (2005) and Lam (2004)

4    As noted by Kuan (2002, 2010), although linear models such as linear bivariate or multivariate classical regression models, autoregressive (AR), moving average (MA) or autoregressive integrated moving average (ARIMA) can apture the dynamics in data, they are unable to handle some nonlinear properties such as asymmetry, dependency weights and volatility. Generally, it is well established in the literature that Markov approach presents more sophisticated methods and original results compared to other structural breaks tests such as Chow test (Hamilton, 1989, 1990).

linear properties such asymmetry, dependency, weight and volatility. Specifically in relation to our study, this approach is appealing because it fits with the fact that FDI can perform differently in different sub-periods. Asides, MSM permits two or more process to exist with a series of shifts between the states occurring in a probabilistic manner, so that shifts occur exogenously rather been imposed. Another motivation to use the approach is the patterns of FDI into Nigeria, which historically have switched in response to many political and macroeconomic shocks. Finally, with the smoothed probabilities graph, MSM allows us to have a probabilistic approach of appurtenance of each regime, while explaining FDI by its determinants, conditionally with all information of the sample. Through stochastic process, switches in volatility from low level (contraction) to high level (expansion) are captured in a probabilistic procedure as shown by MSM equation 1[5].

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P\left( y_t / Y_{t-1}, X_{t,\,s_t} = \begin{cases} f\{y_t / Y_{t-1}, X_t; \theta_1\} & s_t = 1 \\ f\{y_t / Y_{t-1}, X_t; \theta_m\} & s_t = M \end{cases} \right) \tag{1}
$$

where $Y_{t-i}\left\{y_{t-j}\right\}_i^{\infty}$ = 0 shows the history of $y_t$ which depends on unobservable state variables $s_t \in \{1, 2, \ldots, M\}$, which represents the probability of being in a particular state of the data. $X_t$ and $\theta_m$ with m = 1,2,3,…,M are exogenous variables and parameter vector, respectively (Bilgili $et\ al$. 2012 and Krolzig 2000)

For a two state Markov chain, the four transition probabilities are given as:

$$P\{s_t = 1/s_{t-1} = 1\} = \rho_{11}$$

$$P\{s_t = 0/s_{t-1} = 1\} = 1 - \rho_{11}$$

$$P\{s_t = 0/s_{t-1} = 0\} = \rho_{00} \tag{2}$$

$$P\{s_t = 1/s_{t-1} = 0\} = 1 - \rho_{00}$$

where $s_t$ =0 or 1 represents the unobserved state of equation (Hamilton, 1989). The transition probability takes the range of $0 < \rho_{ij} < 1$ and the transition probabilities summed up to one.

As well, the transition probabilities measure persistence in the regime. Then, the expected duration of a typical recession is written as a reverse function of the probability to remain in recession.

$$\sum_{k=0}^{\infty} K_{\rho 00}{}^{k-1}\left(1 - \rho_{00}\right)^{-1} \tag{3}$$

and the expected duration of a typical expression is given as:

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$$\sum_{k=0}^{\infty} K_{\rho_{11}}{}^{k-1}\left(1-p_{11}\right) = \left(1-\rho_{11}\right)^{-1}. \tag{4}$$

Assuming $\Delta y_t$ denotes growth rate of $y_t$ while $\mu_t$ represents the mean growth of $y_t$. The general form of Makov-Switching model takes the form:

$$\Delta y_t - \mu\left(s_t\right) = A_1\left(\Delta y_{t-1} - \mu\left(s_{t-1}\right)\right) + \dots\dots + A_p\left(\Delta y_{t-\rho} - \mu\left(s_{t-\rho}\right)\right) + u_t \tag{5}$$

where $u_t$ is normally and independently distributed.

The low (repression) phase ($s_t=0$) and high (expansion) phase regimes are related with different conditional distributions of $\Delta y_t$. $\mu$, however, depends on regimes (Bilgili et al 2012, Krolzig 2001). As severally noted in the literature, Markov Switching model given as equation 3 can be extended into a multivariate MSM[6], which is adopted in this paper to analyze the behaviour of FDI in Nigeria. This is formally stated as

$$FDI = \beta_0\left(s_t\right) + \beta_{1t}\left(s_t\right) + \sum_{i=2}^{n} B_i X_{1t}\left(s_t\right) + u_t \tag{6}$$

where FDI is foreign direct investment, s is the state (regime), t is trend, $X_i$ is the explanatory variable $i$ and is the residual time and t is time subscript. The state term in the equation (6) is a vector of states; state (regime 0) and state (regime 1) or equivalently corresponds to vector of regimes. Hence, the parameters of $B_0$, $B_1$, ..., $B_n$ denotes time varying parameters.

Maximum likelihood estimation of this model is performed with quarterly data 1986:1 - 20102:4. This is with a view to investigating the possible structural changes (regime shifts) in level, and/or trends as well as possible changes in parameters of vector **b** in FDI-MSM equations through the transition probabilities as explained in Hamilton (1989, 1990) by conducting analytical derivatives of Feasible Sequential Quadratic Programming explicitly detailed in the work of Lawrence and Tits (2001)[7].

Data

The quarterly data used in the work were obtained from the Central Bank of Nigeria, Statistical Bulletin 2013 edition; IMF, International Financial Statistics and OPEC, OPEC Statistical Bulletin, 2006-2012[8]. GDP is the real GDP. The real GDP

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6  Examples of multivariate MSM can be found in the works of Simon (1996), Jeanne and Masson (2000), Raymond and Rich (1997), Frommel et al. (2005), Ribeiro and Pereira (2010), Liu and Mumtaz (2010).

7  The full description of the steps involved in the analytical derivatives of the Feasible Sequential Quadratic Programming can be found in the work of Lawrence and Tits (2001) titled "A computational efficient feasible quadratic programming algorithm, SIAM Journal on Optimisation, 11, 1092-118".

8  A natural starting point for any time series analysis is the stationary test of the data to be used. All the variables were tested for stationarity using Kwiatkowski-Phillips-Scmdmit-Shin (1992)-KPSS stationarity. All the variables were stationary at first difference. This actually explains the use of growth rates of the variables in our estimation.

is defined as nominal GDP deflated by the consumer price index (1990=100). Exchange rate is the real exchange rate defined as domestic currency per unit of U. S. dollar, discount rate is the Central Bank of Nigeria minimum rediscount rate and inflation rate is the consumer price index (1990=100). Export is the total real export, import is total real import, financial development is measured as the ratio of private credit to GDP, and macro instability refers to macroeconomic uncertainty related to output fluctuations. It is constructed based on a GARCH (1, 1) specification in a simple equation in which the logarithmic real GDP follows an AR(1) process. There is no quarterly series on foreign direct investment and crude oil reserves. However, the annual series of these variables were decomposed into quarterly values using linear quadratic method from E-views package. In estimation, the levels of index (CPI), rediscount and exchange rates and the percentage growth rates of FDI, GDP, export, import, and financial development are used throughout MSM predictions. The growth rates were obtained using equation:

$$Z_t = 100\{(Z_t - Z_{t-4})/Z_{t-4})\}$$

where $Z_t$ and $Z_{t-4}$ denote time series observation at time t (current quarter) and at time t-4 (four quarters earlier), respectively.

## 5. ESTIMATION RESULTS

The results of the four alternative Markov-Switching models 1-4 denoted MSM1, MSM2, MSM3 and MSM4 respectively are shown in table 3[9]. Column 1 of table 1shows constant and potential explanatory variables of FDI to be analyzed in alternative MSMs. Columns 2, 3, 4 and 5 of table 3 show the estimation results of Markov Regime-Switching Model 1 (MSM1), Markov Regime-Switching Model 2 (MSM2), Markov Regime-Switching Model 3 (MSM3) and Markov Regime-Switching Model 4 (MSM4) respectively. As shown in column 2 of table 3, MSM1 uses, in addition to constant and trend, the independent variables of GDP growth, macroeconomic uncertainty and financial development following nonlinear time series regression in which FDI growth serves as the dependent variable. The results show that constant, trend and macroeconomic uncertainty (at low regime, Regime 0) are significant determinants of FDI in Nigeria. GDP growth rate is positively correlated with high FDI growth rate (Regime 1) but negatively correlated with low FDI growth (Regime 0). However, the coefficient is not significant in both Regimes. As expected, Nigerian FDI growth rate is positively correlated with Nigerian financial development at both regimes though the coefficient is only significant at the high regime (Regime 1). This shows that as financial devel-

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9   The study estimated four models because employing all the variables together in a model would generate problem of degree of freedom. Indeed, when the number of parameters to be estimated was increased in each MSM, the results showed either poorer goodness of fit measurements or no strong convergence.

opment increases, the FDI growth rate also increases at Regime 1 and Regime 0[10]. This indicates that financial development possibly acts as a mechanism in facilitating the adoption of new technologies in the domestic economy. Hence, the provision of efficient credit and financial services by the financial system may greatly facilitate technological transfer and induce spillover efficiency. Macroeconomic instability tends to encourage FDI in Regime 0 as against conventional wisdom[11]. This possibly suggests that foreign investors perceive a higher level of uncertainty as greater investment return[12]. As a matter fact, a substantial share of FDI to Nigeria is in the petroleum sub sector. Investment in the sector might be so profitable such that returns after adjusting for risk remains quite substantial. The major implication of this finding is FDI may not enhance growth as composition of FDI may have shifted towards more speculative type of investment.

**Table 3.:** Markov Regime Switching Models for FDI growth: 1986-2012

| Variables/ Regimes | MSM1 | MSM2 | MSM3 | MSM4 |
|---|---|---|---|---|
| Constant (Regime 0) | 13843.09 (0.000) | 15499.05 (0.000) | 13355.73 (0.000) | 4248.75 (0.013) |
| Constant (Regime 1) | 1635.18 (0.000) | 12692.64 (0.000) | 12633.65 (0.000) | 15643.38 (0.000) |
| GDP growth Regime 0 | -0.000031 (0.656) | 0.00427 (0.107) | -0.00038 (0.000) | 0.00156 (0.000) |
| GDP growth Regime 1 | 0.0000169 (0.2024) | -0.00018 (0.052) | 0.0012 (0.438) | -0.00019 (0.000) |
| Trend Regime 0 | 57.87 (0.000) | 82.53 (0.0005) | 344.47 (0.000) | 250.754 (0.069) |
| Trend Regime 1 | 236.26 (0.000) | 319.92 (0.000) | 78.93 (0.438) | 133.38 (0.000) |
| Macro instability Regime 0 | 2597.24 (0.000) | -32121.79 (0.137) | 1850.08 (0.121) | -18763.23 (0.000) |
| Macro instability Regime 1 | -35.31 (0.545) | 1723.78 (0.005) | 485.89 (0.177) | 329.28 (0.239) |

10   This finding is consistent with the findings of Deichmann, Karidis and Sayek (2003) and Ang (2008) but contradict the findings of Anyanwu and Erhijakpor (2004), Anyanwu (2011) and Walsh and Yu (2010).

11   Some of the existing studies that found insignificant correlation between instability (measured as political risk) include Edwards (1990), Jaspersen et al. (2000), Hausmann and Fernandez-Arias (2000) and Asiedu (2002).

12   Indeed, the study by Wafure and Nurudeen (2010) on Nigeria found that political instability had significant positive effect on FDI inflows. His results showed that a 1 per cent increase in political instability leads to 1.6 per cent increase in FDI inflows. According to them, the positive effect of political instability on FDI reflect e the situation in the in the Nigeria's oil sector that has continued to attract more foreign investment regardless of political situation in the country.

| Variables/ Regimes | MSM1 | MSM2 | MSM3 | MSM4 |
|---|---|---|---|---|
| Financial development | 5734.60 | 52523.13 | -8319.78 | |
| Regime 0 | (0.276) | (0.005) | (0.000) | |
| Financial development | 917.38 | -15504.55 | 62121.74 | |
| Regime 1 | (0.058) | (0.000) | (0.000) | |
| Oil reserves | | 0.5880 | | |
| Regime 0 | | (0.174) | | |
| Oil reserves | | 0.2716 | | |
| Regime 1 | | (0.513) | | |
| Import growth | | | -0.0063 | |
| Regime 0 | | | (0.879) | |
| Import growth | | | -0.0543 | |
| Regime 1 | | | (0.799) | |
| Export growth | | | 0.0079 | |
| Regime 0 | | | (0.831) | |
| Export growth | | | -0.652 | |
| Regime 1 | | | (0.019) | |
| Exchange rate | | | | 66.474 |
| Regime 0 | | | | (0.0016) |
| Exchange rate | | | | 113.604 |
| Regime 1 | | | | (0.000) |
| Inflation rate | | | | -132.37 |
| Regime 0 | | | | (0.042) |
| Inflation rate | | | | -19.073 |
| Regime 1 | | | | (0.000) |
| Discount rate | | | 136.09 | -165.47 |
| Regime 0 | | | (0.0006) | (0.123) |
| Discount rate | | | 115.91 | 43.87 |
| Regime 1 | | | (0.0001) | (0.094) |

*Source:* Autor`s

Compared to MSM1, MSM2 incorporates oil reserves as an additional explanatory variable. The incorporation of oil reserves is based on the argument that availability of natural resources is a major determinant of FDI to host country. It is contended that FDI takes place when a country richly endowed with natural resources lacks the amount of capital or technical skill needed to extract or/and sale to the world. Hence, vertical FDI occurs in the host country by foreign firms in order to produce raw materials and inputs for production. Constant, trend, macroeconomic instability (Regime 1) and financial development all have significant coefficients as obtained in MSM1. Oil reserves has positive impact on FDI inflows into the country

as expected, but the coefficient is not significant. This result shows that availability of oil reserves is not a major determinant of FDI inflows into the country. What this possibly suggests is that the huge FDI inflows into the oil sector might be explained by the high level of return on investment in the sector arising from lax policy on capital and remittances and massive corruption in the sub sector[13]. Indeed, few studies including Al-Sadig (2009) and Kim, (2010) have reported positive effect of corruption on FDI inflows.

The third nonlinear evaluation of FDI with its determinants is given as MSM3. It employs besides, constant and trend, the independent variables, GDP growth rate, macro instability, financial development, import growth, export growth and discount rate. Constant term has significant positive sign at Regime 0 and Regime 1 at 1% level of significance. GDP is only positive and significant in Regime 0. Trend is positive in both regimes but significant only in Regime 0. Financial development is significant in both regimes but the coefficient is negative in Regime 0 but positive in Regime 1. Import growth has negative non significant effect in both regimes. This shows that Nigeria's import growth dampens FDI inflows into the country. Similar results have been obtained by Bilgili *et al*. (2012) for Turkey. The negative effect of export growth on FDI emerges in high FDI growth rate periods while non significant positive effect of export growth on FDI appears on low FDI growth rate periods. This means that when Nigeria's capability to export increases, FDI shrinks. Discount rate has positive effect on FDI in both Regimes and the coefficient significant at 1% significance level. This simply shows that as the discount rate increases, FDI grows. This should not come as a surprise because for most periods before mid 1986, the interest rate was administratively fixed by the Monetary Authority which led to high financial repression and inefficiency with adverse impact on investment and economic growth. Hence, the liberalization of the interest rate in early 1987 might have led to increased efficiency in resource allocation and thus increased domestic and foreign investment. This finding supports the argument of Yang *et al*. (2000) and Jeon and Rhee (2008) that higher interest rates in the host country make foreign investment more attractive as they lead to profitable investment. Our finding is consistent with the Boateng *et al*. (2015) result for Norway.

The final alternate nonlinear evaluation of FDI with its determinant is reported as MSM4 in table 3. MSM4 employs, besides, constant and trend, the independent variables GDP growth rate, macroeconomic uncertainty, exchange rate, inflation and discount rate. As in MSM1 and MSM2, constant and trend are both positive and significant at both 1% and 10% significance levels. GDP growth rate is positively related to FDI in Regime 0 but negative in Regime 1. When GDP growth rate increases, FDI grows and vice versa. MSM4 reveals that FDI growth is associated positively with ex-

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13   Indeed, over the years, the oil sector has been characterized by massive level of corruption running into several billions of Dollars. The operation of the subsector has shrouded in secrecy without transparency and accountability. In 2012, the then Governor of Central Bank of Nigeria alleged that $20 billion was stolen from the oil revenue that accrued to Federal Government of Nigeria.

change rate at both regimes (Regime 0 and Regime 1). This suggests that an appreciation of the domestic currency (Naira) encourages FDI inflows into economy. This result seems to contradict the findings of some existing studies that depreciation of exchange rate leads to increase in FDI inflows (Froot and Stein 1991, Ang 2008, Azrak and Wynne 1995 and Ramirez 2006). The finding that appreciation leads to increase FDI inflows could possibly be explained by the fact that the nominal return that asset yields in foreign currency should be the main consideration as against the price of the asset in factor explaining FDI inflows. This is as discussed by McCulloch (1989). Our result actually supports the argument by Campa (1993) that positive relationship exists between exchange rate and FDI. Campa argues that an appreciation of the host country's currency will spur increase investment expectation of increased future profit. Empirical study by Boateng, et al. (2015) for Norway supports the postulation by Campa (1993). Inflation is negatively correlated with FDI growth and is significant at 5% and 1% significance levels for Regime 0 and Regime 1 respectively. This result shows that high inflation rates in the host country dampens FDI inflows. This finding can be explained by the fact that high inflation rate reduces the real value of earnings in local currency for inward investment firms as explained by Buckley *et al.* (2007). Our finding is consistent with general finding in the literature including Nnadozie and Osili (2004), Khair-Uz-Zaman and Awan (2006), Anyanwu, (2011), Wafure and Nurudeen (2010) and Boateng *et al.* (2015).

As shown in table 4, all the models seem to perform well. However, MSM1 model seems to fit the data best according to lowest AIC of 13.66908 and highest Log Likelihood of -709.4616 among others. The second best model in the work in terms of AIC and Log-likelihood is MSM3. Using the variance as a measure of goodness of fit, the variance of Regime 1 (102.80) and Regime 0 (5.09638e-006) choose MSM1 as best model among alternatives in this work.

**Table 4.:** Switching variances, transition probabilities and test statistics of Markov Regime-Switching Models: 1986:1-2012:4

|  | **MSM1** | **MSM2** | **MSM3** | **MSM4** |
|---|---|---|---|---|
| Sigma 0 | 5.09638e-006 | 6.819972e-006 | 6.529383e-006 | 6.616353e-006 |
| Sigma 1 | 102.80 | 135.38 | 130.58 | 132.32 |
| P[0/1] | 0.020910 | 0.027468 | 0.033239 | 0.036729 |
| P[1/1] | 0.979090 | 0.972532 | 0.966764 | 0.963271 |
| P[1/0] | 1.000000 | 1.000000 | 1.000000 | 1.00000 |
| P[0/0] | 0.00000 | 0.000000 | 0.000000 | 0.000000 |
| Log likelihood | -709.4614 | -896.378 | -863.3534 | -887.1653 |
| AIC | 13.66908 | 17.02908 | 16.49259 | 16.91498 |
| Linearity Test ($\chi2$) | 2686.4873 | 2351.3589 | 2828.429 | 2383.764 |
|  | (0.0000) | (0.0000) | (0.0000) | 0.0000 |

*Note:* Below the linearity test values are the p-values
*Source:* Autor`s

In general, the four models perform well considering the fact that they all attain strong convergence through SQPF analytical derivatives. Asides, the differences amongst the models in terms of signs and significance of the coefficients are, to a reasonable extent not sharp. Constant has similar signs and significances. The same applies to Trend except for MSM3 (Regime 1) and MSM4 Regime (0) where the coefficients are not significant at 5% level. Financial development has similar signs and significance. However, minor differences exist. The coefficient of financial development is negative in both MSM2 (Regime 0) and MSM3 (Regime 1). The other difference is that GDP growth rate is positive and significant at MSM4 (Regime 0), it is negative and significant at MSM4 (Regime 1) and MSM3 (Regime 0). The coefficients of GDP growth rates are not significant at both Regimes in MSM1 and MSM2.

As revealed in table 4, linearity test show that the null of linearity of four MSMs are rejected at 1%. This simply means that for the four MSMs, conducting nonlinear estimations are more desirable than their linear counterparts. The transition probabilities for the four MSMs are also shown in table 4. They all show that when the current state of FDI in Regime 1 at time t, the probability of jumping FDI from Regime 1 to Regime 0 at time t+1 is 0.0295865 on average. The probability is lowest in MSM1. As the current state is Regime 1 at time t, the probability of remaining at Regime 1 at time t+1 is 0.9704125 on average. From table 4, probability of FDI growth's switching from current Regime 0 to Regime 1 is 1.0000. It can be asserted that the cumulative effect of any shock in the system (in MSM FDI equation) to Nigerian FDI growth rate is persistent in Regime 1 while in Regime 0, the responses of FDI to shock(s) is temporary.

It is possible to observe the time duration (Regime Classification) of the smoothed probabilities. Figures 1a-b to Figures 4a-b provide the smoothed probabilities of Regime 0 and Regime 1 of MSM1 to MSM4 respectively. Regime 0 time points as revealed in Figure 1a are 1991:1; 1998:1-1998:4 and 2001:1-2004:4. Figure 1b: shows that Regime 1 covers periods 1986:3-1990:4, 1992:2-1997:4, 1991:1-1999:4 and 2001:1-2012:3.
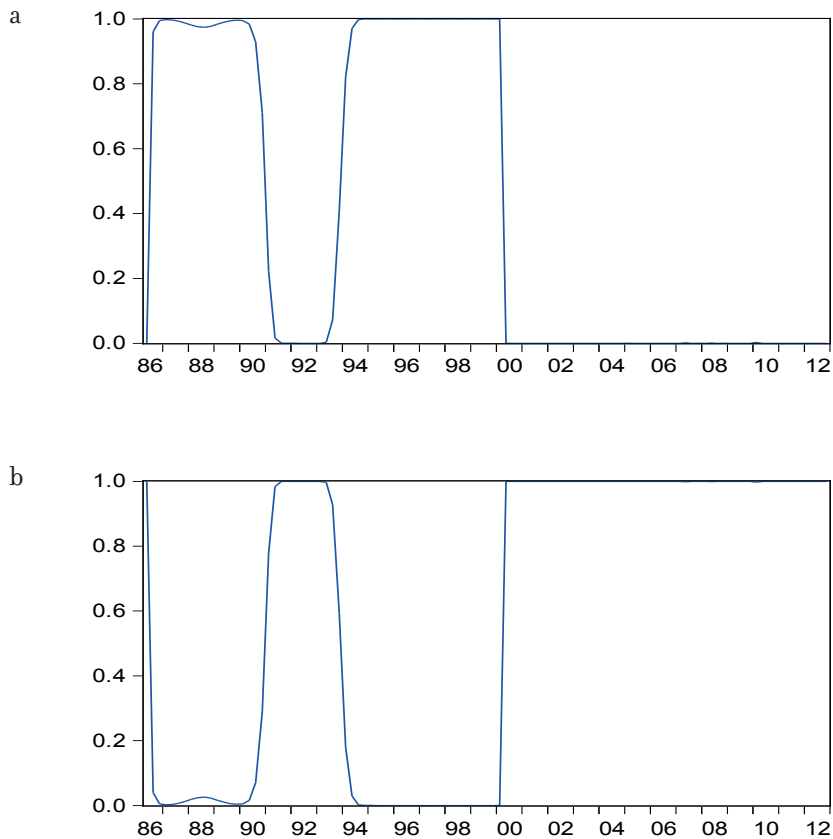
**Figure 1.:** Probability of regime 0 smoothed from MSM1. b: Probability of regime 1 smoothed from MSM1
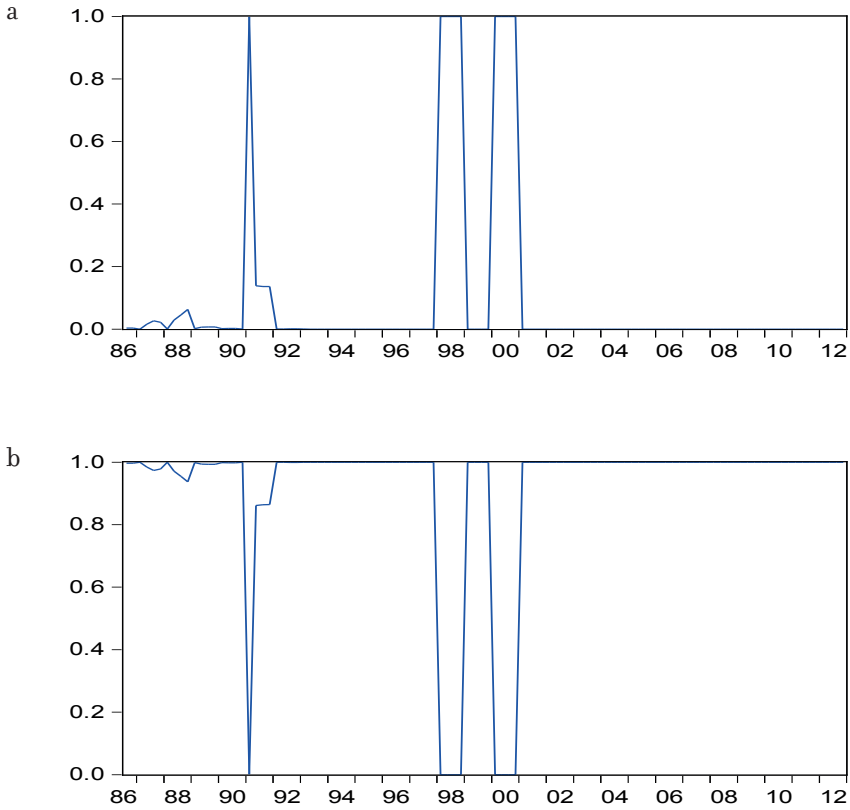
With respect to MSM2, Regime 0 time points are 1987:1-1990:1 and 1994:4-2000:1. However, from Figure 2b, Regime 1 periods include 1991:3-1993:2 and 2000:3-2012:3. From Figure 3 (a) the time points are 1991:2-1992:2; 2000:1-2006:4 and 2009:1-2012:3. Figure 3b reveals that Regime 1 covers periods 1986:2-1990:3 and 1993:3-1999:4.

**Figure 2.:** Probability of regime 0 smoothed from MSM2. b. Probability of regime 1 smoothed from MSM2
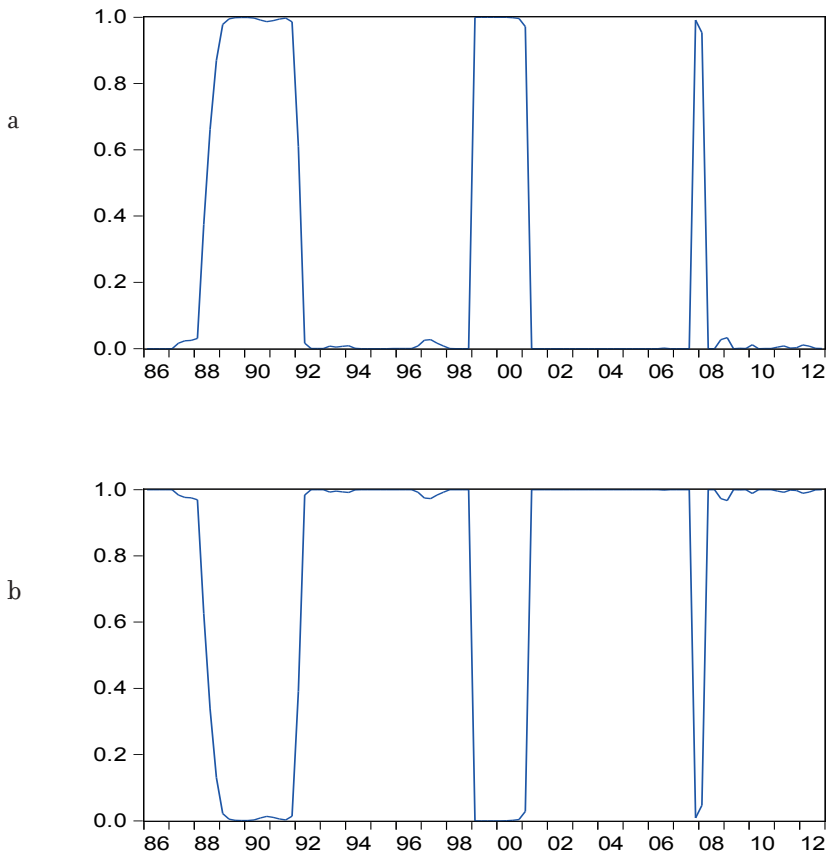


*Source:* Autor`s

**Figure 3.:** Probability of regime 0 smoothed from MSM3. b: Probability of regime 1 smoothed from MS

a



b
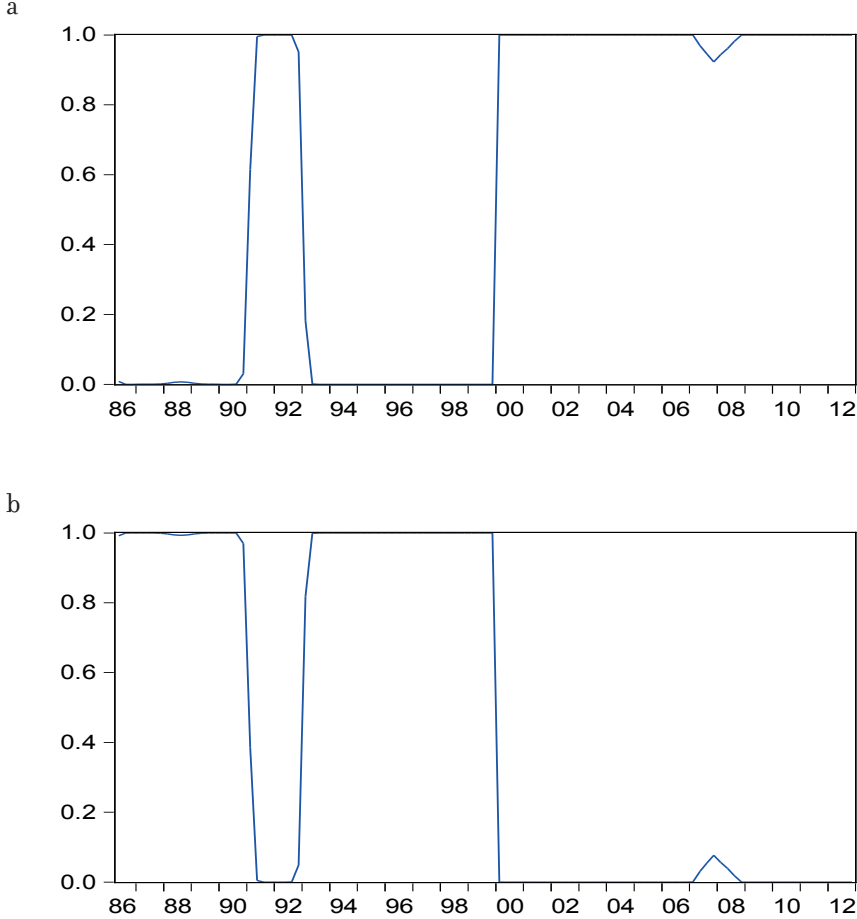


*Source:* Autor`s

Finally, from Figure 4a, Regime 0 time points are 1988:1-1992:2, 1977:3-2001:2 and 2008:1. As revealed in Figure 4b, time points for Regime 1 are 1986:1-1987:2, 1992:4-1998:4, 2001:3-2007:3 and 2008:2-2012:3. Few observations from the time points of the various regimes include one, MSM4 regime include one more time point (2008:1) into Regime 0 classifications in comparison with MSM1 and MSM2. This simply means that the first quarter of 2008 is not considered high.

**Figure** 4.: Probability of regime 0 smoothed from MSM4. b: Probability of regime 1 smoothed from MSM4

a



b



*Source:* Autor`s

FDI point in MSM4. Two, MSM3 adds far more time periods (2000:1-2006:4) and (2009:1-2012:3) into regime 0 classification in comparison with MSM1 and MSM2. Thus, by implication, means that the various quarters 2001:1-2006:4 and 2009:1-2012:3 are not considered high FDI points in MSM3. Regime 0 classification based on smoothed probabilities from MSM1 covers 9 quarters (8.33 per centage of total) with average duration of 2 quarters. In respect of Regime 1 classification based on smoothed probabilities from MSM1, it is made up of 99 quarters (91.67 percentage of total) with average duration of 19.81 quarters. Regime 0 classification of MSM2 includes 35 quarters representing 32.41 percentage of the total. The percentage of Regime 1 point of MSM2, on the other hand, is 67.59. Regime 0 classifications of MSM3 and MSM4 include 43 and 24 quarters respectively. The percentages of Regime 1 points of MSM3 and MSM4, on the other hand, are 60.19 and 77.78 respectively.

At this juncture, it is pertinent to understand some realizations of the Nigerian economy corresponding, in particular, to Regime 0 classification. Considering MSM1 best among others, one may focus Regime 0 points of MSM1. The third quarter of 1986 pertains to the structural adjustment and liberalization programme in Nigeria (Akinlo, 1996). This programme entailed liberalization of the exchange rate, interest rate and massive export promotion. The first quarter of 1991 marked the beginning of a precipitous fall in oil price from $29.10 bbl in 1990 to $20.50 bbl. This sharp reduction in oil price had significant adverse effect on total revenue. The trade balance ratio which was 24 per cent in 1990 dropped sharply to 0.27 per cent in 1991. The first quarter of 1998 marked the height of the banking crises which started in 1994 in the country. A total of 36 banks were liquidated in 1998 due to fraud, mismanagement, and undercapitalization. This problem led to a sharp reduction in credit flows to the private sector with adverse effects on employment, output and economic growth. Moreover, this period marked the beginning of reversion to managed floating exchange rate for the purpose of fostering competitiveness of the economy, encourage export and discourage importation. Arising from the regime shift, the naira exchange rate to dollar increased to 92.6931 as against 90.00 in the last quarter of 1999. The first to fourth quarters of 2000 represent the data points of the bitter political battle with the National assembly - in essence, to delineate the boundaries of their respective authorities under the democracy. Moreover, the new constitution, which gives state and local governments full and automatic right to their shares of the oil revenues, severely constrained the management of the oil windfall gains. Thus in 2000, oil windfall, defined as oil revenue in excess of US$20 per Barrel (so-called excess proceeds), amounted to US $4 billion, or 10 per cent of the GDP. Government at the both National and State levels engaged in huge spending including award of huge wages to public servant in May 2000 which precipitated increased rate of inflation and massive exchange rate depreciation. The other Regime 0 time points from MSM4 namely 2007:4 and MSM3 (2007:3 -2012:3) may represent global financial crises that arose from the US house bubble and the attendant increased default rates on mortgage rate. The world economy was not spared of negative spillover effect of the global financial crises. In Nigeria, several policies were initiated to mitigate the spillover effects of the global financial crises on the domestic economy. These measures included consolidation of the banking sector, reduction in the monetary policy rate and liquidity ratio (from 40 to 30 per cent) as well as a reduction in cash reserve requirements.

In general, from the discussion above, it could be inferred from regime classifications of MSMs that the deviations of each FDI growth rate equation from its mean are not transient. Consequently, perturbations in parameters of constant, level and some of explanatory variables would be persistent. Moreover, the findings emphasize the fact that structural changes (i.e. shocks to each FDI equation) are, in most cases, permanent. This, by implication, means that the potential or probable

persistent shifts in parameter in time series model of FDI would generate bias and inconsistent estimators of FDI fluctuations. Hence, potential parameters shift must be taken into consideration in time series FDI modeling.

## 6. CONCLUSION

The paper examines the dynamics of FDI in Nigeria using the Markov Regime Switching approach. The study employs quarterly data for growth rates of FDI, GDP, export, import, macroeconomic uncertainty, inflation, discount rate, exchange rate, financial development and oil reserves for the period 1986:1 to 2012:4. The paper is distinct from all the previous studies in Nigeria in two ways. First, the adoption of Markov Regime-Switching models which enables us to examine FDI cycles in Nigeria taking cognizance of the potential shifts in parameters of the explanatory variables included in model including constant and trend. Second, the study runs nonlinear estimations of parameters in FDI equations after the tests for null hypothesis of linearity against alternative hypothesis of nonlinearity had been conducted.

The fundamental argument in this work is that FDI process is governed by two different states (otherwise called Regimes) and that a movement from one Regime to another is a function of the transition probabilities. Also, as found by Bilgili et al. (2012) for Turkey, a regime is determined endogenously through the inferences derived the probability of obtaining one regime (0 or 1) depending on previous regime prevailing.

The results show that the coefficient of GDP growth rate is negative and significant in at least one regime of the four MSMs except in MSM1 (Regime 1) and MSM4 (Regime 0) where it is positive. This might be that foreign investors perceive economic growth in Nigeria as non inclusive. As such, increased economic growth rate might not necessary spur foreign investment. Second, except in MSM2 and MSM3 (Regime 1 and Regime 0 respectively), financial development is positively correlated with FDI. Availability of natural resources (oil reserves) though positively correlated with FDI, is not a major determinant of FDI. FDI growth rate is positively correlated with exchange rate and discount rate in both Regimes but correlated negatively with inflation in regimes 0 and 1.

From policy perspectives, the following points are germane. First, government efforts at developing the financial sector will spur increase in FDI inflows into the economy. This therefore calls for more far reaching reforms in the financial subsector. The liberalization policy in the sector must be pursued to the logical conclusion as our results show that interest rate engenders increased FDI inflows. Second, there is the need to enhance the value of the domestic currency to boost higher FDI inflows. This could be done through increased domestic productivity. Third, government should ensure that the rate of inflation is maintained at low level in order not to deter FDI inflows into the country. Moreover, government efforts at reducing importation while increasing exports will serve to boost FDI inflows into the economy.

In conclusion, preponderance evidence from the estimations shows clearly that macroeconomic factors play significant role in FDI inflows. Hence, policy makers in host country must ensure that macroeconomic policies are designed to provide enabling environment for increased FDI inflows. Also, the shifts in parameters of Markov Regime-Switching model demonstrate the need to keep track of potential possible structural changes in parameters to obtain unbiased and efficient estimations.

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