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The Cashless Policy and Foreign Direct Investment in Nigeria: A Vector Error Correction Model (VECM) Approach

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Abstract

The study undertakes an econometric research to analyze the cashless policy and its effectiveness on attracting foreign direct investment in Nigeria using quarterly data of 2006 to 2012. The log linear vector error correction model (VECM) was adopted to examine how automated teller machine (ATM), interbank transfer (IBT) and Mobile money (MM) had impacted on foreign direct investment (FDI). Unit root test was carried out on each of the variables to determine their level of stationarity. They were however found stationary after first difference and then used for the regression analysis. From the various regression results, we find out that the cointegration test confirmed the existence of long run relationship among the variables, while the granger causality shows a bi-directional relationship where IBT and MM was said to granger cause FDI in Nigeria. In the VECM model result, all the explanatory variables are positive and significant meaning that they all contribute positively to the increase in FDI in the country. The study recommends that the use of ATM, IBT and MM should be much more encouraged in Nigeria, with proper awareness on its benefit. Also effective policy needs to be developed by the government through the CBN to ensure the effectiveness and efficiency of ATM, IBT and MM.

Keywords: Automated teller machine (ATM), Interbank transfer (IBT), Mobile money (MM), Foreign direct investment (FDI), Vector error correction model (VECM), and granger causality

1. Introduction

Foreign Direct Investment (FDI) has been debated to be an important vehicle for the transfer of technology, contributing to growth in larger measure than domestic investment. Therefore, the need for the Government to provide special incentives in order to motivate foreign firms to set up companies in the country becomes an important issue. Carkovic and Levine (2002) noted that the economic rationale for offering special incentives to attract FDI frequently derives from the belief that foreign investment produces externalities in the form of technology transfers and spillovers. Several governments in African countries, Nigeria inclusive, have formulated various policies towards stimulating economic activities by attracting FDI. Unfortunately, the efforts of most countries in Africa to attract FDI have been futile in spite of the perceived and obvious need for FDI on the continent.

The Nigerian government has been trying to provide an investment climate conducive for foreign investments, since the inflow of foreign investments into the country has not been encouraging. The need for foreign direct investment in Nigeria is borne out of the underdeveloped state of the country's economy that essentially hinders the pace of her economic development. Despite the various macroeconomic measures put in place by the Nigerian government, there seems to be insufficient inflow of FDI into the country.

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The new payments system is expected to play a very crucial role in any economy, being the channel through which financial resources flow from one segment of the economy to the other, and from investment activities abroad. It, therefore, represents the major foundation of the modern market economy (CBN, 2011). According to CBN, the new cash policy was introduced for a number of key reasons, including, To drive development and modernization of our payment system in line with Nigeria's vision 2020 goal of being amongst the top 20 economies by the year 2020. An efficient and modern payment system is positively correlated with economic development, and is a key enabler for economic growth. To reduce the cost of banking services (including cost of credit) and drive financial inclusion by providing more efficient transaction options and greater reach and to improve the effectiveness of monetary policy in managing inflation, attract foreign investment and driving economic growth.

In addition, the cash policy aims to curb some of the negative consequences associated with the high usage of physical cash in the economy, including: high cost of cash: high risk of using cash, high subsidy, informal economy and inefficiency & corruption (CBN, 2011)

According to (Cobb, 2004), the value of electronic payment goes way beyond the immediate convenience and safety of cards to a greater sphere of contributing to overall economic development.

Against this backdrop, the study seeks or aims to analyze the positive and negative policy implications of cash-less banking on foreign direct investment (FDI), with a view to exposing the possible benefits and challenges poses on FDI and the economy in general.

2. Literature Review: Theoretical and Conceptual Framework/Review

Theory of Foreign Direct Investment

Renewed research interest in FDI stems from the change of perspectives among policy makers from "hostility" to "conscious encouragement," especially among developing countries. FDI had, until recently, been seen as "parasitic" and retarding the development of domestic industries for export promotion(Imoudu, 2012). However, Bende-Nabende and Ford (2002) earlier submitted that the wide externalities in respect of technology transfer, the development of human capital and the opening up of the economy to international forces, among other factors, have served to change the former image. Caves (1996) observed that the rationale for increase efforts to attract more FDI stems from the belief that FDI has several positive effects. Among these are productivity gain, technology transfers, and the introduction of new processes, managerial skills and know-how in the domestic market, employee training, international production networks, and access to markets. Carkovic and Levine (2002) notes that the economic rationale for offering special incentives to attract FDI frequently derives from the belief that foreign investment produces externalities in the form of technology transfers and spill-over. According to Athukorala (2003), FDI provides much needed resources to developing countries such as capital, technology, managerial skills, entrepreneurial ability, brand and access to markets which are essential for developing countries to industrialize, develop, create jobs and attack the poverty situation in their countries.

Another popular conceptualization of, and theoretical framework for, FDI determinants is the "eclectic paradigm" attributed to Dunning (1988, 1995). It provides a framework that groups micro- and macro-level determinants in order to analyze why and where multinational companies (MNCs) invest abroad. The framework posits that firms invest abroad to look for three types of advantages: Ownership (O), Location (L), and Internalization (I) advantages; hence it is called the OLI framework. The ownership-specific advantages (of property rights/patents, expertise and other intangible assets) allow a firm to compete with others in the markets it serves regardless of the disadvantages of being foreign because it is able to have access to, and exploit and export natural resources and resource-based products that are available to it(Anyanwu,2011). These advantages may arise from the firm‟s ability to coordinate complementary activities such as manufacturing and distribution, and the ability to exploit differences between countries. The location advantages are those that make the chosen foreign country a more attractive site (such as labor advantages, natural resources, trade barriers that restrict imports, gains in trade costs and strategic advantages

through intangible assets) for FDI than the others hence the reason for the FDI is to supply the domestic market of the recipient country through an affiliate (horizontal FDI). The location advantages may arise from differences in country natural endowments, government regulations, transport costs, macroeconomic stability, and cultural factors. Internalization advantages arise from exploiting imperfections in external markets, including reduction of uncertainty and transaction costs in order to generate knowledge more efficiently as well as the reduction of state-generated imperfections such as tariffs, foreign exchange controls, and subsidies. In this case, the delocalization of all or a portion of the production process (e.g. production of components/parts and/or different locations) leads to low costs benefits (vertical FDI) (Baniak et al, 2005; Sekkat and Veganzones-Varoudakis, 2007; Pantelidis and Nikolopoulos, 2008; and Kinda, 2010). Following on these, Dunning (1993) identified four categories of motives for FDI: resource seeking (to access raw materials, labor force, and physical infrastructure resources), market seeking (horizontal strategy to access the host-country domestic market), efficiency seeking (vertical strategy to take advantage of lower labor costs, especially in developing countries), and strategic-asset seeking (to access research and development, innovation, and advanced technology) (Cleeve, 2008).

The Theory of Money

Money plays an important role in facilitating business transactions in a modern economy. Various theories of money has been propounded to examine the all round effect of money towards economic transactions. The quantity theory of money is hinged on the Irvin Fisher equation of exchange that states that the quantum of money multiplied by the velocity of money is equal to the price level multiplied by the amount of goods sold. It is often replicated as MV= PQ, M is defined as the quantity of money, V is the velocity of money (the number of times in a year that a currency goes around to generate a currency worth of income), P represents the price level and Q is the quantity of real goods sold (real output). By definition, this equation is true. It becomes a theory based on the assumptions surrounding it.

The first assumption is that velocity of money is constant. This is because the factors, often technical, habitual and institutional, that would necessitate a faster movement in the velocity of money evolve slowly. Such factors include population density, mode of payment (weekly, monthly), availability of credit sources and nearness of stores to individuals. This assumption presupposes that the velocity of money is somewhat independent of changes in the stock of money or price level. However, the Keynes liquidity preference theory suggests that the speculative components of money demand affect money velocity.

Friedman in his modern theory of the quantity theory of money further explores the variables that could affect the velocity of money to include human/nonhuman wealth, interest rate, and expected inflation.

The second assumption guiding the QTM is that factors affecting real output are exogenous to the quantity theory itself. In other words, monetary factors do not influence developments in the realeconomy. The third assumption states that causality runs from money to prices. Thus, the quantity theory of money can be represented as

$$MV \rightarrow PQ$$

In simple terms, this states that prices vary proportionally in response to changes in the quantum of money, with velocity and real output invariant.

The Cashless Policy Concept

Cashless economy does not refer to an outright absence of cash transactions in the economic setting but one in which the amount of cash-based transactions are kept to the barest minimum. It is an economic system in which transactions are not done predominantly in exchange for actual cash (Daniel,Swartz, and Fermar, 2004). Vassiliou (2004) defines electronic payment as a form of financial exchange that takes place between the buyer and seller facilitated by means of electronic communication. According to (Cobb, 2004), the value of electronic payment goes way beyond the immediate convenience and safety of cards to a greater sphere of contributing to overall economic development. Electronic money is also an electronic store of monetary value on a technical device that may be widely used for making payments to undertakings other than the issuer without necessarily involving bank accounts in the transactions, but acting as a prepaid bearer

instrument. A cashless society possesses the following characteristics; all the money used is issued by private financial institutions (banks, and possibly other firms). It is conceivable that the central bank continues to operate like other banks, issuing its own deposits that could be used as money in the same way as other bank deposits are. However, in that case the central bank has no monopoly in the issue of Money. In a cashless society the unit of account (e.g. Dollar, euro) remains a national affair and is provided by the state. The followings among others enhance the functioning of cashless economy; e-finance, e-banking, e-money, e-brokering, e-exchanges etc(Shittu, 2010) In a modern economy, the use of noncash payment methods such as cards (credit and debit) dominates the use of cash in payments. The card based payment system has several players. On the one hand, are the providers of the card based payment system- first of which is the card companies like MasterCard and Visa who provide their payment network for the system to function. The second sets of providers are the banks that act as acquirers for merchants and issuers for cardholders and reach the card payment services to the ultimate users. For these two parties, the card payment system is an income generating initiative and they are motivated to run the system as they are able to generate adequate profits out of their operations. On the other side of the system are the users- both merchants and cardholders.

Syanbola(2013) noted that the most outstanding cashless banking channels world over are Mobile banking; internet banking; telephone banking; electronic card; implants; PoS terminals and ATMs. Electronic banking is also a system by which transactions are settled electronically with the use of electronic gadgets such as ATMs, POS terminals, GSM phones, V-cards etc, handled by e-holders, bank customers and other stakeholders(Edet, 2008).

3. Model Specification and Analysis Techniques

The Structural Model

This section is preoccupied with the formulation of an appropriate model, which theoretically establishes the relationships between our cashless variables and FDI variable. For this purpose, the equation below have been formulated and simultaneously analyzed:

$$FDI = f(ATM, IBT, MM) \text{--------} 1$$

Specifying equation (1) in an exponential regression model, we have;

$$FDI = \alpha ATM^{\beta_1} IBT^{\beta_2} MM^{\beta_3} e^{\mu_t} \text{--------} 2$$

In this form, the coefficients $\beta_1, \beta_2, \beta_3$ can be directly estimated by applying log-linear regression techniques via logarithmic transformation; and those coefficients will be the elasticities. Taking natural logs of both sides of the equation, we have:

$$\log FDI = \log \alpha + \beta_1 \log ATM + \beta_2 \log IBT + \beta_3 \log MM + \mu_t \text{--------} 3$$

Where;

α = is the autonomous parameter (or the intercept)

FDI = Represent foreign direct investment

ATM = ATM is combined computer terminal, with cash vault and record-keeping system in one unit, permitting customers to enter the bank's book keeping system with a plastic card containing a Personal Identification Number (PIN).

IBT = Inter-bank transfer is the amount transferred online from one bank to another

MM = A mobile money payment is an electronic payment made through a mobile device (e.g., a cell phone or a PDA). This uses a mobile device to initiate and confirm electronic payment.

μ_t = represents the stochastic error term.

Estimation Techniques

The estimation techniques to establish the relationship between FDI variable and Cashless variables take the following form: firstly, we employs KPSS test for the stationarity test of the variables , after which Johansen and Juselius cointegration test will be employed to examine if there is long run relationship between the variables, VAR modeling, impulse response function, variance decomposition and granger causality. All this is to affirm to a reasonable extent the conclusion to be drawn from our analysis as this work will be first of its kind to employ these sets of techniques in analyzing the relationship between FDI and Cashless policy in Nigeria.

Stationarity Test

It is important to note that the level at which time series variables change overtime are different from each other. Therefore, examining the linear relationship between those variables will lead to problem. Such problem is called stationarity problem. Stationarity of a series is an important phenomenon because it can influence its behaviour. Considering a simple model

$$Y_t = Y_{t-1} + U_t \qquad 3.1$$

Y_t is no-stationary when the mean, variance and covariance are not constant overtime. Hence, there is a need to apply differencing operator (Δ) to it. If a non-stationary series, Y_t must be differenced d times before it becomes stationary, then it is said to be integrated of order. We write $Y_t \sim I(d)$. Therefore, I(0) means the series is stationary at level, I(1) means the series is stationary at first difference and I(2) shows a stationarity of a series at second difference or integration of order (0), (1) and (2) respectively .

Three standard procedures of unit root test namely the Augmented Dickey Fuller (ADF), Phillips-Perron (PP), and the Kwiatkowski-Phillips- Schmidt-Shin (KPSS) tests have being commonly employed in literatures. As for this study, the KPSS tests will be employed to test the stationarity of the variables

Johnasen Cointegration Test

If two or more series are individually integrated (in the time series sense) but some linear combination of them has a lower order of integration, then the series are said to be cointegrated.

This study uses two tests to determine the number of cointegration vectors: the Maximum

Eigenvalue test and the Trace test. The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for r = 0, 1, 2…n-1.

This test statistics are computed as:

$$LRmax(r/n+1) = -T*\log(1-\lambda) \qquad 3.2$$

Where λ is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Its equation is computed according to the following formula:

$$LR_{tr}(r/n) = -T*\sum_{i=r+1}^{n} \log(1-\pi i) \qquad 3.3$$

In some cases Trace and Maximum Eigenvalue statistics may yield different results. In this case the results of trace test should be preferred.

Vector Error Correction Model (VECM)

A vector error ccorrection model is a way to model nonstationary variables that appear to converge to a long-run cointegrating relationship. In the VEC model the adjustment parameters show how each variable deviates in the short-run from the long-run equilibrium relationships given by the cointegrating vectors. Therefore, to study both the short-run and the long-run dynamics between nonstationary but cointegrated variables and the dynamic interactions between them one should estimate a VEC model and make inferences using this system.

A vector autoregression (VAR) model of order p with n variables can be represented by the following equation:

$$Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots\ldots + \alpha_p Y_{t-p} + \beta X_t + \mu_t \qquad 3.4$$

where Y*t* is an (*n1*) vector of endogenous variables , X*t* is an (*m1*) vector of deterministic terms, β is an (*nm*) matrix of coefficients on the deterministic term, α*i*'s for *i=1,2,..,p* are (*nn*) matrix of autoregressive coefficients, and an (*n1*) vector of non-autocorrelated disturbances (innovations) with zero mean and contemporaneous covariance matrix .$E[\varepsilon_t \varepsilon_t^{'}] = \pi$.

The Var(*p*) model defined in the above equation (2) can be appropriately reparametrized as:

$$\Delta Y_t = \Omega Y_{t-1} + \sum_{i-1}^{p-1} \Omega i \Delta Y_{t-I} + \beta X_t + \mu_t \qquad 3.5$$

Where now $\Omega = -(I - \sum_{i=1}^{P} \alpha)$ and $\Omega i = \sum_{k=i+1}^{p} \alpha\, t$ are ($n \times n$) matrix of coefficients and *I* is an ($n \times n$) identity matrix.

The rank of matrix Ω equals to the number of independent cointegrating vectors. The rank of this matrix (denoted by *r*) could be between 0 and n. If rank of matrix Ω is equal to 0, all of the *n* variables are unit root processes and are not cointegrated. In this case, the VAR should be solely specified in first differences. It is clear from this discussion that, a VAR model in first differences should not be estimated unless there are no cointegrating relationships between the I(1) variables involved. At the other extreme, if rank of Ω equals to *n*, then the VAR model consists of all stationary variables. In the interim cases, where the rank Ω of is between 1 and (*n-1*), there are multiple cointegrating vectors. In this last case, it is appropriate to work with the vector error correction model (VECM) formulation of the VAR model given in equation (3.5).

Therefore, this paper employs a vector error correction mechanism (VECM) technique after cointegration has been established among the variables. The VECM is adopted to estimate the effects of cashless policy on FDI in Nigeria. According to Ang and McKibbin (2007), once the variables are cointegrated; it becomes easy to distinguish between the short-run dynamics and long-run relationship. The estimation is conducted using the econometric computer software package, E-Views version 7.0. Quarterly series spanning 2006:q1 to 2012:q4 are adopted. This is to ensure enough data points to cater for loss of degree of freedom. The data are sourced from the Central Bank of Nigeria's Statistical Bulletin, December 2011 and its 2012 Payment Report.

Granger Causality Test

A simple definition of Granger Causality, in the case of two time-series variables, *X* and *Y* is:

"*X* is said to Granger-cause *Y* if *Y* can be better predicted using the histories of both *X* and *Y* than it can by using the history of *Y* alone."

We can test for the absence of Granger causality by estimating the following VAR model:

$$Y_t = a_0 + a_1 Y_{t-1} + \ldots\ldots + a_p Y_{t-p} + b_1 X_{t-1} + \ldots\ldots + b_p X_{t-p} + u_t \qquad 3.6$$

$$X_t = c_0 + c_1 X_{t-1} + \ldots\ldots + c_p X_{t-p} + d_1 Y_{t-1} + \ldots\ldots + d_p Y_{t-p} + v_t \qquad 3.7$$

Then, testing H_0: $b_1 = b_2 = \ldots\ldots = b_p = 0$, against H_1: 'Note H_0', is a test that *X does not* Granger-cause Y

Similarly, testing H_0: $d_1 = d_2 = \ldots\ldots = d_p = 0$, against H_1: 'Note H_0', is a test that *Y does not* Granger-cause *X*. In each case, a rejection of the null implies there is Granger causality.

4. Empirical Investigation and Results

Results of Unit Root Tests

Table 2.1: Unit Root Test

		INTERCEPT	TREND & INTERCEPT
UNIT ROOT @ LEVEL			
ATM		0.864604	0.242831
IBT		0.869753	0.279553
MM		0.880221	0.379465
FDI		0.943057	0.324077
UNIT ROOT @ FIRST DIFFERENCE			
ATM		0.116022*	0.069317*
IBT		0.198104*	0.094315*
MM		0.116373*	0.095089*
FDI		0.119862*	0.047356*
CRITICAL VALUE			
	10%	0.347000	0.119000
	5%	0.463000	0.146000
	1%	0.739000	0.216000

Author's computation (2014). Notes: * indicates rejection of the null hypothesis of non-stationarity at the strongest 1% percent level of significance. Number of lags was selected using the AIC criterion. For KPSS, Barlett-Kernel is used as the spectral estimation method. The bandwidth is selected using Newey-West method.

From table 4.1 above, the result of the KPSS techniques of unit root test shows that all the variables in the model are not stationary at level at both intercept and considering trend and intercept. In other words, the null hypothesis of non stationarity of the variables cannot be rejected. Further application of KPSS on the first difference of the data shows an outright rejection of non stationarity of the null hypothesis and the acceptance of alternative hypothesis of the stationarity nature of the data. It then means that the data are integrated of order one i.e. I(1). The present situation of the data makes the use of multiple ordinary least square method of estimation abnormal or else the result that will be obtain from the regression will be spurious.

Lag Selection Criteria

The Schwarz Information Criterion (SC) is used to select the optimal lag length. Based on the

SIC, it is found that one lag is optimal. SC is used for model selection such as determining the lag length of a model, with smaller values of the information criterion being preferred.

Table 2.2: Lag Selection Criteria Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-460.4324	NA*	9.53e+17	44.23165	44.43061	44.27483
1	-458.8087	2.474158	9.02e+17*	44.17226	44.42095*	44.22623*
2	-457.7430	1.522374	9.03e+17	44.16600*	44.46444	44.23077

* 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

Cointegration Test Results

Table 2.3a Cointegration test Result @ 5% Level of Significance

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.968426	89.37441	47.85613	0.0000
At most 1 *	0.818921	37.54322	29.79707	0.0053
At most 2	0.546404	11.91092	15.49471	0.1613
At most 3	0.003506	0.052687	3.841466	0.8184
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.968426	51.83119	27.58434	0.0000
At most 1 *	0.818921	25.63230	21.13162	0.0108
At most 2	0.546404	11.85823	14.26460	0.1161
At most 3	0.003506	0.052687	3.841466	0.8184
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 2.3b Cointegration test Result @ 1% Level of Significance

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.01	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.968426	89.37441	54.68150	0.0000
At most 1 *	0.818921	37.54322	35.45817	0.0053
At most 2	0.546404	11.91092	19.93711	0.1613
At most 3	0.003506	0.052687	6.634897	0.8184
Trace test indicates 2 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.01	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.968426	51.83119	32.71527	0.0000
At most 1	0.818921	25.63230	25.86121	0.0108
At most 2	0.546404	11.85823	18.52001	0.1161
At most 3	0.003506	0.052687	6.634897	0.8184
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

With the unit root result depicted in table 4.1 above, there is a clear indication that all the variables are integrated of the same order therefore show a possibility of long run relationship among the variables. This brings a need for conducting a cointegration test i.e a test of long run relationship among the variables. The

Johansen-Juselius maximum likelihood procedure was applied in determining the cointegrating rank of the system and the number of common stochastic trends driving the entire system. We reported the trace and maximum eigen-value statistics and its critical values at both one per cent (1%) and five per cent (5%) in the table below. The result of multivariate cointegration test based on Johansen and Juselius cointegration technique reveal that both trace and maxi-eigen statistic shows two cointegrating equations at 5% level of significant, while trace statistic shows two cointegrating equation and Maxi-Eigen statistic indicates one cointeragrating equation at 1% level of significance. These results suggest that the appropriate model to use is the VECM specification with more than one cointegrating vector in the model.

Vector Error Correction Model (VECM) Framework

The result of the long run relationship among foreign direct investment (FDI), ATM is combined computer terminal, inter banks transfer (IBT) and mobile money (MM) in the below table:

Table 2.4 Error Correction Model (VEC) Framework

Error Correction:	D(FDI)	D(ATM)	D(IBT)	D(MM)
CointEq1	-0.493855	-0.008235	-9.19E-06	0.000204
	[-1.49237]	[-1.59572]	[-1.25552]	[1.60340]
D(FDI(-1))	0.029353	0.000517	3.78E-06	3.53E-05
	[0.08119]	[0.09167]	[0.47278]	[0.25369]
D(FDI(-2))	0.414861	0.006988	1.68E-05	0.000159
	[1.25152]	[1.35177]	[2.29144]	[1.24857]
D(ATM(-1))	1.176903	0.157482	0.000230	0.002179
	[0.03639]	[0.31228]	[0.32098]	[0.17524]
D(ATM(-2))	82.73365	0.786275	0.002139	0.031919
	[2.71042]	[1.65182]	[3.16738]	[2.71961]
D(IBT(-1))	12162.98	316.8404	0.255336	1.078990
	[0.74857]	[1.25046]	[0.71022]	[0.17271]
D(IBT(-2))	30317.32	82.68513	0.537338	12.54349
	[1.99195]	[0.34838]	[1.59558]	[2.14345]
D(MM(-1))	245.0866	4.990236	0.001602	0.631406
	[0.25896]	[0.33812]	[0.07650]	[1.73512]
D(MM(-2))	231.3158	0.024204	0.007973	0.055651
	[0.35043]	[0.00235]	[0.54590]	[0.21927]
C	-98301407	1360250.	1771.075	-8817.763
	[-0.49774]	[0.44166]	[0.40529]	[-0.11612]
R-squared	0.776000	0.864482	0.513835	0.649577
Adj. R-squared	0.673143	0.689459	05166574	0.599274
F-statistic	10.90188	9.802929	1.479681	12.59516

The VECM result presented above shows that long-run relationship exists between the variables, as the error correction term is significant that is, the vector error correction term in the models should have the required negative sign and lie within the accepted region of less than unity. The vector error correction term in column two has the expected negative sign and is statistically significant and it shows a low speed adjustment towards equilibrium. The results of the estimation shows positive relationship with foreign direct investment and the R-square shows that the explanatory variables account for about 77 percent variation in foreign direct investment in Nigeria and 23 percent can be due to other factors not captured in the model. Taking into consideration the degree of freedom, the adjusted R-squared shows that 67 percent of the dependent variable is explained by the explanatory variables. It is revealed from the result that a unit change in the value of ATM first and second lag will lead to 1.2 and 82.7 increase in foreign direct investment in Nigeria respectively. Also, a unit increase in IBT (-1) and IBT (-2) will lead raise the value of FDI by 12162.98 and 30317.32 respectively and MM in its first and second lag increase the FDI by 245.08 and 231.31.

Granger Causality Test Result

As Cointegration test did not specify the direction of a causal relation, if any, between the variables. Economic theory guarantees that there is always Granger Causality in at least one direction(Order and Fisher,1993). Hence, this aspect of the work seeks to verify the direction of Granger Causality between FDI, ATM, IBT and MM. The estimation results for granger causality between the very variables are presented below:

Table 2.5 Granger Causality Test Result

Pairwise Granger Causality Tests
Date: 12/17/13 Time: 19:14
Sample: 2006Q1 2012Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ATM does not Granger Cause FDI	26	0.11482	0.8921
FDI does not Granger Cause ATM		0.68716	0.5140
IBT does not Granger Cause FDI	26	0.32349	0.0272
FDI does not Granger Cause IBT		0.13667	0.8730
MM does not Granger Cause FDI	26	0.54848	0.0459
FDI does not Granger Cause MM		1.84854	0.1822
IBT does not Granger Cause ATM	26	0.02544	0.0249
ATM does not Granger Cause IBT		1.42593	0.2626
MM does not Granger Cause ATM	26	0.03151	0.9690
ATM does not Granger Cause MM		1.49135	0.2480
MM does not Granger Cause IBT	26	0.01906	0.9811
IBT does not Granger Cause MM		2.31273	0.0237

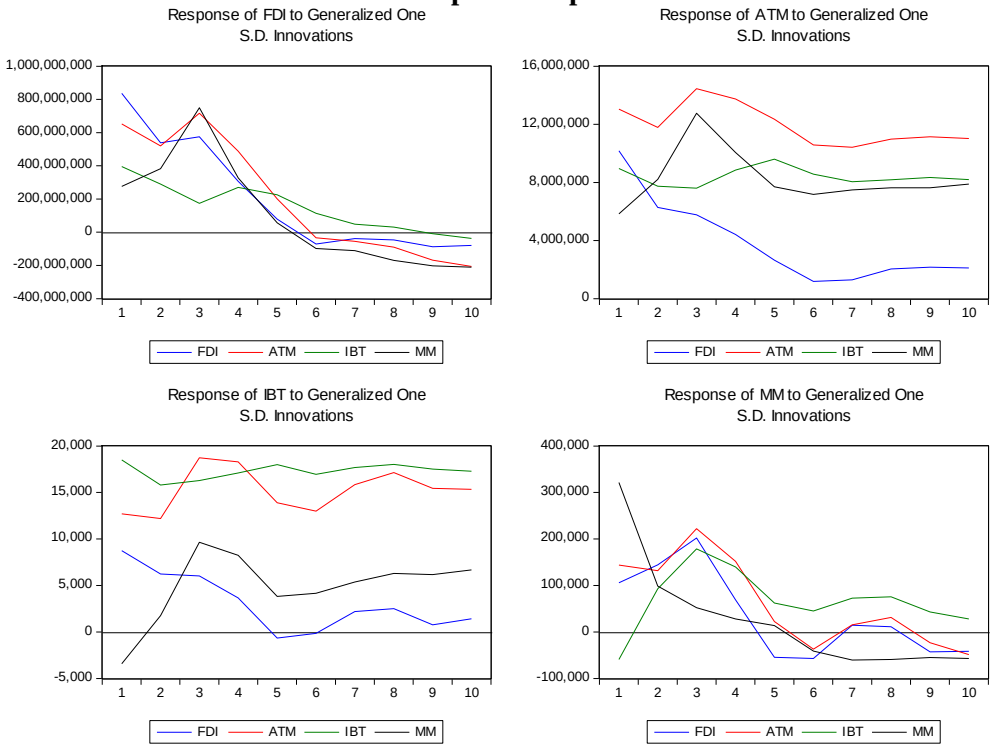
The above result shows a bi-directional relationship between the variables where IBT and MM granger cause FDI in Nigeria i.e. the null hypothesis of that the variables does not granger cause FDI can be rejected and accept the alternative hypothesis given the P-value with lesser value than 5 percent level of significance. It was also reveal that IBT granger cause MM in Nigeria. The null hypothesis that ATM does not granger

cause FDI cannot be rejected which is slightly different from the positive and significant result obtained in VECM.

Impulse Response

The impulse response describes the reaction of the system as a function of time (or possibly as a function of some other independent variable that parameterizes the dynamic behavior of the system). It analysis dynamic affects of the system when the model received the impulse. As our VECM model, we have four variables, the responses between these variables are presented in the below figure, A ten-period horizon is employed to convey a sense of the dynamics of the system i.e how far into the future we want to check the reaction of each of the variable with another. The first figure will be explained as the base of this study:

Table 2.6: Impulse Response Functions



From figure 1 in table 4.5 above, FDI response to the shock in ATM is positive initially up to the 6th quarter and after this period, the shock in ATM leads to a negative impact on the FDI. The response is marked with a continuous decrease in the ATM which produced similar result on the FDI. A one standard deviation shock in IBT initially produced a positive response of FDI but respond negatively after the 8th quarter. One standard deviation shock in MM also affects FDI positively up to the 5th quarter and turns negative after this period.

Variance Decomposition

The variance decomposition shows the amount of information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. We employ a ten year forecasting time horizon and observed the relevance of the variables over time.

Table 2.7 Variance Decomposition

Variance Decomposition of FDI: Period	S.E.	FDI	ATM	IBT	MM
1	8.36E+08	100.0000	0.000000	0.000000	0.000000
2	1.03E+09	93.47900	2.375960	0.376025	3.769017
3	1.35E+09	72.66763	11.55557	11.87557	4.901238
4	1.44E+09	67.82798	17.72805	13.03221	4.411758
5	1.47E+09	65.90528	19.44619	14.21176	4.436777
6	1.48E+09	64.82009	19.11220	16.49681	4.570902
7	1.49E+09	64.36567	19.02965	16.06954	4.535149
8	1.50E+09	63.56772	19.08245	18.69371	4.656113
9	1.52E+09	62.26862	19.70813	20.45435	4.568898
10	1.55E+09	60.27881	21.22291	23.09439	4.403885
Variance Decomposition of ATM: Period	S.E.	FDI	ATM	IBT	MM
1	13038589	60.88553	39.11447	0.000000	0.000000
2	18554349	41.52790	54.52966	0.385012	3.557428
3	26020392	26.02875	65.07622	3.143394	5.751632
4	31390450	19.86704	72.19727	2.665611	5.270082
5	35671724	15.93649	77.13457	2.064203	4.864742
6	39084289	13.36774	79.86242	1.722584	5.047263
7	42088881	11.62222	81.63886	1.490408	5.248514
8	44871984	10.43174	83.03266	1.329000	5.206604
9	47524721	9.506880	84.13910	1.196885	5.157136
10	50031949	8.756182	84.89696	1.094350	5.252512
Variance Decomposition of IBT: Period	S.E.	FDI	ATM	IBT	MM
1	18500.33	22.37742	25.86582	51.75676	0.000000
2	25162.20	18.24173	35.69612	42.47878	3.583366
3	34698.94	12.60023	60.57946	22.99072	3.829591
4	43093.32	8.889717	72.09658	15.72937	3.284336
5	50062.32	6.604372	74.61597	14.99547	3.784184
6	55421.58	5.389573	75.20551	14.78364	4.621281
7	60499.84	4.654475	77.05316	13.80687	4.485494
8	65668.72	4.095204	79.09029	12.61570	4.198805
9	70461.71	3.568836	80.04705	11.96294	4.421171
10	74735.14	3.208731	80.41148	11.51907	4.860726

Variance Decomposition of MM:

Period	S.E.	FDI	ATM	IBT	MM
1	321482.9	10.85318	9.292862	47.36732	32.48663
2	364982.5	24.06498	7.913350	36.87083	31.15084
3	432822.5	38.88312	11.32335	27.18398	22.60955
4	468052.8	35.41561	20.96366	23.89023	19.73051
5	488626.4	33.74045	23.76470	22.92721	19.56764
6	504879.5	32.88720	22.31581	24.79839	19.99860
7	512708.5	31.97074	21.65425	26.92056	19.45445
8	520855.5	31.02575	21.45989	27.99645	19.51792
9	528474.9	30.78902	20.94113	29.26533	19.00452
10	538954.5	30.19831	20.37103	30.60685	18.82380

Cholesky Ordering: FDI ATM IBT MM

Table above gives the fraction of the forecast error variance for each variable that is attributed to its own innovation and to innovations in another variable. The own shocks of FDI constitute a significant source of variation in its forecast error in the time horizon, ranging from 100% to 65.9% after five years and 60.27% after ten years. The variation in FDI is accounted for by ATM (19.44% and 21.22%), IBT (14.2% and 23.09%), and MM (4.43% and 4.40) after five years and ten years respectively. 60.25%. it can be noticed here that the IBT gives the highest variation in the FDI after the ten years and this is in line with the result form the VECM model with the highest value of 12162.98 and 30317.32 than others representing how FDI will respond to a unit change in IBT. Similar explanations hold for the variations other variables as shown in the above tables.

5. Conclusion and Recommendation

The main objective of this study is to examine the relationship between foreign direct investment, automated teller machine, interbank transfer and mobile money in Nigeria. Quarterly data of these variables were collected and analyzed in turn. The analysis shot in the arm with the KPSS test of unit root test which identified the order of integration of the variables. This was followed by the cointegration test of long run relationship among the variables, after which the result of the unit root test and the cointegration test gives acceptance to the suitability VECM model for further analysis. Also granger causality which was meant to determine the direction of causality among the variables, impulse response function and variance decomposition analysis was conducted for robustness of our analysis and verify the result obtained from the VECM model. Hence, all these approach indicates the existence of long run relationship among the variables under consideration and all the explanatory variables are positively related to the dependent variable.

From the various regression results, we find out that the cointegration test confirmed the existence of long run relationship among the variables, while the granger causality shows a bi-directional relationship where IBT and MM was said to granger cause FDI in Nigeria. In the VECM model result, all the explanatory variables are positive and significant meaning that they all contribute positively to the increase in FDI in the country. Among the dependent variables, IBT is said to be contributing more to FDI given the highest value of 12162.98 and 30317.32 at first and second lag respectively of response of FDI to a unit change in IBT. Impulse response function also depict further this relationship similar conclusion can be reach. In the same vein, IBT accounted for the highest percentage of variation in FDI given the variance decomposition with 14.2% and 23.09% in the fifth and tenth year. Hence, given the important role foreign direct investment play in the economy, it is imperative to identify and enhance the factors that will increase its level in the economy.

Therefore, we recommend that the use of ATM, IBT and MM should be encouraged in Nigeria, with proper awareness on its benefit. Also policy needs to be developed by the authority to ensure the effectiveness and efficiency of ATM, IBT and MM.

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