



Department of  
Economics and Finance

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Working Paper No. 12-06

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Economics and Finance Working Paper Series

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February 2012

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# **Banking Consolidation in Nigeria, 2000-2010**

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**February 2012**

## **Abstract**

This study examines the Nigerian banking consolidation process using a dynamic panel for the period 2000-2010. The Arellano and Bond (1991) dynamic GMM approach is adopted to estimate a cost function taking into account the possible endogeneity of the covariates. The main finding is that the Nigerian banking sector has benefited from the consolidation process, and specifically that foreign ownership, mergers and acquisitions and bank size decrease costs. Directions for future research are also discussed.

**Keywords:** Nigeria, banking consolidation, dynamic panels

**JEL classification:** G21, C23, O55

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## **1. Introduction**

This paper focuses on the impact of banking consolidation in Nigeria on banks' costs during the period 2000-2010. This process started in 2004 after the Central Bank of Nigeria (CBN) announced new capital requirements for Nigerian banks. The intention was to make banks increase their average size through mergers and acquisitions. Some of them could neither satisfy the new capital requirements nor find a suitable merger partner, and therefore were forced to go into liquidation. As a result, their number was considerably reduced. Not surprisingly, all foreign banks survived the recapitalisation as they usually relied on capital injections from the parent company to meet the capital requirements. The total number of Nigerian banks immediately after the consolidation, that is, before the Stanbic Bank/IBTC merger, was 25 (Hesse, 2007; Porter, 2007; Assaf, Barros and Ibiowie, 2011).

The present study makes a threefold contribution. First, it provides evidence on the impact of consolidation on costs in the specific case of Nigerian banks, as this can vary from country to country, depending on market characteristics and regulations (Focarelli, Panetta and Salleo, 2002; Vander Venet, 2002). Second, it adds to the limited number of existing studies on banking consolidation (Chapelle and Plane, 2005a; 2005b; Francis, Hasan and Wang, 2008; Yildirim and Philippatos, 2007; Binam, Gockowski, and Nkamleu, 2008; Igbekele, 2008; Assaf, Barros and Ibiowie, 2011) by estimating a more suitable dynamic model rather than conducting the efficiency analysis typical of most papers. In particular, it adopts the Arellano and Bond (1991) dynamic GMM method. Third, it focuses on Africa, a region which has attracted only limited attention in the literature (Figueira, Nellis, and Parker, 2006; Hauner and Peiris, 2005; Okeahalam, 2006), most studies examining instead European or US banks.

The layout of the paper is the following. Section 2 describes the main features and the evolution of the Nigerian banking sector. Section 3 provides a brief review of the literature on banking efficiency. Section 4 outlines the econometric approach. Section 5 specifies the hypotheses to be tested. Section 6 discusses data sources and definitions. Section 7 presents the

empirical results. Section 8 summarises the main findings and their implications and suggests directions for future research.

## **2. The Nigerian Banking Environment**

The Nigerian banking system has evolved since the colonial periods in three distinct phases. The first, generally referred to as the free-banking era, was the pre-independence period when the industry was dichotomised between foreign and indigenous banks. The foreign banks, which obtained their operating licences abroad and dominated banking activities during this era, were seen to act solely in the interest of their foreign owners rather than of Nigerians and of the Nigerian economy (Brownbridge, 1996). Since there was neither a banking legislation nor a regulator, entry was relatively free. This created an avenue for all kinds of speculative investors who operated banks that were generally under-capitalised and poorly managed. Early exit was common among the domestic banks, which were clearly disadvantaged. By 1940, the majority of indigenous banks had collapsed, with the only survivors being those that were established and, in all likelihood, patronised by the three regional governments. Yet this did not stop the creation of more banks: there were in fact 150 indigenous banks established between 1940 and 1952 (Adegbite, 2007). The experience of the banking crashes of the 1930s and 1940s possibly informed the government's decision to adopt in 1952 the banking ordinance, which represents the first major attempt at regulating banking operations. However, this regulation appeared to make little or no impact on the way banking was conducted, as there was no regulator to enforce compliance. The CBN was established in 1959 to regulate and perform other overseeing functions (Hesse, 2007). The second phase was the indigenisation period of the 1970s when the government introduced various control measures such as the nationalisation of foreign-owned banks, entry restrictions, a deposit rate floor or an interest rate ceiling. This period is known as the static period which reflects the low number of banks and the establishment of very few branches by the existing banks.

The next phase began in 1986 with the implementation of the Structural Adjustment Programme (SAP) prescribed by the World Bank/IMF. Some of the control measures such as entry conditions, sectoral credit allocation quotas and interest rate regulation of the indigenisation period were relaxed. This reintroduced dilution into the industry and the number of banks increased from 42 in 1986 to 107 in 1990, and by 1992 it had reached 120. The sharp increase in the number of banks without a correspondingly large increase in the capacity of the regulatory and supervisory mechanisms caused both off-site surveillance and on-site examination of banks to suffer (Oyejide, 1993). Systemic failure resulted. Rather than mobilising and allocating resources to needy sectors, disintermediation was witnessed as many of the new banks, commonly referred to as new generation banks, preferred to make money through arbitrage and other rent-seeking activities (Lewis and Stein, 1997). Hesse (2007) suggests as a possible explanation the fact that the parallel exchange rate that prevailed in that period allowed banks quickly to make profits from various arbitrage opportunities rather than intermediate between depositors and lenders. Also, many of the banks owned by local investors seemed to have been set up primarily in order for their owners to obtain foreign exchange which could be sold at a premium (Brownbridge, 1996). The banks that were owned by state governments, 25 as of 1989, accumulated bad debts because of the extension of proprietary loans to the state governments and to politically influential borrowers (Brownbridge, 1996). This probably explains why some analysts believe that the distress in the banking sector originated from SAP as bureaucrats allocated resources through discretionary policies. Because of the high fragmentation and low financial intermediation of the banks, the government in 1991 established some prudential guidelines (Hesse, 2007) through the promulgation of the Banking and Other Financial Institutions Decree (BOFID) and placed an embargo on issuing new bank licences. Shortly after, 24 of the existing banks were found to be insolvent and were liquidated. Thus, by 2004, the number of banks had been reduced to 89. Despite government intervention, the remaining 89 banks were characterised by a low capital base, insolvency and illiquidity, overdependence on public sector deposits and foreign exchange trading, poor asset

quality and weak corporate governance (Soludo, 2006). This led to another round of recapitalisation in 2004 when banks were required to increase their minimum capital base from Naira 2 billion to Naira 25 billion by the end of 2005. This brought about radical changes to the structure and nature of banking operations.

Other important results of the consolidation process were that bank branch networks rose from 3382 prior to consolidation to 4500 post consolidation, aggregate bank assets increased from Naira 3209 billion in 2004 to Naira 6555 billion in 2006 and the capital adequacy ratio climbed from 15.2% in 2004 to 21.6% in 2006 (Balogun, 2007). More information on the performance of the banking industry is provided in Table 1.

<<Insert Table 1 around here>>>

### **3. Literature Review**

Most studies on banks' efficiency (Altunbas, Gardener, Molyneux, and Moore, 2001; Berger, 1995; Berger and Humphrey, 1997; Berger and Mester, 1997; Bos and Schmiedel, 2007; Goddard, Molyneux, and Wilson, 2001; Maudos, Pastor, Pérez, and Quesada, 2002; Schure, Wagenvoort, and O'Brien, 2004; Williams, Peypoch and Barros, 2009) focus on the US and Europe and neglect banks in emerging countries such as Nigeria. Multi-country analysis usually considers factors such as legal tradition, accounting conventions, regulatory structures, property rights, culture and religion as possible explanations for cross-border variations in financial development and economic growth (Beck, Demirgüç, -K, and Levine, 2003; Beck and Levine, 2004; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997; Levine, 2003; Stulz and Williamson, 2003). Studies at country level usually focus on market dynamics as determinants of efficiency (Arpa, Giulini, Ittner, and Pauer, 2001; Bikker and Haaf, 2002), or provisions for loan losses which can exert a negative impact on the level of economic activity (Cavallo and Majnoni, 2002; Cavallo and Rossi, 2001; Laeven and Majnoni, 2003). Other factors such as

market structure and bank-specific variables have been proposed on the basis of the structure–conduct–performance paradigm, and have been used to test the role of ownership and governance in explaining bank performance (see Berger, 1995; Berger and Humphrey, 1997; Bikker and Haaf, 2002; Goddard et al., 2001; Molyneux, Altunbas, and Gardener, 1996). In general, the extensive empirical evidence does not provide conclusive proof that bank performance is explained by either concentrated market structures and collusive price-setting behaviour or superior management and production techniques. Bank performance levels are found to vary widely across banks and banking sectors (Altunbas, et al., 2001; Maudos et al., 2002; Schure et al., 2004).

Another strand of the literature analyses the impact of consolidation on banking costs. The need to reduce costs through economies of scales and scope, or to increase revenues through gaining additional market shares, are usually the main drivers of consolidation (Amel, Barnes, Panetta, and Salleo, 2004). The literature also discusses the linkage between mergers and acquisition activities and the transfer of knowledge between the acquiring and the acquired company. However, the relationship between consolidation and costs does not seem to be always positive. Some studies, for instance, suggest that efficiency gains from consolidation disappear after a certain size is reached and that above a certain threshold a firm might start exhibiting diseconomies of scale (Amel et al., 2004). The increase in size also creates further pressure on managers owing to the difficulty of managing large institutions. The evidence for the banking industry is mixed. Banal-Estañol and Ottaviani (2006, 2007), for instance, highlighted the need for diversification to ensure the success of bank mergers. They also argued that mergers are not always beneficial as they might make firms more aggressive when they compete in quantities. The evidence on the effects of consolidation also seems to vary by country. This is because each country has its own market characteristics and regulations (Focarelli, Panetta, and Salleo, 2002; Vander Venet, 2002). In general, no strong evidence on the benefit of consolidation is found in the US, while in Europe the conclusions seem to be mixed (Carbo and Humphrey, 2004; Cavallo and Rossi, 2001; Diaz, Garcia, and Sanfilippo, 2004; Esho, 2001; Sathye, 2001).

For Asian countries such as Japan the conclusions are also mixed and vary with the period analysed (Drake and Hall, 2003).

#### 4. Methodology

As mentioned above, the present paper aims to analyse the impact of consolidation on banking costs in Nigeria. The empirical specification is a cost function estimated as a dynamic log-linear model which includes a lagged dependent variable aiming to capture persistent effects and takes into account the possible endogeneity of the covariates. In particular, the Arellano-Bond (1991) approach is taken. This is commonly used in applied research ( Baltagi et al, 2009; Bauxauli-Soler and Sanchez Marin, 2011) and has the following form:

$$v_{it} = c_i + u_{it}, \quad i=1,\dots,N; t=1,\dots,T \quad (1)$$

$$C_{it} = \rho_1 C_{i,t-1} + \mathbf{x}_{it} \boldsymbol{\beta} + v_{it} \quad (2)$$

where  $C_{it}$  is the dependent variable measuring bank cost performance,  $C_{i,t-1}$  is the lagged dependent variable,  $\mathbf{x}_{it}$  is a vector of observable corporate governance covariates for firm  $i=1,\dots,N$  and years  $t=1,\dots,N$ .  $\rho_1$  and the vector  $\boldsymbol{\beta}$  are the parameters to be estimated. The error term  $v_{it}$  in equation (1) includes the unobservable time-invariant firm characteristics  $c_i$  (fixed effects) and  $u_{it}$ , which is the idiosyncratic error (equation 2). This model formulation is appropriate in our case, because it allows for dynamics in the dependent variable, a plausible assumption, since the best-performing banks are likely to remain so over the following year.

Several econometric issues arise when estimating this model. First, the covariates can be endogenous because causality may run in both directions and, therefore, these regressors may be correlated with the error term. Second, fixed effects  $c_i$  can be correlated with the covariates. Thirdly, the presence of the lagged dependent variable gives rise to autocorrelation. Finally, the panel dataset has a short time dimension and a medium banks' dimension. The Arellano and Bond (1991) linear dynamic panel data estimation is adequate in this context and



includes the first lag of the dependent variable (equation 1) as a covariate and unobserved fixed effects (as in equation 2). By introducing autocorrelation into the model, the unobserved effects  $c_i$  become correlated with the lagged dependent variables, thus making the standard estimators inconsistent. To address this issue, the Arellano and Bond (AB) procedure starts with the transformation of all regressors by differencing equation (1),

$$\Delta C_{it} = \rho_1 \Delta C_{i,t-1} + \Delta \mathbf{x}_{it} \boldsymbol{\beta} + \Delta u_{it} \quad (3)$$

In this way, the time-invariant parameter  $c_i$  in equation (2) is removed. Arellano and Bond (1991), building on Holtz-Eakin et al. (1988) and using the general method of moments (GMM) framework developed by Hansen (1982), identify the lags of the dependent variable that are valid instruments and explain how to combine these lagged variables into a larger instrument matrix. They found that lag 2 or higher of the dependent variable are valid instruments. Furthermore, if the explanatory variables are not strictly exogenous, lagged levels of these variables can also be added as additional instruments. This estimator is designed for datasets with many units and few periods, and it requires that there be no autocorrelation in the idiosyncratic errors.

## **5. Factors Affecting The Efficiency of Banks**

Our aim is to test the relationship between banks' costs and the following covariates: foreign bank membership, banks involved in mergers and acquisitions, bank size and consolidation period. The reasons for the selection of each of these covariates and the hypotheses to be tested are explained below.

### **5.1 Foreign Ownership**

Foreign ownership might have an impact on costs by contributing to the transfer of knowledge and economies of scale between banks belonging to the same group. Chiu et al. (2008), for example, tested this hypothesis on a sample of Taiwanese firms and reached the conclusion that

group affiliation can be beneficial, though this might be dependent on the size of the group. Other studies have also linked the success of group affiliation to the type of market, firms with group affiliation tending to outperform those without in competing markets, since for the latter it is harder to gain new market shares (Khanna and Palepu, 2000; Ghemawat and Khanna, 1998; Cho, 2007; Griffith-Jones, 2007). Therefore it might be more profitable to join a foreign group, thereby sharing its resources and reputation to make up for external market failures (Khanna and Paleou, 2000).

H1: Foreign group ownership decreases Nigerian banks' costs. This hypothesis is tested with the variable "Foreign".

## **5.2 Mergers and Acquisitions**

Mergers and acquisitions between similar companies are known as horizontal mergers (Andrade, Mitchell and Stafford, 2001), and aim to improve cost performance and synergy through a larger market share. In the former case the merged companies reduce operating costs but keep the premises of the merged or acquired company (Garette and Dussauge, 2000).

H2: Bank mergers and acquisitions reduce Nigerian banks' costs. This hypothesis is tested with the variable "M&A".

## **5.3 Firm Size**

It is often argued that large firms might be more efficient, because they can use more specialised inputs, coordinate their resources better, reap the advantages of economies of scale (Alvarez and Crespi, 2003) and make up for external market failures (Khanna and Palepu, 2000; Ghemawat and Khanna, 1998). Related studies also indicated that firm size has a positive impact on efficiency and decreases costs (Altunbas et al., 1997, Berger and Humphrey, 1991, Alvarez and Arias, 2003).

H3: An increase in bank size reduces Nigerian banks' costs. This hypothesis is tested with the variable "Total Assets".

#### **5.4 Banking Consolidation**

Banking consolidation aims to improve cost performance (Amel, Barnes, Panetta and Salleo, 2004) and therefore it may have a negative impact on banks' costs. This hypothesis will be tested with a consolidation dummy variable.

H4: Banking consolidation reduces Nigerian banks' costs.

### **6. Data**

The dependent variable in our model is banks' costs, that have been extensively analysed in the empirical literature (Francis, Hasan and Wang, 2008; Yildirim and Philippatos, 2007; Assaf, Barros and Ibiowie, 2011). The independent variables listed in Table 2 were selected on the basis of microeconomic theory (Varian, 2009).

Our sample includes all the 25 Nigerian banks that got past the recapitalisation hurdle. Data were collected from annual reports of the banks for the period 2000-2010 (275 observations). In the empirical banking literature, there are two approaches to measuring banks' outputs and costs (Berger and Humphrey, 1997). The production approach treats banks as producing accounts of various sizes by processing deposits and loans, and incurring capital and labour costs. Operating costs are thus specified in the cost function and output is measured as the number of deposits and loan accounts. The intermediation approach sees banks as transforming deposits and purchased funds into loans and other assets. Costs are expressed as total operating plus interest costs and output is measured in monetary units. These two approaches have been applied in different ways. Limited data availability means that in our case we are constrained to apply only the intermediation approach, which is in fact the most commonly used one in banking studies (Sealey and Lindley, 1977; Berger and Humphrey, 1997). The estimated function is the following:

$$\begin{aligned}
\text{Ln} \frac{\text{Cost}_{it}}{\text{PD}_{it}} = & \alpha_{it} + \gamma_{CL} \text{CL}_{it} + \gamma_{SEC} \text{SEC}_{it} + \gamma_{PL} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} + \gamma_{PK} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} + \gamma_{CL,CL} \frac{1}{2} \text{LnCL}_{it} \text{LnCL}_{it} \\
& + \gamma_{SEC,SEC} \frac{1}{2} \text{LnSEC}_{it} \text{LnSEC}_{it} + \gamma_{PL,PL} \frac{1}{2} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} + \gamma_{PK,PK} \frac{1}{2} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} + \\
& \gamma_{CL,SEC} \text{LnCL}_{it} \text{LnSEC}_{it} + \gamma_{CL,PL} \text{LnCL}_{it} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} + \lambda_{CL,PK} \text{LnCL}_{it} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} + \gamma_{SECPL} \text{LnSEC}_{it} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} + \\
& \gamma_{SEC,PK} \text{LnSEC}_{it} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} + \gamma_{PL,PK} \text{Ln} \frac{\text{PL}_{it}}{\text{PD}_{it}} \text{Ln} \frac{\text{PK}_{it}}{\text{PD}_{it}} \\
& + \beta_1 \text{Foreign}_{it} + \beta_2 M \& A_{it} + \beta_4 \text{Size}_{it} + \beta_5 \text{Consolidation}_{it} + v_{it}
\end{aligned}$$

with the associated factor share equations.

The data characteristics are presented in Table 2.

<<Insert Table 2 around here>>

## 7. Results

The results based on the Arellano-Bond (1991) model using three different specifications are presented in Table 3. F-tests suggest that the third specification should be preferred. The Hausman test is used to test for endogeneity (omitted variable biased, measurement error, or reverse causality; Woldridge, 2002; Baltagi, 2001). The Hausman statistic is 145.41 (p-value 0.000) and therefore the hypothesis that the variables are endogenous is clearly rejected.

<<Insert Table 3 around here>>

The autoregressive parameter  $\rho_I$  is found to be positive and statistically significant in all cases, which supports the use of a dynamic panel data model. The Sargan test of over-identifying restrictions is used to assess the validity of the instruments and the results imply acceptance of the null hypothesis that the restrictions are valid (Roodman, 2006). Furthermore, there is strong evidence against the null hypothesis of zero autocorrelation in the first-differenced errors at order 1 and 2. Overall, costs increase with positive covariates and decrease with negative ones.

## 8. Conclusions

This paper analyses the cost performance of Nigerian banks over the period 2000-2010 using the Arellano-Bond panel method. Furthermore, it compares their performance in terms of costs before and after consolidation using a binary consolidation variable. The main finding is that the Nigerian banking sector has benefited from the consolidation process, and specifically that foreign ownership, mergers and acquisitions and bank size decrease costs. These are important results for banking associations, often relying on simple methods and partial ratios in their analysis, as well as policy-makers: policies and regulations should take into account the endogeneity issue, namely the simultaneity between banks' costs and covariates.

Future studies could also examine in depth the impact of the current financial crisis, as a result of which the large and sudden capital inflows that were injected by foreign investors during the consolidation exercise were abruptly withdrawn. Another development was the unwillingness of correspondent banks to confirm lines for Nigerian banks. However, with consolidation, fewer banks now require correspondent banks and the reverse is also true as fewer correspondent banks are needed. As for the capital outflows, the CBN has injected funds into some of the problem banks to prevent failure, and has drawn up a four-pillar strategy with the aim of improving the quality of the banks by implementing risk-based supervision and reforming the regulatory framework (Sanusi, 2010). The recent creation of the Asset Management Corporation is a move in that direction. Given the fact that the impact of consolidation on cost efficiency is likely to differ depending on country characteristics, it would also be of interest to conduct the analysis for other economies in the West Africa sub-region, as well as check the robustness of the results using alternative estimation methods.

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**Table 1: Banks' characteristics**

Group	Surviving Bank	Shareholders funds	Component institutions	No. In group
1	First Bank	58.996	First Bank of Nigeria Plc, FBN Merchant Bankers Ltd, MBC	3
2	First Inland	26.389	IMB, First Atlantic Bank, Inland Bank, NUB	4
3	FCMB	25.342	First City Monument Bank, Cooperative Development Bank, Nigeria-American Merchant Bank, Midas	4
4	Union Bank	106.97	Union Bank of Nigeria Plc, Broad Bank, UTB, Union Merchant Bankers	4
5	Wema Bank	26.230	Wema Bank, National Bank	2
6	Unity Bank	29.425	Intercity Bank, First Interstate, Tropical Commercial, Pacific, Societe Bancaire, Centre-Point, NNB, Bank of the North, New Africa Bank Ltd.	9
7	ETB	28.41	ETB, Devcom	2
8	Fidelity Bank	25.596	Fidelity, FSB International, Ma	3
9	IBTC/Chartered	33.494	Regent, IBTC, Chartered	3
10	Intercontinental	57.25	Intercontinental, Global, Equity, Gateway	4
11	Oceanic Bank	36.505	Oceanic Bank, International Trust Bank	2
12	Platinum-Habib	28.491	Platinum, Habib	2
13	Sterling Bank	25.31	NAL, Trust Bank of Africa, INBM, Magnum Trust, NBM	4
14	UBA Plc	47.624	UBA, Standard Trust Bank, CTB	3
15	Spring Bank	41.29	Citizens, Guardian Express, ACB, Omega, Trans International, Fountain Trust	6
16	Access Bank	28.894	Access, Marina International, Capital Bank	3
17	Afribank	25.085	Afribank, Afribank Merchant Bankers	2
18	Citibank-NIB	33.375	Citibank, Nigeria International Bank	2
19	Diamond Bank	34.97	Diamond Bank, Lion Bank, Africa International	3

20	Skye Bank	31.469	Prudent, EIB, Bond, Reliance, Coop Bank	5
21	Zenith Bank	95.324	Zenith	1
22	Stanbic Bank	28.386	Stanbic Bank	1
23	Standard Chartered	33.760	Standard Chartered	1
24	Ecobank	25.763	Ecobank	1
25	GTB	36.420	GTB	1
Total number of merging banks				75
Failed banks				14
Pre Consolidation Total				89

**Table 2: Description of the Variables**

Variable	Description	Min <sup>a</sup>	Max <sup>b</sup>	Mean	Std. Dev
Cost	Operational cost at 2000 in Nairas	1266.27	91207.29	17889.44	18694.06
CL	Customer loans at 2000 in Nairas	1944.95	244149.1	52933.98	51442.01
SEC	Securities at 2000 in Nairas	3464	114484.7	23470.32	22166.1
PL	Price of labour measured dividing the wages by the number of employees	0.2026	8.878	2.357	1.370
PD	Price of deposits measured dividing the interest paid in deposits by the value of deposits	0.0048	0.5823	0.0964	0.1034
PK	Price of capital measured dividing amortization by fixed assets	0.0002	0.355	0.055	0.0591
Foreign	Dummy variable for Foreign bank	0	1	0.12	
M&A	Dummy variable for Banks involved in M&A activities	0	1	0.92	
Size	Size is measured by total assets as a proxy for bank size in Nairas at 2000	6,798.00	851,241.00	139,018.83	155,553.69
Consolidation	Dummy variable equal to one for the period 2004-2010 and zero elsewhere	0	1	0.636	

<sup>a</sup> Min – Minimum; <sup>b</sup> Max – Maximum.



**Table 3: Dynamic Panel Data Model Results**

	<b>Model1</b>	<b>Model 2</b>	<b>Model 3</b>
Constant	2.319 (4.04)***	0.890 (3.40)***	0.852 (3.17)***
L.Cost <sub>t-1</sub>	0.794 (18.61)***	0.501 (9.79)***	0.62 (10.15)***
CL	0.0005 (3.14)***	0.0087 (3.22)***	0.0011 (2.83)***
SEC	-0.0004 (-0.04)	-0.0008 (-3.36)***	-0.00011 (-4.01)
PL	0.101 (1.23)	0.112 (2.95)***	0.132 (3.43)***
PK	-0.936 (-1.30)	-0.832 (-2.01)	-0.013 (-0.52)
1/2 CL <sup>2</sup>	0.528 (9.40)***	-0.182 (-3.31)***	-0.623 (-4.44)***
1/2 SEC <sup>2</sup>	0.968 (3.29)***	-0.936 (-3.34)***	-0.9189 (-2.12)**
1/2 PL <sup>2</sup>	0.980 (3.29)***	-0.5219 (-2.37)	-0.96957 (-3.36)**
1/2 PK <sup>2</sup>	0.004 (3.37)***	0.0180 (3.02)***	0.200 (3.85)*
CL*SEC	0.968 (3.29)***	0.944 (3.81)***	0.658 (10.15)***
CL*PL	0.980 (3.29)***	0.719 (3.22)***	0.853 (3.24)***
CL*PK	0.012 (2.49)**	0.038 (2.96)***	0.085 (3.17)***
SEC*PL	0.980 (3.29)***	0.946 (3.34)***	0.753 (4.43)***
SEC*PK	0.853 (3.24)***	0.501 (9.79)***	0.713 (3.52)***
PL*PK	0.011 (2.83)***	0.012 (3.36)***	0.020 (3.44)***
Foreign	-0.025 (-3.21)***	-0.062 (-4.36)	-0.140 (-3.12)
M&A	-0.032 (-3.29)***	-0.0259 (-3.98)	-0.019 (-3.31)***
Size		0.012 (3.84)***	0.024 (3.24)***

Consolidation			0.815 (3.07)***
Nobs	275	275	275
F-Statistic (p-value)	17.50 (0.000)	17.83 (0.000)	17.91 (0.000)
First order serial correlation <sup>a</sup> (p-value)	-7.68 (0.000)	-7.63 (0.000)	-7.66 (0.000)
Second order serial correlation <sup>a</sup> (p-value)	0.27 (0.003)	0.11 (0.002)	0.12 (0.007)
Sargan test <sup>b</sup> (p-value)	0.80 (0.931)	0.611 (0.214)	0.435 (0.153)

Notes: All models were estimated in Stata 12.

The Z score in parentheses are below the parameters; those followed by \* are statistically significant at the 1% level; those followed by \*\* are statistically significant at the 5% level.

<sup>a</sup> Arellano-Bond test for zero autocorrelation in first-differenced errors. H0: no autocorrelation.

<sup>b</sup> Sargan test of over-identifying restrictions. H0: over-identifying restrictions are valid.