Optimal Bank Capital – The Nigerian Experience

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Abstract: *The question of what constitutes an optimal bank capital has generated so much controversy among bank regulators and practitioners for decades. The new Basel recommendation – Basel III framework, has once again thrown up the question of what level of bank capitalization would be considered optimal to the front burner of national and international discourse. This study provide empirical evidence using selected bank performance indicators in Nigeria to show that optimal bank capital is a misnomer unless there is a sound macroeconomic environment. The study shows that performance of banks did not improve substantially after the 2005 recapitalization exercise. It was also evident from the study that Nigerian banking history has demonstrated the futility of using bank recapitalization as a regulatory tool. There is therefore a veritable ground to question the primacy and pride of place accorded to capital by regulatory authorities among the factors that enhances banking system stability. We therefore recommend that the Central Bank of Nigeria should focus their attention in promoting monetary stability and sound macroeconomic environment to enable banking business to thrive in Nigeria.*
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I. Introduction

Banking sector in any economy serves as a catalyst for growth and development and is therefore so sensitive and sacrosanct to the economy in terms of stability and growth that it must not be 'left alone' by the Government. It is not surprising in the light of this fact, that governments all over the world attempt to evolve an efficient banking system, not only for the promotion of efficient intermediation, but also for the protection of depositors, encouragement of efficient competition, maintenance of public confidence in the system, ensuring stability of the system and protection against systemic risk and collapse. However, economists differ on the level of government intervention in the economy, particularly on regulation imposed on the financial intermediaries. While some believe that many regulations are necessary in order to protect the depositor's funds, others believe that the banks are over regulated. One area of regulation that has generated so much debate is in the area of capital regulation. In the Nigerian context, capital regulation appears the only tool in the arsenal of the regulatory authority – the Central Bank of Nigeria. We shall return to this later.

In the aftermath of the recent economic recession which pulled down many global banks and exposed multiple weaknesses in regulation and banking structures, the Basel Committee on Banking Supervision agreed to new rules on the minimum level (capital ratio) and composite structure of Banks capital on the 12th of September, 2010. Broadly speaking, the new rules which are widely referred to as Basel III (and are mainly Basel II plus new regulations based on lessons from the market crisis), still stipulate a minimum Total Capital Ratio of 8%. However, in addition to increasing the portion of the 8% requirement that is Core Tier 1 Capital (from 2% to 4.5%), it requires Banks to reserve more common equity under what it calls Capital Conservation Buffer (2.5%), which in many respects is a modification of the IMF proposed 'Bank Tax'. Thus, with this new buffer, Banks' Total Capital Ratios would rise to a minimum 10.50%. However, these new capital requirements will be progressively implemented over an 8-year span, with full implementation taking effect by January 1, 2019 [1]. Furthermore, following the final assent to the Basel Committee's proposals at the Seoul G-20 Leaders Summit in November 2010, member countries of the Bank for International Settlement (BIS) are currently domesticating the proposal and making further amendment in line with the peculiarities of their country's financial system.

The new Basel proposition – Basel III has once again brought the issue of capital regulation and adequacy of equity capital (or optimal capital) to the front burner of international discourse. As usual, the debate on the proprietary or otherwise of the new capital proposition (Basel III) is between the bankers (operators) and the regulators – the Central Banks and other regulatory bodies.

Jenkins [2], (Member of the Financial Policy Committee, Bank of England) remarked:

"We are living through the greatest credit crisis of our generation. And, needless to say it is not over. Now credit bubbles are not new. They are always the same, and always a little bit different. All such episodes feature heavy doses of reckless lending, greed and stupidity. What made our bubble different was the extent and degree of *leverage*. Ladies and gentlemen, we will not abolish greed. We cannot outlaw stupidity. But we can

and must place prudent limits on leverage. It is therefore the debate over the degree of bank leverage which becomes central to regulatory reform and systemic stability. Regulating bank leverage in turn begets the search for the appropriate degree of equity on the balance sheet. And here, opinions diverge. Banks want as little equity in the mix as their formidable lobby can achieve."

The remarks by Jenkins somehow summarizes the thinking of regulatory authorities the world over. To the regulator, banks insist that higher equity ratios will reduce bank profitability, credit availability and therefore damage the economy. To their investors, banks warn that higher equity in the mix will raise their cost of capital, depress their return on equity, and thereby damage shareholders value. Will it? Is that the way it works? There are broadly speaking two empirical approaches in the determination of the proprietary or otherwise of raising a bank's capital, namely, implicit approach or use of dummies and explicit approach or use of outcome variables.

The outcome approach essentially seeks to assess the impact of a bank capital increase on the banks and/or the economy using some selected micro or macroeconomic indicators. This paper adopted the outcome approach by looking at the impact of 2005 bank capital increase in Nigeria using five performance indicators of the banking industry namely: net interest margin, yield on earning assets, funding cost, return on equity and return on assets. The paper will also review some empirical literatures on the impact of requiring banks to fund more of their operations through equity capital than debt (less leverage) and what level of equity capital will be considered optimal. As the paper is situated in the Nigerian context, we shall also show using some performance indictors whether capital increases have impacted positively on the banks and the economy of the country.

The rest of the paper is organized as follows. Following this introduction, section 2 reviews some empirical foundations in support of larger bank capital and other theoretical underpinnings on calculating cost of capital, capital requirement and regulatory reforms. Section 3 provides an overview on bank capital regulation in Nigeria while section 4 focuses on empirical analysis of the impact of the 2005 bank recapitalization exercise in Nigeria using some performance indicators. Section 5 concludes and summarizes the paper.

II. Empirical Foundations on Bank Capital

2.1 Calculating the Cost of Capital

The question "what is optimal capital in a banking system" has agitated the minds of regulators and practitioners for ages. This is not an easy question and any answer will most likely require an analysis of the costs and benefits of having banks fund more of their assets with loss-absorbing capital – that is equity – rather than debt. According to Mills et al. [3] the benefits come because a larger buffer of truly loss-absorbing capital reduces the chance of banking crises which, as both past history and recent global financial crisis show, generate substantial economic costs. The offset to any such benefits come in the form of potentially higher costs of intermediation of saving through the banking system; the cost of funding bank lending might rise as equity replaces debt and such costs can be expected to be reflected in a higher interest rate charged to those who borrow from banks. That in turn would tend to reduce the level of investment with potentially long lasting effects on the level of economic activity. Calibrating the size of these costs and benefits is important but far from being straightforward.

Setting capital requirements is a major policy issue for regulators – and ultimately governments – across the world. The recently agreed Basel III framework expects banks to use more equity capital to finance their assets than was required under previous sets of rules. This has already triggered warnings from some about the cost of requiring banks to use more equity (see, for example, Institute for International Finance [4] and Pandit [5]. But measuring those costs requires careful consideration of a wide range of issues about how shifts in funding affect required rates of return and on how costs are influenced by the tax system; it also requires a clear distinction to be drawn between costs to individual institutions (private costs) and overall economic (or social) costs. And without a calculation of the benefits from having banks use more equity (or capital) and less debt no estimate of costs – however accurate – can tell us what the optimal level of bank capital is or expected to be.

In calculating the cost and benefits of having banks use more equity and less debt it is important to take account of a range of factors including:
i. The extent to which the required return on debt and equity changes as funding structure changes.
ii.. The extent to which changes in the average cost of bank funding brought about by shifts in the mix of funding reflect the tax treatment of debt and equity and the offsetting impact from any extra tax revenue received by government.
iii. The extent to which the chances of banking crisis decline as equity buffers rise – which depends greatly upon the distribution of shocks that affect the value of bank assets.
iv. The scale of the economic costs generated by banking sector problems (Barrell et al [6])

As observed by Mills et al [7] few studies try to take account of all these factors; yet failure to do so means that conclusions about the appropriate level of bank capital are not likely to be reliable.

It is important to remark that even proportionally large increases in bank capital are likely to result in a small long-run impact on the borrowing costs faced by bank customers. But substantially higher capital requirements could create very large benefits by reducing the probability of systematic banking crises. In a study, Mills et al [8] used data from shocks to incomes from a wide range of countries over a period of 200 years to assess the resilience of a banking system to these shocks and how equity capital protects against them. They found that the amount of equity funding that is likely to be desirable for banks to use is *very* much larger than banks have had in recent years and higher than targets agreed under the Basel III framework.

2.2 Capital requirements and regulatory reform

In the financial crisis that began in 2007, and which reached an extreme point in the Autumn of 2008, many highly leveraged banks found that their sources of funding dried up as fears over the scale of losses – relative to their capital – made potential lenders pull away from extending credit. The economic damage done by the fallout from this banking crisis has been enormous; the recession that hit many developed economies in the wake of the financial crisis was exceptionally severe and the scale of government support to banks has been large and it was needed when fiscal deficits were already ballooning in most countries especially in Europe and United States (Eboh and Ogbu, [9]).

Such has been the scale of the damage from the banking crisis that there have been numerous proposals – some now partially implemented – for reforms of banking regulation. Proposals for banking reform broadly fall into two groups. The first group requires banks to use more equity funding (or capital) and to hold more liquid assets to withstand severe macroeconomic shocks. The second groups of proposals are often referred to as forms of "*narrow banking*". These proposals aim to protect essential banking functions and control (and possibly eliminate) systematic risk within the financial sector by restricting the activities of banks (Eboh and Ogbu, [10]). But in an important sense proposals of both types can be seen to lie on a continuous spectrum. For example, "mutual fund banking" as advocated by Kotlikoff [11] is equivalent to having banks to be completely equity funded (operate with a 100% capital ratio); while a pure "utility bank" of the sort advocated by Kay [12] can be seen as equivalent to a bank with a 100% liquidity ratio.

Measuring the cost and benefits of banks having very different balance sheets from what had become normal in the run up to the crisis is therefore central to evaluating different regulatory reforms.

The argument that balance sheets with very much higher levels of equity funding, and less debt, would mean that banks' funding costs would be much higher is widely believed. But there are at least two powerful reasons for being skeptical about it. According to Mills et al [13] in the UK and USA economic performance was not obviously far worse, and spreads between reference rates of interest and the rates charged on bank loans were not obviously higher, when banks made very much greater use of equity funding. This is prima facie evidence that much higher levels of bank capital do not cripple development, or seriously hinder the financing of investment. Conversely, there is little evidence that investment or the average (or potential) growth rate of the economy picked up as leverage moved sharply higher in recent decades.

Furthermore, it has been shown that spreads on bank lending were not significantly higher when banks" had higher capital levels. According to Gertler and Quaralto [14] Bank of England data show that spreads over reference rates on the stock of lending to households and companies since 2000 have averaged close to 2%. Evidence indicates that the spread over Bank rate of much bank lending at various times in the twentieth century was consistently below 2%. According to The Banker 15] reports "*traditionally bank advances are made at rates of interest very close to the Bank rate – at the most customers might be asked to pay 2 percent above Bank rate, with the bulk of funds being placed at somewhat less than this*" Over a decade earlier (in 1959) the Radcliffe report stated: "*Most customers pay 1 percent over Bank rate subject to a minimum of 5 percent; exceptionally credit-worthy private borrowers pay only 0.5 percent above Bank rate*". Almost thirty years before the MacMillan Report [16] on UK banking noted that: "*The general position, with occasional deviations, is that ... the rate of interest charged on loans and overdrafts is ½ a per cent to 1 per cent above Bank rate*". Going back even further, Homer and Sylla [17] report that in 1890, 1895 and 1900 English country towns banks charged average rates of respectively 5.1%, 4% and 4.5% on overdrafts. UK Bank rate averaged 4.5%, 2% and 3.9% in those years, so the average spread was about 1%.

The absence of any clear link between the cost of bank loans and the leverage of banks is also evident in the US. In the work by Mills et al [18] using US data on a measure of the spread charged by US banks on business loans over the yield on Treasury Bills. They show that the significant increase in leverage of the US banking sector over the twentieth century was not accompanied by a decrease in lending spreads, indeed the two series are mildly *positively* correlated so that as banks used less equity to finance lending the spread between the rate charged on bank loans to companies and a reference rate actually increased. Of course such a crude analysis does not take into account changes in banks asset quality or in the average maturity of loans. Nevertheless this

evidence provides little support for claims that higher capital requirements imply a significantly higher cost of borrowing for firms.

The second reason for being skeptical that there is a strong positive link between banks using more equity and having a higher cost of funds is that the most straightforward and logically consistent model of the *overall* impact of higher equity capital (and less debt) on the total cost of finance of a company implies that the effect is zero. The Modigliani-Miller (MM) theorem implies that as more equity capital is used the volatility of the return on that equity falls, and the safety of the debt rises, so that the required rate of return on both sources of funds falls. It does so in such a way that the weighted average cost of finance is unchanged (Modigliani and Miller [19]).

From the foregoing, it is not self-evident that requiring banks to use more equity and less debt has to substantially increase their costs of funds and/or mean that they need to charge substantially more on loans to service the providers of their funds.

According to Reinhart [20] there are certainly reasons why the Modigliani-Miller result is unlikely to hold exactly, and in the next section we consider them and assess their relevance for measuring the social cost of having banks use more equity to finance lending. But it would be a bad mistake to assume that the reduced volatility of the returns on bank equity deriving from lower bank leverage has no effect on its cost at all. Indeed recent empirical research for the US suggests that the Modigliani-Miller theorem might not be a bad approximation even for banks. Kashyap et al [21] find that the long-run steady-state impact on bank loan rates from increases in external equity finance is modest, in the range of 25-45 basis points for a ten percentage point increase in capital requirements (that is a rise in capital of 10% of bank assets, which would roughly halve leverage).

2.3   The Cost of Equity

The Modigliani-Miller (MM) theorem states that, in the absence of distortions, changes in a company's capital structure do not affect its funding cost. According to Mills et al [22] there are several reasons why the theorem is not likely to hold exactly for banks, though to jump to the conclusion that the basic mechanism underlying the theorem – that equity is more risky the higher is leverage – is irrelevant would certainly be a mistake. The key question is to what extent there is an offset to the impact upon a bank's overall cost of funds of using more equity because the risk of that equity is reduced and so the return it needs to offer is lowered. Some of the reasons that this offset will be less than full are well known and apply to both banks and non-financial companies. The most obvious one is the tax treatment of debt and equity. Companies can deduct interest payments, but not dividends, as a cost to set against their corporation tax payments (though this effect can be offset – possibly completely – if returns to shareholders in the form of dividends and capital gains are taxed less heavily at the personal level than are interest receipts).

Econometric evidence suggests that tax distortions have a significant influence on financial structure (Auerbach [23]), Cheng and Green [24], Graham [25]. For example, Weichenrieder and Klautke [26] conclude that a 10-point increase in the corporate income tax rate increases the debt-asset ratio by 1.4 - 4.6 percentage points; Desai et al [27] estimate the impact on the debt-asset ratio at 2.6 percentage points. IMF (2009) calculations suggest that with a corporation tax rate of 28% UK companies required post-tax return for debt finance was around 225 basis points lower than for equity in 2008.

To this end, stricter capital requirements will mean banks are less able to exploit any favourable tax treatment of debt. But the extra corporation tax payments are not lost to the economy and the value of any extra tax revenue to the government offsets any extra costs to banks. Indeed the extra tax receipts could, in principle, be used to neutralize the impact on the wider economy of any increase in banks' funding costs. So it is not clear that in estimating the wider economic cost of having banks use more equity, and less debt, we should include the cost to banks of paying higher taxes.

Another friction or distortion that may create a cost to banks of using less debt stems from (under-priced) state insurance. Aikman and Nelson [28] observed that deposit insurance – unless it is charged at an actuarially fair rate – may give banks an incentive to substitute equity finance with deposit finance. If governments insure (either implicitly or explicitly) banks' non-deposit debt liabilities the cost of that funding will also fall relative to equity. With non-deposit debt such insurance is usually not explicit so it is less clear that there is an incentive for banks to lever up by using wholesale (un-insured) debt. Nor does the existence of insurance – either explicit or implicit and on some or all of the debt liabilities of a bank – nullify the mechanism underlying the MM result. The essence of MM is this: higher leverage makes equity more risky, so if leverage is brought down the required return on equity financing is likely to fall. That is true even if debt financing is completely safe – for example because of deposit insurance or other government guarantees. In fact the simplest textbook proofs of the MM theorem *assume* that debt is completely safe.

Because of the existence of these distortions – potential tax advantages for issuing debt and under-priced (implicit and explicit) guarantees for debt – it should not be surprising if the MM irrelevance theorem

does not hold to the full extent. There are also agency arguments as to why banks might find it advantageous to use debt (see Calomiris and Kahn [29] and for an example of a model relying on those agency effects see Gertler et al. [30].

2.4 Translating Changes in Bank Funding Costs into Changes in Output for the Wider   Economy
To estimate the economic cost of higher capital requirements, Mills et al [31] calibrated the impact of higher funding costs for US banks on output. They assumed any rise in funding costs is passed on one-for-one by banks to their customers. The impact of higher lending costs on GDP could be assessed using a structured macroeconomic model that incorporates banks (see, for example, BIS 2010a [32], and Barrell *et al*, [33]). They followed the strategy used in the Bank of England Financial Stability Review [34], which is more transparent and focuses on the key transmission channels between banks' cost of funding, firms' cost of capital, investment, and GDP. In their analysis,

Mills et al [35] assumed that output (Y) is produced with capital (K) and labour (L) in a way described by a very standard production function. Shifts in the cost of borrowing to finance investment alter the equilibrium capital stock and it is the impact of that upon steady state output that gives the long run cost of higher bank capital requirements. For a production function with constant elasticity of substitution, $Y = f(K, L)$ the responsiveness of output to cost of capital was estimated using the chain rule. Estimates of the economic cost, in terms of lower output, of higher capital requirements on banks depend on several things: the magnitude of the market wide equity risk premium; whether or not tax factors affect the impact upon non-financial firms of banks having to use more equity; the extent of any offset so that the required return on bank equity falls with lower leverage; the importance of bank lending in firms total finance; the elasticity of substitution between labour and capital; and the choice of discount rate. The economic cost is the present value of all lost GDP to infinity expressed as a percentage of current annual GDP. The impact of a doubling in capital (halving in leverage) is to increase the average cost of bank funds by about 38 bps when there is no MM offset and it is assumed that all of the impact of the extra tax paid by banks is included as an economic cost.

According to Mills et al [36] to reduce the present value of the flow of annual GDP by 13% of current annual output (1268 basis points); it would mean the level of GDP was permanently about one third of a percent lower. They further found that when they allowed a 45% MM offset the impact on bank cost of funds falls to about 22bp and the effect on GDP falls to under 0.2% (generating a present value loss of about 7.5% of annual GDP). Of that impact on WACC just under 5bp is a tax effect; the effect of higher capital on WACC without tax is slightly under 18bp, generating a hit to GDP of about 0.15% (creating a present value loss of just under 6%). They reported that if the MM effect is bigger (75%) the rise in WACC falls to around 8bps and the fall in long run level of GDP is just over 6bps.

2.5 Quantifying the Benefits of Higher Capital Requirements
Higher capital makes banks better able to cope with variability in the value of their assets without triggering fears of (and actual) insolvency. This should lead to a more robust banking sector and a lower frequency of banking crises. The benefit of having higher capital levels can be measured as the expected cost of a financial crisis that has been avoided.

2.5.1. Probability of crisis and bank capital
We can think of a banking crisis – at least of the sort that higher capital can counter – as a situation where many banks come close to insolvency. That is where the fall in the value of their assets is close to being as large as (or is greater than) the amount of loss-absorbing equity capital they have. The type of fluctuations in asset values that would generate such a situation is generalized falls in bank assets – things not specific to a particular bank. It is difficult to predict the likely volatility of banks asset values and therefore the probability of extreme events that could lead to a financial crisis. A common starting point is to assume a normal distribution for the value of bank assets. But this normality assumption very likely understates the likelihood of extreme events; historically extreme events occur with a frequency much higher than implied by a normal distribution.

A large part of banks" assets are debt contracts whose value depends on the ability of borrowers to honour interest and principal repayments from their income and savings. There is likely to be a close link between the value of bank assets (in aggregate) and a country's national income (GDP). So the basic assumption is that losses in the value of assets are linked to *permanent* falls in GDP. Specifically it is assumed that the percentage fall in the value of risk-weighted assets moves in line with any permanent fall in the level of GDP. In a work using UK banks,

Barnes et al [37] found that on the aggregate big UK banks have had total assets that are almost 3 times risk-weighted assets (on the Basel II definitions). Thus the typical risk weight is about 30%. They assumed that a bank sees a fall in the value of each of its assets that is equal to the permanent fall in GDP (in percent) multiplied by the risk weight of that asset. If GDP permanently falls by 1% an asset worth £1 and with a risk

weight of 0.3 would see its value fall by 0.3%, so it would be worth 99.7p. If GDP fell by 10% in a year (a very large fall), and using the average risk weight of 0.3, the fall in assets would be 3% – so assets would be worth 97% of their start of year value. A bank with leverage less than 33.3 (1/0.03) could withstand such a loss. Based on this assumption, they used an assumed probability distribution for changes in annual GDP to calculate the probability of a banking crisis in any given year for different levels of bank capital. This means that modelling GDP largely reflects shocks that cause bank asset values to fluctuate – rather than shocks that emanate from banks and cause movements in incomes. What they did was to calibrate a model of shocks to incomes (i.e. GDP) using data from a large group of countries over a two hundred year period during which most of the biggest movements in GDP reflect wars and political turmoil that are likely to be substantially independent from banking conditions. Historical data on changes in GDP strongly suggests that the frequency of such large negative shocks is very much greater than would be implied by an estimated normal distribution, a distribution which most of the time matches the GDP data well. A much better way to match the distribution of risks that end up affecting GDP is to assume that most of the time risks – or shocks – follow a normal distribution, but once every few decades a shock comes that is very large and which is not a draw from a normal distribution.

This assumption – that GDP changes are normal, but with the added chance that there are low probability quite extreme outcomes – is one made by Robert Barro in a series of important studies of rare events that hit economies (see Barro [38]).

2.5.2. Expected cost of crisis and bank capital
To assess the impact of a financial crisis, one needs to make some assumptions about the size of its initial effect on incomes (GDP) and their persistence. We make the same assumptions as in the Bank of England's FSR [39], that if a banking crisis occurs, GDP falls initially by 10% and three quarters of this reduction lasts for just five years whilst one quarter is permanent. Based on that assumption, and a discount rate of 2.5%, the present value gain of permanently reducing the likelihood of a systematic crisis in any one year by one percentage point is around 55% of current annual GDP. The initial impact of a 10% fall in GDP is in line with the IMF estimate of the typical cost of a financial crisis. It also accords with the recent experience of most countries in Europe and the United States. In the UK for instance, the level of GDP in the first half of 2010 was around 10% below what it would have been if growth from 2007 H1 had been equal to the long-run UK average. The estimate of the cost of crisis is, of course, sensitive to our assumptions about the impact of the financial shock and its persistence. If we assumed no permanent effects on GDP, the benefits of higher capital requirements would then fall to about 20% of GDP per percentage point reduction in the likelihood of crises.

These simple calculations suggest this: when we allow for rare – but very negative – events that hit GDP and whose frequency matches historic data (but which do not follow a normal distribution) there are likely to be large benefits from banks having much more capital. In the next section we turn to estimating how large those benefits are and how they compare to the costs of banks using more capital.

2.5.3 Calibrating optimal capital
Using the estimates for the social costs and benefits of higher capital requirements, we can assess what is a socially-optimal level of capital for the banking sector; that is the level of capital where the extra benefit of having more capital just falls to the extra costs of having more capital. The marginal benefit of additional units of equity capital is the reduction in the expected cost of future financial crises. Given the assumed distribution of shocks to bank asset values, this benefit tends to decline with additional capital. But since it looks like there are very occasionally extremely negative shocks to asset values, the benefit of extra capital does not fall monotonically. The costs of having banks finance more of their assets with equity is, given our assumptions, linear. So the marginal cost (for a given set of assumptions on the equity risk premium, the extent to which MM holds and the degree to which investment is assumed to be financed from bank lending) is constant. Both costs and benefits are measured as the expected present value of all changes to the future levels of GDP.

In a seminal work by Jappali et al [40] they show using two estimates the marginal benefits of extra capital: in one estimate they assumed that a quarter of the fall in output associated with a financial crisis is permanently lost; in the second estimate they assume that 5 years after a banking crisis the level of GDP returns to where it would have been had there been no crisis. The highest cost scenario is one where there are no MM offsets and additional tax payments from banks to the government are simply a loss to society. Their base case (the middle cost line) assumes a 45% MM offset (the lowest estimated MM offset) and that the Government uses any additional tax receipts to neutralize the negative impact on corporate investment from banks paying more tax. The lowest cost scenario makes the assumption that banks provide 16% of business finances, rather than the 33% assumed in the base case. Their result shows clearly the implication of assuming that there is a small probability of a huge negative shock to incomes and bank asset values – it means that there is a benefit in having extremely high levels of capital (of the order of 50% of risk weighted assets) to allow banks to survive such a shock. But there is a great deal of uncertainty about what the true probability of very big negative shocks

to economies is and how bad those shocks really are. But even if one ignored the chances of those extreme shocks – and ignored the rise in marginal benefits of equity capital at very high levels – one would still find that the point at which benefits of more capital fell below costs will not be until capital was 17% to 20% or so of risk-weighted assets. This would be about 5 times as much capital – and one fifth the leverage – of banks now.

But as noted above that result is hugely influenced by our assumption that there is a non-negligible probability of a fall in GDP and risk weighted assets of the order of 38% or so. If we set that to one side – perhaps because the uncertainty around the probability of such a huge fall in incomes is great – the implied optimal levels of capital for the central assumptions on costs and benefits is very much lower. In that case our central estimate of optimal capital – assuming some permanent impact of a crisis on GDP – is 19% of risk-weighted assets. Therefore, once we ignore very bad outcomes all the optimal capital ratios estimated are within the 16-20% range.

The latest Basel agreement takes some significant steps in the direction their (Japalli et al [41]) results suggest. It does so by redefining capital to be truly loss-absorbing and setting the (ultimate) minimum target for common equity capital at 7% of risk-weighted assets. That 7% figure of adjusted risk weighted assets corresponds to a higher proportion of risk weighted assets under the previous Basel rules; it corresponds to a minimum level of loss-absorbing capital that is probably closer to 10% of the Basel II version of risk weighted assets. Nevertheless our foregoing empirical analysis suggests clearly that far more ambitious reforms would ultimately be desirable – a capital ratio which is at least twice as large as that agreed upon in Basel would take the banking sector much closer to an optimal position.

III.   Bank Capital Regulation in Nigeria: An Overview

The prime regulatory body for financial institutions in Nigeria is the Central Bank of Nigeria. The Central Bank of Nigeria was established in 1958. Its principal objects are to: (i) issue legal tender currency in Nigeria; (ii) maintain external reserves to safeguard the international value of the Nigerian currency; (iii) promote monetary stability and a sound financial system in Nigeria; and (iv) act as banker and financial adviser to the Federal Government. The promotion of monetary stability is a prerequisite for a sound financial system, and indeed, for the economic development of any country (Ogowewo and Uche [42]). Prior to its establishment, monetary activities were overseen by the West African Currency Board (WACB), which was established in 1912 with headquarters in London. The WACB was charged essentially to provide for and to control the supply of currency to the British West African Colonies, Protectorates and Trust Territories. Even though WACB was not a monetary authority in the strict sense of the word and has various limitations, the colonial government was reluctant to replace it with a central bank. According to Ogowewo and Uche [43] the Bank of England feared that central banks in newly independent developing countries might be unable to adhere to sound principles of monetary system management, especially when exposed to political pressures. According to them, the Bank of England was no doubt keen to avoid the mistakes of the past where several central banks collapsed in Europe in the early 20th century.

Eventually with passage of time, it became obvious to the Bank of England that political independence and central banking were inexorably linked, it reluctantly conceded. The Bank of England, however, ensured that enough safeguards were put in place to prevent political interference and ensure monetary stability in post-independence Nigeria. Specifically, it ensured that the Central Bank of Nigeria Ordinance, 1958, had explicit provisions limiting the ability of the Central Bank to expand the money supply. This was an important part of the architecture of Nigeria's monetary law. In this regard, the Central Bank of Nigeria Ordinance, 1958, provided that the value of the central bank reserve should, at least for a period of five years, be not less than the aggregate of an amount representing 60 per cent of the bank's notes and coins in circulation together with an amount representing 35 per cent of the Bank's other demand liabilities; after five years, such reserves should be not less than 40 per cent of the aggregate of the Bank's notes and coins in circulation and other demand liabilities. With the passage of time, these restrictions were discarded and the Central Bank became progressively less inhibited in funding government deficits. The implication of this trend is the failure of the Central Bank to promote monetary stability in the country with dire consequences for the financial system in particular and the economy in general.

As further observed by Ogowewo and Uche [44] "having failed in its primary responsibility to provide a sound macro-economic environment for economic activity including banking, the Central Bank has focused on banking supervision, albeit poorly, as if it were the panacea to the problem of banking instability" In this context, the regulation has tilted more towards bank capital regulation. In fact between 1952 till date, there have been over 13 episodes of bank capital increases. Although the first commercial bank was established in Nigeria in 1891, it was not until 1952 that the stipulated quantum of bank share capital became a regulatory tool. The initial banks that were operating in Nigeria in the late 19th century had extensive British links. At the time, the United Kingdom did not have any formal and elaborate structure of banking supervision as the regulation of banking in the UK began with informal controls by the Bank of England and was eventually placed on a

statutory basis by the Banking Act 1879. Accordingly, from the onset there was no attempt to regulate banking in Nigeria. Most of the early foreign banks in Nigeria were established to cater for British trading interests and the banking needs of the colonial government. It was not their aim to service the indigenous people. This discriminatory attitude led to the emergence of indigenous banks. Most of these banks were poorly staffed, poorly capitalized and sometimes fraud infested. This made it difficult for the colonial administration to sustain a laissez-faire banking regulatory regime in the Nigerian colony. Mr. G. D. Paton of the Bank of England was therefore appointed to review the Nigerian banking system with a view to introducing regulation. It was the Paton Report of 1948 that led to the enactment of the Banking Ordinance, 1952. On the issue of bank capital, the Ordinance stipulated a minimum share capital of £12,500. Existing banks were then given three years to meet the requirements of the Ordinance or cease to exist as banks. Within two years of the Ordinance taking effect, there were mass runs on most of the indigenous banks that had not met the set criteria. This led to the failure of 17 of these indigenous banks in 1953–54 alone. The fact that there was little integration between the foreign and indigenous banks helped quarantine the remaining part of the banking industry from any contagion amongst the indigenous banks. The colonial government gladly allowed the indigenous banks to perish. Since 1952, the level of bank share capital required by the Central Bank has continued to rise. In 1958, the Banking Ordinance, 1952, was repealed. The new Banking Ordinance of 1958 raised the minimum share capital requirement for foreign banks from £100,000 to £200,000. The requirement for the indigenous banks remained unchanged. In practice, however, this had little effect on the Nigerian banking industry at the time as most of the foreign banks then in existence already had paid up capital above the recommended minimum. In 1962, the minimum share capital requirement for banks was again reviewed upwards: that for indigenous banks was raised to £250,000, while in the case of foreign banks, they were now required to retain in Nigeria funds equal to the minimum £250,000. A seven years grace period was allowed by the government for full compliance. Just as the seven years grace period was about to expire, a new banking decree – a law enacted by the then military dictatorship – repealed the Banking Ordinance of 1958. The Banking Decree, 1969, increased the share capital for indigenous banks to £300,000 and that for foreign banks to £750,000. The end result of all these increases was the exit of private indigenous banks from the Nigerian banking space. By 1969, all the indigenous banks that survived the 1953–54 crises had been taken over by regional/state governments. This was because share capital increases had made private indigenous participation in bank ownership difficult. More capital increases were to follow especially after the introduction of Structural Adjustment Programme in 1986. One of the major planks of the Structural Adjustment Programme was the liberalization of the financial sector which saw to the proliferation of banks and other non-bank financial institutions. After just two years of the adoption of the Structural Adjustment Programme, the Central Bank had increased the minimum share capital base to 6 million for merchant banks and 10 million for commercial banks. This new capital base was not sustainable due to high level of inflation prevalent in the country and another increase was announced two years later. The new capitalization was 12 million and 20 million for merchant banks and commercial banks, respectively. By 1991, the Banks and Other Financial Institutions Decree repealed the Banking Decree of 1969. Again, the new Decree raised share capital to 40 million and 50 million for merchant banks and commercial banks, respectively. Once again, the fact that inflation had eroded the real value of the previous capital requirement was a major reason for the increase. By 1988, all commercial banks were required to have a share capital of N10million while merchant banks were required to have a capital base of N6million. Two years later, this was increased to N12million for merchant banks and N20million for commercial banks. A year later, with the promulgation of Banks and Other Financial Institutions Decree (BOFID) 1991, commercial banks capital requirement was increased to N50million while that of merchant banks was raised to N40million. Moreover, by 1997, all commercial banks were mandated to have a capital base of N500million. This was again increased to N1billion two years later in 1999. By 2004 there was further increase of banks capital to N2billion with a deadline of December 2005. But before this deadline, by 2005, it was increased by 1150 percent to N25billion. And finally in 2010 following the abolition of the universal banking concept, banks were calibrated into three categories (International, National and Regional) with different capitalization requirements of N50bllion, N25billion and N10bllion respectively.

From the foregoing, it is evident that bank capital increases is a common regulatory tool in Nigeria. It is also evident that these increases have not succeeded in instilling stability in banking as the history of banking crisis in Nigeria will attest. It has rightly been argued that: ''[M]ore capital does not necessarily mean more safety. Whether more capital decreases the risk of bankruptcy depends on what happens to the asset portfolio when the new capital is introduced. Furthermore, since capital is costly to raise (as compared say to pure debt), banks would be under pressure to generate higher returns from the additional capital, thereby forcing them to take on greater risks''

IV.   Empirical Analysis of the Impact of Bank Re-capitalization Exercise
To assess the impact of bank capital increases in Nigeria, we review the impact of the 2005 bank capital increase on the performance of Nigerian banks. To achieve this, the study employed secondary data

obtained from Nigeria Deposit Insurance Corporation (NDIC) annual reports of various issues. The data were analyzed using ratio analysis to measure banks performance. An analytical technique was further employed to test the equality of the mean of the key profitability ratios using t-test statistic of the pre and post 2005 key profitability ratios of banks. All the insured banks were used for the study. We used the 2005 recapitalization as the base year, testing the performance of banks five years before the 2005 recapitalization exercise and five years after the 2005 recapitalization exercise (2005 inclusive) to see the significance of that year recapitalization exercise.

4.1 Methods of Data Analysis and Definition of Ratios:
In an attempt to test the significance of the 2005 recapitalization on bank performance, this study adopts a simple ratio analysis, using specifically profitability ratios to evaluate the performance of Banks five years before the 2005 recapitalization exercise comparing it with the performance of the banks five years after the recapitalization exercise. A test of equality of mean was also carried out using the t-test to see if there is any significant difference in the mean of the pre and post ratios used. The ratios used are as stated below:

i.   **Net Interest Margin:** This is calculated as interest income from loans and security investment less interest expense on deposit and other debt issues divided by total asset. This ratio measure how large a spread between interest revenues and interest costs the banks management have been able to achieve by close control over earning assets and the pursuit of the cheapest sources of fund. *Net interest margin* is also known as "net yield on interest-earning assets." The formula for net interest margin is: Net Interest Margin = (Interest Received - Interest Paid)/Average Invested Assets. Net interest margin is always expressed as a percentage. Assume John borrows $1,000,000 and uses it to buy bonds of Company XYZ. The bonds pay 5% interest per year, or $50,000. The interest rate on the loan is 3%, or $30,000 per year. Using the formula above, John's net interest margin is: Net Interest Margin = ($50,000 - $30,000) / $1,000,000 = 0.02 or 2%. A positive net interest margin means the investment strategy pays more interest than it costs. Conversely, if net interest margin is negative, it means the investment strategy costs more than it makes. Banks are keenly interested in their net interest margins because they lend at one rate and pay depositors at another. However, comparisons between net interest margins of different banks are not always useful because the nature of each bank's lending and deposit activities varies. Net interest margin is a measure of an investing strategy's success, especially when investors are attempting to "arbitrage" the market by borrowing at a rate that they believe is below what their potential returns will be.

ii. **Yield on earning assets** - This represents the percentage of return that an institution is receiving on its earning assets. Earning assets include all assets that generate explicit interest income or lease receipts. It is typically measured by subtracting all non-earning assets, such as cash and due from banks, premises, equipment, and other assets from total assets. Earning Assets is calculated as Earning Assets = Total Assets - Non Earning Assets.

iii. **Funding cost** – This is the weighted average cost of capital for the industry.

iv. **Return on equity** – This is measured as net income after taxes divided by total equity capital. It measures the rate of return to the shareholder.

v.   **Return on Asset** – This is defined as net income after taxes divided by total assets. This ratio is an indicator of managerial efficiency; it indicates how capable the management of the banks has been in converting the bank's assets into net earnings.

The data was limited in temporal scope to five years before the 2005 recapitalization exercise and five years after the 2005 recapitalization exercise (2005 inclusive). The choice of the 2005 is very significant. The 2005 re-recapitalization exercise was the largest in Nigeria banking history. In that particular episode existing and new banks were made to recapitalize from N2billion to N25billion – an increase of 1,115 percent.

4.2 Data Analysis, Results and Discussions
Table 1 below shows the data used in carrying out the study. The table clearly highlights the pre and post situation for the various performance ratios of banks in Nigeria following five years before and five years after the 2005 recapitalization exercise.

Table 1 Pre and Post Recapitalization Performance Evaluation Indicators for Nigerian Banks

Indicator	Pre-Capitalization					Post Capitalization				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Net Interest Margin	14.88	9.12	10.47	7.71	10.21	9.53	9.87	8.42	6.77	8.02
Yield on Earning Assets	4.51	27.37	27.55	20.32	18.22	4.07	3.47	20.58	18.27	22.87
Funding Cost	8.09	9.47	13.05	9.63	9.66	10.7	12.7	11.32	11.01	10.34
Return on Equity	115.27	57.41	41.63	29.11	27.23	4.81	4.12	36.83	24.11	-9.28
Return on Assets	3.78	4.82	2.63	2.00	2.58	0.75	0.59	5.92	4.29	-64.72

Source: NDIC Annual Report, Various Years

Brief analyses of the indicators are as follows:

Net Interest Margin (NIM) – There was a gradual fall in the NIM for post- recapitalization result. In 2002 it was 10.47, it dropped to 7.71 in 2003 and later pick up in 2004 to stand at 10.21. It started to fall again in 2005 and maintained a continuous decline post capitalization, standing at 8.02 in 2009. A higher NIM relative to the industry average implies how efficient the management has been able to keep the growth of interest income ahead of interest expenses. The result obtained indicates that banks management are still trying to get their bearings after the 2005 recapitalization exercise. Therefore, the result suggests that banks management have been less efficient after the recapitalization but a test of equality of mean will help us reach a better conclusion.

Yield on Earning Assets (YEA) – The YEA rose sharply from 4.51 in 2000 to 27.55 in 2002, later drop to 20.32 in 2003 and dropped further to 18.88 in 2004. It continued to drop even after the recapitalization exercise of 2005. It was 4.07 in 2005 but later dropped to 3.47 in 2006 before picking up again in 2007 to 20.58. This growth was not maintained as it dropped again to 18.27 in 2008. This result shows that the banks earned more income on their earning assets before the recapitalization exercise of 2005 than after the recapitalization.

Funding Cost: The funding cost (FC) rose from 9.47 in 2000 to 13.05 in 2002, and later fell to 9.63 in 2003 and 9.66 in 2004. It rose again to 10.7 in 2005 after the recapitalization and maintained a continued increase thereafter. This is quite expected as with every major recapitalization exercise - there is an expected increase in funding cost as all the banks will be all out to meet the deadline. However, this was tapered off in 2007 and 2008 and was consistent with the industry average even before the recapitalization.

Return on Equity (ROE): This index measures the rate of return to shareholders, was quite low after the recapitalization falling sharply from 99.45 in 2000 to 41.63 in 2002 and further to 29.11 and 27.23 in 2003 and 2004 respectively. It nose-dived to 4.81 in 2005 after the capitalization exercise and did not improve even thereafter, falling further to 4.12 in 2006 before picking up in 2007. The situation went from bad to worse in 2009 as there was a significant loss of -9.28 to shareholders. This shows that the shareholders receive very low returns in terms of dividend after the recapitalization. This is not surprising as most banks raise their fund through equity shares which now increase the equity capital and the profit after tax did not improve substantially to compensate the shareholder who added additional funds to finance the bank recapitalization.

Return on Assets (ROA): This also fell from 3.78 in 2000 to 2.63 in 2002 and fell further to 2.00 in 2003. It picked up slightly to 2.58 in 2004 before falling again to 0.75 in 2005. Surprisingly, immediately after the recapitalization exercise in 2005, it fell to all-time low to 0.59 in 2006. This shows that management of the banks have not been able convert the banks' assets into net earnings after the recapitalization exercise.

4.3 Test of Equality of Mean
To test the robustness of the result, we test for equality of mean. Test of Equality of mean helps to compare mean of a variable to see if there is any significant different between the mean of a period compared with another period of the same variable to know if there is any significant different in the two mean compared. Conventionally, where it is higher than .05 it means that they are not significant – implying that there is no different between the two mean compared. But where it is less than .05 it means they are significant. The descriptive statistics in Table 2 will offer a guide.

Table 2 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std Deviation
Net Interest Margin:					
Pre-2005	5	9.12	14.88	11.2700	2.92055
Post-2005	5	7.71	10.47	9.4633	1.52399
Yield on Earning Asset:					
Pre-2005	5	4.62	17.55	8.9367	7.45937
Post-2005	5	18.88	27.55	22.2500	4.64606
Funding Cost:					
Pre-2005	5	8.09	9.47	8.9933	.78271
Post-2005	5	9.63	13.5	10.7800	1.96593
Return on Equity:					
Pre-2005	5	80.59	99.45	88.7067	9.70049
Post-2005	5	27.23	41.63	32.6567	7.82778
Return on Asset:					
Pre-2005	5	3.96	4.52	4.2033	.28711
Post-2005	5	2.00	2.63	2.4033	.35019
Valid N (listwise)	5				

Source: Author's computation

Table 2 shows that NIM pre recapitalization mean is higher at 11.27 than the post capitalization NIM mean at 9.4 but table 3 shows that the difference in the mean is not statistical significant. The implication of this is that there is no difference in the performance of the banks in respect of Net Interest Margin before and after 2005 recapitalization exercise.

On yield on Earning Asset, the pre 2005 recapitalization mean is 8.9 with a standard deviation of 7.4 while the post capitalization mean is 22.25 with a better standard deviation of 4.64 meaning that the figures are more aligned. The implication of the result is that post-capitalization the banks earning assets have higher yield after the 2005 recapitalization exercise. Table 3, also shows that the difference in the pre and post mean is significant at 5% level which implies that statistically, there is a significant difference in the means of the two periods compared.

On funding cost, the pre-capitalization mean shows 8.99 with a standard deviation of 0.78 while the post 2005 recapitalization mean shows 10.78 with a standard deviation of 1.96, The implication of this is that pre-capitalization funding cost is better than the post. However, table 3 shows that at 5% level there is no significant difference in the two means compared - meaning that it is not statistically significant. This implies that statistically, there is no difference in the means of the pre and the post funding cost. This is further illuminated in the descriptive analysis, which shows that the post capitalization funding cost is tending to the position of the bank during the pre 2005 recapitalization period.

Table 3 T- Test Paired Sample Test

		Mean	Std Dev.	T	Df	5% Level
Pair 1	Net interest Margin Pre-2005 – Net Interest Margin Post 2005	10.78	6.437	1,22	2	0.045
Pair 2	Yield on Earning Assets Pre-2005 – Yield on Earning Assets Post 2005	28.11	9.256	3.22	2	0.018
Pair 3	Funding Cost Pre-2005 – Funding Cost Post 2005	-6.17	2.569	-4.23	2	0.478
Pair 4	Return on Asset Pre-2005 – Return on Asset Post-2005	210.06	25.55	12.44	2	0.012
Pair 5	Return on Asset Pre-2005 – Return on Asset Post-2005	-37.36	4.654	-9.143	2	0.230

Source: Authors' computation

The return on equity result shows that the pre recapitalization mean is much higher at 270.6 and 9.7 standard deviation respectively than the post recapitalization mean of 60.59 though it has a better standard deviation of 7.8. This implies that the shareholders earn better return on their investment before the recapitalization. In other words, the 2005 recapitalization has left shareholders worse off and this is likely to continue unless the banks are able to generate higher profit than they are currently doing. Moreover, the t-test also shows the difference between the pre mean and the post mean, is significant at the 0.05 level of significance. This means that the shareholders are not earning as much as they were earning before 2005 recapitalization.

On return on asset, the trend is the same as in Return on Equity, the pre recapitalization mean is better than the post recapitalization mean and the t-test show that the difference between the two mean are significant at 0.05 significant level. This implies that the banks, after the 2005 recapitalization are not turning over their assets enough to generate more profit after tax.

On the aggregate, the study has shown from the analysis of the profitability indices of banks and test of equality of the pre and post mean for 2005 recapitalization exercise, that it is not all the time that recapitalization transforms into good performance of the banks. The study has also shown that it takes more than mere capital (however large) to bring about profitability and stability in the banking system. From the foregoing, it is reasonable to argue that as banks recapitalize the economic environment has to be conducive to enable the banks make good profit and deepen the financial structure of the economy. It is also evident from the result that no amount of bank capital can be regarded as optimal for banking sector profitability and stability unless there is a conducive economic environment. This is where the several calls on the government to ensure macroeconomic stability in the country can hardly be over-emphasized.

V. Recommendations and Conclusion

Bank (re)capitalization is as good as a regulatory tool only if there is a conducive environment. Requiring banks to recapitalize every now and then without providing a sound macro-economic environment for economic activity including banking will amount to an exercise in futility. Nigerian banking history has provided us with an advantage of hindsight in this regard. Since 1952 when the first Banking Ordinance was enacted, there have been over 13 episodes of regulatory-induced bank recapitalization exercise in Nigeria – that is, a capital upward revision of every four years on the average, yet there have been as many banking crises as there has been bank re-capitalization exercises in Nigeria. Indeed, the country's chequered banking history has provided a good ground to question the primacy often ascribed to capital by the Central Bank of Nigeria among the factors driving the solvency of banks. The Nigerian case has also shown that high capitalization does not automatically translate to improved bank risk management. As remarked by Okafor [45] 'in the process of tackling banking problem through capital infusion, the relevant issue is not the level of capital injected into the bank but rather the optimality of the investment portfolio mix generated from the capital base'. The study has provided glaring evidence that bank regulators in Nigeria have relied rather heavily on bank recapitalization in tackling banking sector problem without any appreciable success. Our analysis has shown that without a conducive and sound macroeconomic environment the question of optimal bank capital will be a misnomer.

It is therefore recommended that the Central Bank of Nigeria should rely less on bank re-capitalization as a regulatory tool but should focus attention in ensuring macroeconomic and monetary stability to enable not only banking business but other businesses to thrive in the country. The government too has a role to play in providing necessary infrastructure to ensure that the cost of doing business in Nigeria is reduced significantly to enable the banks make good returns on shareholders' investment. The banks on their part should put in place good corporate governance that will allow for transparency and minimize the incidence of fraud in the banks.

Appendix
Bank Profitability Ratios

Year	Net Interest Margin (%)	Yield on Earning Asset (%)	Funding Cost (%)	Return on Equity (%)	Return on Assets (%)
2000	14.88	4.51	8.09	115.27	3.78
2001	9.12	27.37	9.47	57.41	4.82
2002	10.47	27.55	13.05	41.63	2.63
2003	7.71	20.32	9.63	29.11	2.00
2004	10.21	18.22	9.66	27.23	2.58
2005	9.53	4.07	10.7	4.81	0.75
2006	9.87	3.47	12.7	4.12	0.59
2007	8.42	20.58	11.32	36.83	5.92
2008	6.77	18.27	11.01	24.11	4.29
2009	8.02	22.87	10.34	-9.28	-64.72
Average Pre	53.39	97.97	49.90	270.65	15.81
Average Post	42.61	69.26	56.07	60.59	-53.17
Difference	10.78	28.71	-6.17	210.06	-37.36

Source: NDIC Annual Reports & Accounts (Various Years)
Computation by Researcher

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