SPECIFICATION AND ESTIMATION OF DEMAND AND SUPPLY FUNCTIONS OF COMMERCIAL BANKS' LOANS AND ADVANCES IN NIGERIA: 1961–1983

Abstract

This study attempts to analyse commercial banks' portfolio behaviour as well as the public's desire for credit. It does so by specifying and estimating the demand and supply functions of commercial banks' loans and advances in Nigeria over the period 1961–1983. The purpose is to provide an insight into those factors that determine both the demand for and supply of loans and advances in Nigeria. We proceeded to specify and estimate our equations taking due cognisance of the institutional setting of the Nigerian economy and the whole gamut of policy instruments that the monetary authority usually employs to control commercial banks' credit to the economy.

The general conclusions of the study are that the factors which are conventionally considered to be relevant in the demand and supply functions of commercial banks' loans and advances turned out to be empirically unimportant during the period covered. The implication of this is that any policy measures designed to control the supply of loans through these factors will not yield the desired results. The conclusions also point to the existence of a host of other considerations that compel commercial banks to grant loans and induce borrowers to go for these loans. However, further research is obviously necessary to shed more light on these issues.

Introduction

Loans and advances together constitute one of the most important components of the asset portfolio of the commercial banks. This asset is different from the other assets such as treasury bills, treasury certificates, etc. in that the initiative lies with the public; that is, the banks' customers who maintain deposits rather than the banks themselves. Thus, the volume of loans is expected to be a function of demand as well as the supply conditions as reflected in the banks' lending rates and other non-price rationing factors. Similarly, the willingness of banks to extend credit will in turn depend on their liquidity.

This study attempts to analyse commercial banks' portfolio behaviour as related to their loans and advances as well as the public's desire for these forms of credit. Specifically, the study aims at specifying and estimating the demand as well as the supply functions of commercial banks' loans and advances, with a view to identifying those factors that influence both variables in Nigeria. In other words, we are interested in identifying those factors that compel the banks to grant loans and those that induce borrowers to go for such loans. It is worth noting that a knowledge of these factors would be useful in designing economic policy. This stems from the fact that variations in the size and composition of bank's loans and advances, generally, play a significant role in transmitting the influence of monetary policy to the economy. For example, the market for bank loans to commercial and industrial customers has long been deemed a key element in the process of income determination, through its impact on aggregate economic activity.

The Commercial banks' loan market is one major linkage between the monetary and real sectors of the economy. Traditionally, Central bankers have held that it is through this market that the effects of monetary policy are transmitted to the expenditure stream. By manipulating discount rates and reserve requirements, the central bank can affect the supply of credit in the loan market and (via spillover effects) other markets, and consequently the price and volume of loans. Thus, if one is interested in policy questions, it is clearly relevant to examine the banks' behaviour, since the efficacy of monetary policy is not independent of the investment decisions of the commercial banks.[1]

The remaining part of the paper has been divided into four sections. Section I is devoted to a review of the existing body of literature on the specification and estimation of the demand and supply functions of commercial banks' loans. In Section II we specify and estimate the equations relating to the supply of bank loans and the demand for bank loans in Nigeria for the period 1961 to 1983. Section III treats the analysis of our estimated model, while section IV is devoted to the summary and policy implication of our findings. The appendix contains our data definitions and sources.

I. LITERATURE REVIEW

Until the pioneering work of Melitz and Pardue,[2] earlier empirical attempts at investigating those factors that influence the demand for and supply of commercial banks' loans and advances, were mainly embodied in large-scale econometric models of the entire economy.[3] These models according to Melitz and Pardue failed to yield satisfactory results as far as commercial bank loans were concerned. Thus, one could claim that the work of Melitz and Pardue marked the starting point of rigorous interest in the behaviour of credit beneficiaries and suppliers of credit. In spite of the shortcomings of these earlier studies, a number of important features regarding the demand and supply relationship were recognized by them. First, there was a general consensus that the demand for bank loans is a demand for credit, while loan supply is merely a reflection of commercial banks' desire to earn income (or rate of return) on their asset portfolio. Secondly, some measure of economic activity like gross domestic product or its component like investment, inventories and exports were admitted as major determinants of demand for bank loans. Thirdly, the assets of commercial banks were regarded as the over-riding factor as far as the determination of the supply of loans was concerned. Finally, interest rate on commercial bank loans was regarded as a very important factor in the determination of both variables. From the demand side, this interest rate measures the cost of borrowing or obtaining credit, which is inversely related to the size of funds demanded. In the supply function, however, this interest rate is the rate of return on this important bank asset, and is positively related to amount of loanable funds, *ceteris paribus*. This implies that, the higher the cost of credit, the lower will be the demand for it; and the higher the supply.

The work of Melitz and Pardue turned-out to be significant in several respects. First, they recognized that the demand for and supply of bank loans could best be tackled from a

simultaneous equations system. Accordingly, they claimed to have obtained strong results using a simple simultaneous-equation method of estimation. Secondly, they contended that their demand equation was derived from the general theory, starting at the microeconomic level (that is, the individual level). Finally, having established the micro-economic foundation of their equations, generalization to the entire economy merely reduced to aggregation over all the individual units.

Furthermore, Melitz and Pardue having recognized that the demand for bank loans is a demand for credit like their predecessors,[4] contended that their basis for an individual credit falls within Fisher's model of individual credit demand.[5] In such a capital-theoretic analysis, the important variables are time preference, the rate of interest and the productivity of the system (given by the production possibility curve). Thus, through the analysis of this Fisherine techniques, Melitz and Pardue concluded that, "the individual's demand for credit depends on his production possibilities, his credit opportunities and his tastes including prominently, his tastes for present relative to future consumption".[6]

Extending their analysis to the case of firms, the authors contended that the problem of the firm reduces to one of maximizing the present value of the firm independently of time preference and consumer tastes. Thus, aggregate demand for credit (or bank loans) can be obtained by summing-up individuals' as well as firms' demand for credit at any given time.

The Fisherine capital-theoretic approach hinges on two basic tenets. The first is that the demand for credit (or loans) depends on time preference and tastes, that is, the valuation of present to future income. This valuation can be conveniently measured by the rate of interest on commercial bank loans. Secondly, is that the demand for credit depends on the productivity of the credit acquired. A good proxy for such productivity is the level of economic activity often measured by gross domestic product (GDP) or its other components like investment, inventories or exports. In their estimation, Melitz and Pardue estimated the aggregate demand for bank credit in real terms by deflating loan demand and components of GDP by the price level expected. To them, making use of nominal variables would have amounted to imputing money illusion into the demand functions.

The supply equation on the other hand, in the work of Melitz and Pardue contained variables which reflect the constraints on the capability of the commercial banks to extend credit continuously. Theoretically, the factors determining the supply of commercial banks' loans can be divided into four. First, there is a scale constraint, which is approximated by the total commercial bank assets in excess of legally required reserves, after deducting commercial bank loans. This variable is intended to reflect some level of commercial banks' activity. Secondly, there is the yield on commercial bank loans approximated by an index of the commercial banks' interest rate on short-term business loans. Thirdly, there is the yield on alternative commercial banks' earning assets. In their estimation, Melitz and Pardue approximated this variable by the yield on three- to five-year government securities. This variable reflects the opportunity cost of lending. Finally, there is the cost per dollar of bank deposit liabilities; the higher this cost, the lower the return of total commercial bank activity. This cost per dollar of deposits should reflect mainly interest payments on savings deposits, partly because the cost of servicing demand deposits, are largely compensated by service charges.

To make the model to fall into the simultaneous equations system, it is assumed that in equilibrium, the supply of bank loans equals the demand, so that the same variable appear in each equation as the dependent variable. In addition, the rate of interest on commercial bank loans appeared in both equations – playing the role of the cost of borrowing or cost of credit in the demand equation, while it serves as the rate of return on loans in the supply equation.

In another empirical study conducted by Ojo,[7] (although largely influenced by the work of Melitz and Pardue) on the Nigerian Commercial bank loans, the following features were observed. First, Fisher's capital-theoretic approach formed the basis of his analysis, although with modest modifications to take account of the underdeveloped nature of the Nigerian economy. Secondly, Ojo's measure of productivity of the system is the GDP and its components, in particular exports and what he termed internal demand defined to include consumption, investment and government expenditure. To complete the Fisherine model, he measured time preference by the rate of interest on commercial bank loans. In addition, two sets of dummy variables were introduced into the demand equation – to take account of the seasonality factor in the Nigerian economy and the political crises during the period 1966 – 1970. Finally, aggregate demand for bank loans was estimated in nominal terms, thus imputing money illusion to individuals in the economy.

For the supply equation, Ojo recognized that in a country like Nigeria where the central bank is constrained in the use of open market operations to control bank credit due to underdeveloped money and capital markets, non-market devices are often employed to achieve the same objectives. Such non-market mechanism according to him is the liquidity ratio which strikes directly at the liquidity of the banking system and as such determines the capacity of the banking system to extend credit. This variable was then admitted as a candidate and is expected to have an inverse relationship with the supply of loans. Another variable considered relevant is the assets of commercial banks which measure the turnover or bank activity and hence bear a direct relationship with the supply of loans. Finally, following Melitz and Pardue a variable which measures the cost per unit naira of deposit was defined.

II. MODEL SPECIFICATION AND ESTIMATION[8]

Before specifying our model, it is necessary to recapitulate some of the behavioural assumptions as enunciated by Goldfeld[9] concerning commercial banks' portfolio behaviour that will guide us in our specification. At any point in time, banks are assumed to have a desired level of loans which depend on the current and expected yields of both loans and competing assets, on total assets size, and on other elements. An implicit assumption is that demand for loans increases with aggregate income.

Similarly, funds to satisfy loans demand will typically be made available via sales of securities particularly short-term securities and where there is problem of illiquidity. Generally speaking, a bank's short-term securities are its most-liquid earning asset and its loans are the less liquid. Thus, a bank which substitutes loans for short-term securities runs the risk of a heavy decline in its liquidity position.

The basic behavioural assumptions underlying commercial banks' loans can therefore be stated as follows: banks are assumed to have a desired composition of their asset portfolios which depend on the entire constellation of yields (or interest rates) on all financial assets the banks are legally required to hold. This desired composition is to be viewed as a set of long-run preferences, which, because of time and uncertainty, must depend on expected as well as on current yields. These preferences for individual assets are assumed to be consistent with rational profit maximizing behaviour of the banks. Thus, for example, the desired volume of loans will depend positively on its yield (the loan rate) and negatively on all other yields.

Employing the capital-stock adjustment model, we posit that quarterly flows of the commercial bank loans depend on the discrepancy between current and desired levels. Furthermore, we posit that quarterly flows attempt to adjust only partially for this discrepancy to be wiped off. If we designate the beginning-of-the period value as the current value and replace the desired level by some function of interest rates, then we end up with an equation in which the actual flow depends on interest rates and the lagged stock. The lags which arise out of the partial-adjustment assumption are presumed to reflect uncertainties and the time lags inherent in the decision process.

In addition to these influences, it is further assumed that other items impinge on the quarterly flows. In particular the banks are viewed as taking as given a set of short-run constraints which together influence decidedly the path from actual to desired stocks.

Specification of the Supply Function

Generally speaking, in Nigeria, policy guidelines on loans, credit, interest rates, etc. should be included as important determinants in any specification of the supply equation. Actually, banks in Nigeria work religiously to adhere to these guidelines to avoid penalties normally imposed by the monetary authority in case of default; rather than considerations of profitability and/or returns to assets. Credit guidelines, levels of liquidity ratio, cash ratio, etc. are some of the policy prescriptions that constrain the behavioural responses of commercial banks.[10]

We posit that commercial banks have a desired level of loan supply which depends on their liquid assets (or reserves) and in particular on their excess liquid assets (or excess reserves)[11]. We contend that at high level of liquid assets (or liquid asset ratio) commercial banks will actually seek to increase their loans because of the relatively higher attractiveness of loans in terms of its yield. Thus, as liquid assets are liquidated to finance loan demand, the ratio will fall and as it approaches the minimum acceptable level, the growth of loans will be restrained.

However, we consider excess liquid assets/excess liquidity ratio as the more relevant supply variables. This is so because, we believe that it is the excess rather than the total that acts as a constraint on the expansion of loan given an adequate loan demand, since loans can only increase where commercial banks have enough assets to meet their obligations. Thus, any asset above the required limit can be used to increase other assets, particularly in a situation where loan supply depends on the public's demand for loans.

Other variables included in the supply equation are: the yield on commercial bank loans (defined as the average commercial banks lending rate), the yield on other alternative commercial banks earning assets – a measure of opportunity cost of lending – like interest rates on treasury bills, treasury certificates and government stocks. The yield on commercial bank loans is expected to be positively related to loan supply, while yields on other competing assets are related inversely to loan supply. Other variables considered relevant in the supply function are some policy variables employed by the monetary authority. These are the Central Bank's discount (or rediscount) rate to take account of possible commercial banks borrowing from the central bank to finance loan demand in a situation of illiquidity; and the reserve requirement[12]. These two variables tend to limit credit expansion when they are increased, and work in the opposite direction when they are reduced. Thus, they relate to loan supply in an inverse manner. They work through commercial bank reserves by first choking off some of their reserves when they are raised, reducing excess reserves and through this their effects are transmitted to the loan market.

Finally, following Melitz and Pardue and Ojo, we add a variable defined as the cost per naira of deposits.[13] Supply of loan vary directly with this cost.

Our general equation forms for desired loan supply are stated as follows:

$$L^s* = f(LA, RL, RC, RD, QR, C) \quad (1a)$$
$$L^s* = f(XLA, RL, RC, RD, QR, C) \quad (1b)$$
$$L^s* = f(LR, RL, RC, RD, QR, C) \quad (1c)$$
$$L^s* = f(XLR, RL, RC, RD, QR, C) \quad (1d)$$

where:

L^s* = desired level of loan supply
LA = liquid assets (or reserves)
XLA = excess liquid assets (or excess reserves)
LR = liquidity ratio
XLR = excess liquidity ratio
RL = average lending rate (i.e. yield on commercial bank loans)
RC = rate of interest on competing assets
RD = Central bank discount (or rediscount) rate
QR = required reserves
C = cost per naira of deposit

$f'(LA)$, $f'(XLA)$, $f'(LR)$, $f'(XLR)$, $f'(RL)$ and $f'(C)>O$; while $f'(RC)$, $f'(RD)$ and $f'(QR)<O$.

In linear form, equations (1a) – (1d) can be written thus; for period t:

$$L^s_t* = a_o + a_1LA_t + a_2RL_t + a_3RC_t + a_4RD_t + a_5QR_t + a_6C_t + V_{1t} \quad (2a)$$
$$L^s_t* = b_o + b_1XLA_t + b_2RL_t + b_3RC_t + b_4RD_t + b_5QR_t + b_6C_t + V_{2t} \quad (2b)$$
$$L^s_t* = c_o + c_1LR_t + c_2RL_t + c_3RC_t + c_4RD_t + c_5QR_t + c_6C_t + V_{3t} \quad (2c)$$
$$L^s_t* = d_o + d_1XLR_t + d_2RL_t + d_3RC_t + d_4RD_t + d_5QR_t + d_6C_t + V_{4t} \quad (2d)$$

where: V_{it} = error (or disturbance) terms.

This desired level of loan supply L^s_t* cannot be measured because it is not observable. To make it observable, we postulate a 'stock adjustment principle', and assume that because of scale constraint, bank liquidity and risks and uncertainty involved in the deposits and loans markets, the actual realized change in loan in any one period is only a fraction of the desired change. In other words, the adjustment of loan supply to the desired level is only gradual. This leads to the 'stock adjustment equation':

$$L^s_t - L^s_{t-1} = \delta [L^s_t* - L^s_{t-1}] + w_t \quad (3)$$

$o<\delta\leq 1$; where δ = adjustment coefficient.

The closer is to unity the greater is the adjustment made in the current period.

Substituting equation (2a) into (3) and rearranging we obtain the estimating equation:

$L^s_t = \alpha_0 + \alpha_1 LA_t + \alpha_2 RL_t + \alpha_3 RC_t + \alpha_4 RD_t + \alpha_5 QR_t + \alpha_6 C_t + \alpha_7 L^s_{t-1} + U_t$ ..... (4)

where: $\alpha_i = \delta a_i$ (i = 0,1,2,3,4,5,6,); $\alpha_7 = 1 - \delta$; $U_t = (W_t + \delta V_t)$.

For simplicity we assume that the new error term $(W_t + \delta V_t)$ is not autocorrelated. The coefficient $\alpha_7 = (1 - \delta)$ measures the speed of adjustment of actual (or realised) level to the desired level of loan supply.

By applying the stock adjustment principle to equations (2b) – (2d) we arrive at equations similar to (4) above.

Specification of the Demand function

The demand for loans particularly on the part of businesses is the result of a complex set of economic calculations coupled with or rather constrained by a set of beliefs concerning the efficacy of the loans secured. We posit that the demand for loans in period t depends on the following factors: expected productivity in the economy and the level of economic activity, level of domestic liquidity and a time preference variable measured by rate of interest on commercial bank loans. This is a measure of the cost of credit (or loan) to the borrower and should relate to loan demand in an adverse fashion. In general, our demand equations could be written as follows:

$L^d_t = f(Y^e_t, LQ_t, RL)$ ..... (5a)

$L^d_t = f(EA^e_t, LQ_t, RL)$ ..... (5b)

where: $f'(Y^e_t)$; $f'(EA^e_t) > o$ and $f'(LQ)$, $f'(RL) < o$

L^d_t = loan demanded in period t

Y^e_t = expected productivity in period t

LQ_t = level of domestic liquidity in period t

EA^e_t = expected level of economic activity in period t

RL_t = average lending rate (i.e cost of commercial bank loans) in period t.

Since 'expected' variables are *ex-ante* variables which are not observable, to measure such expectational model, we assume an 'adaptive expectation' model and rewrite equation (5) in its linear form as

$L^d_t = i_o + i_1 Y^e_t + i_2 LQ_t + i_3 RL_t + e_t$ ..... (6a)

$L^d_t = k_o + k_1 EA^e_t + k_2 LQ_t + k_3 RL_t + e'_t$ ..... (6b)

where e_t, e'_t = error terms

Given that neither Y^e_t nor EA^e_t is directly observable, we postulate that, expectations concerning their values are formed on the 'adaptive' rule, that is:

$Y^e_t - Y^e_{t-1} = \lambda (Y_t - Y^e_{t-1})$ ..... (7a)

$EA^e_t - EA^e_{t-1} = \lambda (EA_t - EA^e_{t-1})$ ..... (7b)

and $o < \lambda \leq 1$

where λ = expectation coefficient.

This rule implies that current expectations of borrowers are formed by modifying (or adapting) previous expectations in the light of the actual achievements, that is, the current experience. Equation (7) also implies that expectations are seldom fully realized in any one period.

Solving for Y^e_t and EA^e_t in (6), lagging by one period and substituting into equation (7) and solving further we obtain:

$L^d_t = \beta_o + \beta_1 Y_t + \beta_2 LQ_t + \beta_3 RL_t + \beta_4 L^d_{t-1} + \beta_5 LQ_{t-1} + \beta_6 RL_{t-1} + z_t$ ..... (8a)

$L^d_t = \gamma_o + \gamma_1 EA_t + \gamma_2 LQ_t + \gamma_3 RL_t + \gamma_4 L^d_{t-1} + \gamma_5 LQ_{t-1} + \gamma_6 RL_{t-1} + z'_t$ ..... (8b)

where:

$\beta j = \lambda i_j$ (j = 0,1,2,3); $\beta_4 = (1 - \lambda)$ and $\beta_k = -(1 - \lambda) i_j$ (j = 2,3, and K = 5,6)

$\gamma j = \lambda k_j$ (j = 0,1,2,3); $\gamma_4 = (1 - \lambda)$ and $\gamma_h = (1 - \lambda) k_j$ (j = 2,3 and h = 5,6)

However, for estimation purposes, we replace Y_t in (8a) and EA_t in (8b) by Y_{t-1} and EA_{t-1} respectively.[14]

Estimation of Demand and Supply Equations

Before stating our estimation procedure, it will be necessary to clarify certain basic issues involved in our specification and how these issues were tackled during the estimation of our models. First, the use of 'adaptive expectations' hypothesis often creates additional problem during estimation. One clear problem is that of serial correlation (or autocorrelation) in the presence of a lagged dependent variable as an explanatory variable in our demand equation. Although, we recognize this shortfall, we have assumed that serial correlation is not a serious problem in our model specification.

Secondly, we recognize that a model of this nature can best be handled within a simultaneous equation system. However, due to lack of adequate computational facilities, we have been constrained to use a single equation procedure. Finally, we assume that in equilibrium loan demand equals loan supply. This assumption enables us to use the same variable as dependent variable in each equation.[15]

For estimation purposes we have employed the techniques of ordinary least squares (OLS). Equation (4) and the final forms of equations (2b), (2c) and (2d) were used to estimate the supply side; while equations (8a) and (8b) were used for the demand side. The log-linear version of the relevant equations were also estimated and the results are presented in tables (1) and (2) below.

Furthermore, during estimation a number of additional explanatory variables were introduced into the model. First, a trend variable (time (T)) was introduced into the demand equation to represent the effect of increase in productivity and level of economic activity and other similar long-run effects.[16] Secondly, two dummy variables – war dummy (WD) and a policy dummy (PD) – were introduced into the demand and supply equations respectively, to account for the civil war and the monetary authorities' effort to regulate the level of loans/advances through the imposition of ceilings on bank lending enforced by the credit guide-lines.[17] It is significant to note here that, the policymaker through a strong bias towards direct controls has often raised serious problems for the would-be model-builder. This is because a model must not only incorporate the traditional policy variables – bank reserve ratio, discount rate, etc – but also take account of a multitude of direct controls, many of which are exceedingly difficult to quantify in an objective statistical manner. These include ceilings on bank credit, officially controlled interest rates, constant reserve ratio, etc. Accordingly, rather more policy dummy variables appear in the model than would normally be expected.[18]

III. ANALYSIS OF ESTIMATED MODEL

The results of our regression exercise are presented in Tables 1 and 2. Table 1 contains the supply equations, while Table 2 contains the demand equations. The equations presented in the tables were chosen on the basis of minimum estimated standard error (or standard deviation) of the equation about the regression line.

Supply of Loans Equations

Considering that one of the primary purposes of this study is to identify and measure the influence of those factors that induce commercial banks to grant credit (through loans and advances) to investors, rather than to measure the influence of a few major variables on the supply of loans, the results obtained cannot be considered encouraging (Table 1). However, given the seemingly relatively good overall fit for the equations, we venture to analyse our regression results for the supply of loans.

A cursory examination of the results obtained showed that the overall fit for each equation was quite good as the explanatory variables explained about 99 per cent of the total variations in the dependent variable as adjudged by the values of the adjusted coefficient of determination (i.e R^2). However, with closer examination of each of the equations in turn, one gains a better insight as to the performances of the variables in each equation.

All the equations involving either total liquid assets (LA) or excess (XLA) yielded identical results in our regression exercise; so also are the equations involving either liquidity ratio (LR) or excess liquidity ratio (XLR).

The estimated regression coefficients for all asset variables (LA, XLA, LR and XLR), required reserves (QR) and the rate of interest on competing assets (RC), possess the wrong signs, even though they all turned out to be statistically significant. On the other hand, the estimated coefficients of the cost per naira of deposit (C) appeared with the expected signs in equations A1–A2, A5–A8, but in all cases were generally insignificant. Furthermore, the coefficients of the lending rate (RL), which we regard as a measure of the rate of return on credit have the wrong signs and are of very low statistical significance and do not differ significantly from zero. The results containing RL as an explanatory variable have, however, not been reported because whether used alone or together with the discount rate (RD), the variable RL turned out to be statistically insignificant. The results obtained for RC and RL are not surprising and are consistent with the view that interest rates (nominal rates) – which were fairly fixed throughout the period – have little or no effect on most financial variables including loans and advances. Nominal interest rates have generally been found to be insignificant in most empirical studies. Thus, our result is in line with Feldstein's conclusion that, "the use of nominal interest rates, when theoretical considerations suggest that the real interest rates is the relevant variable, results in a substantial bias towards zero of the coefficient with frequent opposite signs of the actual coefficient."[19]

The signs of all the asset variables, QR, RC, RL, and in some cases C which were opposite to the expected signs provide no empirical support that these variables have significant influences on loans and advances during the period. In principle, these results would have occurred either because they do not actually reflect a good measure of commercial banks' liquid assets, required reserves, rate of return on competing assets, rate of return on credit and cost per unit of deposits, respectively; or because the influence of these variables were not important during the sample period. QR which is supposed to be a policy instrument had remained fixed at 25 per cent of deposit and therefore could be said to be an ineffective instrument during the period. This can be further attributed to the fact that commercial banks generally found themselves in a position of high liquidity for most part of the period covered by this study due to the monetization of the 'oil money'.

On the other hand, the variable discount rate (RD) (which theoretically is a policy instrument often used by monetary authorities to discourage borrowings from them by commercial banks in a situation where demand far exceeds supply of credit and the commercial banks are illiquid to meet such demands), possessed very large coefficient all through and is consistent with our postulated relationship (i.e. negative relationship) and the coefficients were all statistically significant except in equation (A7). This indicates the importance of this policy variable in influencing the supply of commercial banks' loans and advances. From equation (A1) a one-point increase in RD reduces the supply of loans by 119.6.

Furthermore, the supply of loans do appear to be explained by a partial adjustment mechanism with a fairly fast speed of adjustment – from equation (A3) the speed of adjustment is 0.866. This coefficient is highly significant and indicates the important influence of the previous quarter's level on the current level. The credit guideline policy dummy variable (PD), although insignificant in all the equations indicates the direction of its influence. Using the linear relationships equations (A2) and (A4), we discovered that it has a contractionary influence on the supply of loans with the negative sign of the coefficient. In the log-linear versions, the response of Ls to the dummy variable PD indicates insensitivity to the introduction of credit ceiling guideline as a policy instrument.

Considering the elasticity of loan supply with respect to changes in these explanatory variables, we observed that, generally speaking, the supply of loans is generally insensitive to changes in these variable as is discernible from the low coefficients in equations (A5) – (A8).

Demand for Loans Equations

Judging by standard statistical tests of significance $\bar{R}^2$ and F, the overall fit for the demand equations could be considered good. However, we make the following observations.

The productivity variables measured by the level of gross domestic product (Y) and the growth rate of GDP – a measure of the level of economic activity (EA), as well as the trend variable (T), – taking account of increased productivity over time, were all wrongly signed and were either not significant or were of very low statistical significance, thus violating our *apriori* expectations. Thus, our expectations variables Y and EA did not behave in the way we predicted, that is, that with rising productivity the public's desire for bank loans will increase. The implications of our result, is that productivity or increased level of economic activity (i.e. economic growth) did not play any significant role in the demand for loans. However, this conclusion does not seem quite plausible since rising productivity has the tendency to attract additional investment from investors and where investments are financed via credit, there is tendency for additional credit demand. We could, however, attribute the insignificance of the productivity variables to the fact that we are dealing with an aggregate demand model where productivity might not necessarily be the over-riding factor. However, we contend that in a more disaggregated model – say into sectors – the importance of productivity as a determinant might come out clearly, particularly in the industrial and agricultural sectors. We also

feel that the index of industrial production would have been more appropriate as a measure of productivity in an aggregated model like this. This was, however, not tested because of data constraints.

Similarly, liquidity in the economy (LQ) either in current or lagged form appeared with opposite signs to our postulated sign, although with the lagged value statistically significant and current value statistically insignificant all through. We attribute this wrong sign to our definition of liquidity which was too restrictive and did not take into consideration other physical wealth that could be readily converted into liquid form.

Current lending rate (RL) also appeared with the wrong sign and was statistically insignificant. On the other hand, the coefficient of lagged lending rate possessed the right sign but is statistically insignificant using the standard t-test. The lending rate in the demand equation is supposed to reflect the cost of credit. However, a cursory look at this rate over time showed that it has remained relatively constant, in which case it cannot be viewed as the cost of credit to the borrowers.

The war dummy (WD) introduced to take care of the possible effects of the civil war on loan demand during the period 1967 (III) to 1970 (I) turned out to be insignificant. We are, therefore, constrained to state that the Civil war had litle or no constraining effect on loan demand during the period. This might be true when it is recognised that we are dealing with an aggregate demand and that during this period the government component of demand for credit increased to enable it raise funds to prosecute the war.

Furthermore, the adjustment coefficients in all the equations reported are rather very high, thus giving a slower speed of adjustment of loan demand to their desired level. Similarly, the expectations coefficients were high, giving a slow speed of adaptation to previous experiences on the part of borrowers.

Finally, we state that we have not reported the log-linear version of our demand equations, since they did not provide any significant improvement on the results obtained when we used the linear version. Generally, the coefficients of the log-linear relationships were low, indicating low elasticities (or poor responsiveness) of loan demand to changes in these variables.

IV. SUMMARY AND CONCLUSIONS

During the course of our study, we discovered that most of the conventional theoretical factors considered to influence the demand for and the supply of commercial banks' loans turned out to be empirically unimportant. Of particular interests in the supply equations are liquid assets of commercial banks, and the policy instruments like required reserves and the interest rates (both lending rate and the rate of interest on competing assets) which turned out to be statistically insignificant and in most cases appeared with wrong signs. The implication of these findings is that asset variables and costs have not been major determinants of loan supply in Nigeria during the period of our analysis; neither do policy instruments like required reserves, interest rates policy and credit ceiling in any discernible way influenced the supply of loans by commercial banks.

The inference that could be drawn from this for the conduct of monetary policy and the monetary authorities, is that any policy designed to control supply of loans through these media will not yield the desired results. In fact our analysis showed that lending rates do not actually measure the rate of return on credit as assumed.

Similarly, our analysis tended to underplay the importance of the theoretical factors deemed to determine loans demand. The most shocking result being the inability of the level of economic activity/productivity to influence loans demand in any discernible manner as portrayed by the insignificant coefficients in our regression exercise. Lending rates also turned out not to be a true reflection of the cost of credit in our study.

These conclusions point to the fact that, there are a host of other considerations that compel commercial banks to make loans available; and also induce borrowers to go for these loans. As for the policy dummy variable, the conclusions drawn should be viewed with caution, since the construction of dummy variables are generally subjective and value assigned do not often reflect the true position. A more appropriate construction would have been to design it in such a form as to reflect passive, expansionary and restrictive monetary policy.

Finally, we advise that the conclusions drawn be treated with caution given the limitations of our study. We identified at the beginning that the issue of demand for and supply of loans could best be handled within a simultaneous equations framework, but we proceeded to use a single-equations approach, because of inadequate computational facilities. In fact we cannot categorically claim that we have really estimated a demand as well as a supply equation, even though we ensured that different variables entered each equation. We are in essence saying that the identification conditions of our equations cannot be easily determined. Concluding, we state that the study as it stands, still has room for further research.

CHARLES N. O. MORDI
ECONOMETRICS OFFICE
RESEARCH DEPARTMENT

NOTES

1. See Stephen M. Goldfeld, *Commercial Bank Behaviour and Economic Activity*, (Amsterdam: North Holland Publishing Co., 1966). Chapter 2.
2. Jacques Melitz and Morris Pardue: "The Demand and Supply of Commercial Bank Loans," in *Journal of Money, Credit and Banking*, Vol. 5, 1973, pp. 669–692.
3. See for example Frank de Leeuw, "A Model of financial Behaviour" in James S. Duesenberry *etal.* (eds.), *The Brookings Quarterly Econometric Model of the United States* (Chicago: Rand McNally and Co., 1965) pp. 464–530; Stephen M. Goldfeld, *op cit*; Patric H. Hendershott, "Recent Development of the Financial Sector of Econometric Models", *Journal of Finance*, 23 (March, 1968) pp. 41–66 and Ronald L. Teigen, "An aggregated Quarterly Model of the U.S. Monetary Sector, 1953–1964", in Karl Brunner, (ed.), *Targets and Indicators of Monetary Policy* (San Francisco: Chandler Publishing Co., 1969) pp. 175–218.
4. *ibid.*
5. See Irving Fisher, *The Rate of Interest: Its Nature, Determination and the Relation to Economic Phenomena* (New York: Macmillan and Co., 1907) and *The Theory of Interest* (New York: Augustus M. Kalley, 1961).
6. For a detailed discussion of this Fisherine technique, see Melitz and Pardue, *op cit* pp. 670–678.
7. Oladeji Ojo, "The Demand and Supply of Commercial Bank Loans in Nigeria 1960–72" in O. Teriba and V. P. Diejomaoh (eds.), *Money, Finance and Economic Development*, Essays in Honour of Ohasanmi Olakanpo (Nigerian Economic Society, 1978) pp. 73–85.
8. We acknowledge the fact that the works of Melitz and Pardue and Ojo, *op cit* have influenced us, but the specification also reflects our areas of disagreement with their work.
9. Refer to Stephen M. Goldfeld, *op cit*, pp. 24–28.
10. Essentially, it is assumed that, subject to certain important institutional and policy constraints (including, of course officially controlled interest rates), market forces play the major role in determining the level of commercial banks' advances.
11. Other variants of these reserve variables employed are the ratios of liquid assets (or reserves) to total deposits that is liquidity ratio and excess liquid assets to total deposits i.e. excess liquidity ratio.
12. Discount (or rediscount) rate serves primarily as a penalty rate, but it also indicates whether contractionary or expansionary monetary policies are being intended by the monetary authorities. Discount rate is designed to influence the availability and cost of credit. The instrument of reserve requirement often involves direct control of bank liquidity by the monetary authority.
13. See Melitz and Pardue, and Ojo *op cit* for a detailed description of the relevance of this cost and how it operates. Per naira cost of deposit (C) is defined as

$$C = r\left(\frac{\text{Savings deposits}}{\text{Total deposits}}\right)$$

where r = rate of interest on savings deposits.
14. This replacement is done because when expectations are formed in period t, the current levels of Y and EA, Y_t and EA_t are usually unknown, so we may replace them by Y_{t-1} and EA_{t-1}, the most recent available information on Y and EA. This replacement implies the behavioural (expectation formation) rule:

$Y_t^e - Y_{t-1}^e = \lambda\,(Y_{t-1} - Y_{t-1}^e)$ ..... (i)

$EA_t^e - EA_{t-1}^e = \lambda\,(EA_{t-1} - EA_{t-1}^e)$ ..... (ii)

Thus the expectations models in fact becomes:

$L_t^d = f(Y_{t-1}, L_{t-1}^d, LQ_t, RL_t, LQ_{t-1}, RL_{t-1})$ ..... (iii)

$L_t^d = f(EA_{t-1}, L_{t-1}^d, LQ_t, RL_t, LQ_{t-1}, RL_{t-1})$ ..... (iv)

15. We assume that in the short-run demand plays a dominant role and supply adjusts to it.
16. The trend variable T runs from 0 to 90 starting with T=0 for 1961(II) and ending with T=90 for 1983(IV).
17. The war dummy (WD) takes the form WD=1 for 1967(III) to 1970(I); and WD=0, otherwise. The policy dummy (PD) takes the form PD=1 for the period 1964(II) to 1983(IV) and PD=0 otherwise. Ceiling on credit as a policy instrument was first introduced during the 1964 fiscal year even though its operation was on and off, until 1969 when the monetary policy circular was introduced and the credit guideline became a regular policy instrument of the monetary authority.
18. We have, however, restricted the use of policy dummy variable to only ceiling on bank credit. Over the years these direct controls have often acted in the form of a significant supply constraint. Dummy variables of this type inevitably involve some degree of subjective judgement about the relative strength of policy at any point in time.
19. See Martin Feldstein, "Inflation, Specification bias and the Impact of Interest rates", *Journal of Political Economy*, vol. 78, No. 6 November/December 1970, pp. 1325–39.

Table 1

REGRESSION RESULTS: SUPPLY OF COMMERCIAL BANKS' LOANS AND ADVANCES [1961(iii)–1983(iv)]

LINEAR RELATIONSHIP: DEPENDENT VARIABLE: L^S

NUMBER OF OBSERVATION (n) = 90

		INDEPENDENT VARIABLES												
Equation No.	Constant	LA	XLA	LR	XLR	QR	RC	RD	C	L^S_{-1}	PD	$\bar{R}^2$	F	S[1]
A1.	−104.5		−0.181			0.768	141.2	−119.6	63.1	0.833		0.999	15220.9	99.59
	(−0.99)		(5.83)*			(8.36)*	(2.86)*	(−2.26)*	(0.87)	(24.77)*				
A2.	−76.9	−0.181				0.959	152.4	−130.3	59.0	0.831	−29.8			
	(0.69)	(−5.80)*				(8.81)*	(2.97)*	(−2.39)*	(0.81)	(24.57)*	(−0.84)	0.999	12999.4	99.77
A3.	70.5			−2.48		0.529	160.0	−126.3	−67.5	0.866				
	(0.49)			(−2.72)*		(5.48)*	(2.41)*	(−1.86)**	(−0.74)	(22.54)*		0.999	11764.9	113.3
A4.	31.9				−2.47	0.543	168.3	−138.9	−61.5	0.861	−1.43			
	(0.22)				(−2.36)*	(5.50)*	(2.37)*	(−1.89)**	(−0.66)	(22.08)*	(−0.03)	0.999	9843.1	114.6
	LOG – LINEAR RELATIONSHIP: DEPENDENT VARIABLE: $\ln L^S$													
	Constant	lnLA	lnXLA	lnLR	lnXLR	lnQR	lnRC	lnRD	lnC	$\ln L^S_{-1}$	PD	$\bar{R}^2$	F	S[1]
A5.	0.423		−0.0926			0.442	0.326	−0.261	0.0425	0.635				
	(5.16)*		(−6.81)*			(8.84)*	(2.55)*	(−1.76)**	(1.05)	(13.22)*		0.998	10619.3	0.0579
A6.	0.634	−0.228				0.622	0.349	−0.246	0.0385	0.580	0.0213			
	(6.95)*	(−6.45)*				(8.53)*	(2.64)*	(−1.62)**	(0.94)	(10.76)*	(0.87)	0.998	9102.0	0.0585
A7.	0.975			−0.153		0.337	0.245	−0.132	0.0486	0.641				
	(6.78)*			(−5.23)*		(7.11)*	(1.79)**	(−0.84)	(1.10)	(12.13)*		0.998	7962.5	0.0627
A8.	0.722				−0.0928	0.350	0.325	−0.261	0.0430	0.635	0.0018			
	(7.43)*				(−6.52)*	(7.88)*	(2.50)*	(−1.72)**	(1.06)	(12.71)*	(0.08)	0.998	9102.0	0.0583

[1] S = estimated standard deviation about the regression line

Figures in parenthesis below each coefficient are the t–ratios

* Coefficient significant at 0.05 significance level

** Coefficient significant at 0.10 significance level

Table 2

REGRESSION RESULTS: DEMAND FOR COMMERCIAL BANKS' LOANS AND ADVANCES [1961(iii)–1983(iv)]

DEPENDENT VARIABLE: L^d

NUMBER OF OBSERVATION (n) = 90

Equation No.	INDEPENDENT VARIABLES												R^2	F	D-W	S
	Constant	Y	RL	LQ	EA	L^d -1	Y -1	RL-1	LQ-1	EA-1	T	WD				
B1.	3.7	0.0242	14.48	0.0444		0.810		-14.94	0.111							
	(0.02)	(1.94)**	(0.38)	(0.98)		(16.79)*		(0.60)	(2.19)*				0.999	11994.2	1.93	112.2
B2.	46.0		10.79	0.0308		0.817	0.0232	-17.60	0.120							
	(0.21)		(0.43)	(0.71)		(17.58)*	(- 1.86)**	(- 0.71)	(2.29)*				0.999	11948.6	1.78	112.4
B3.	188.4		3.44	0.0139	- 0.0608	0.882		-29.49	0.0845							
	(0.91)		(0.14)	(0.32)	(- 0.08)	(28.2)*		(1.21)	(1.69)**				0.999	11472.2	1.88	114.7
B4.	152.5		5.90	0.0114		0.877		26.82	0.0892	1.383						
	(0.76)		(0.24)	(0.27)		(28.57)*		(1.12)	(1.82)**	(-1.89)**			0.999	11964.7	1.81	112.3
B5.	88.7	0.0204	20.19	0.048		0.795		9.65	0.117		-1.211	3.62				
	(0.27)	(1.52)	(0.75)	(1.04)		(15.20)*		(0.37)	(2.27)*		(-0.88)	(0.09)	0.999	8868.2	1.92	113.0
B6.	31.7		17.50	0.037		0.800	0.0194	-11.52	0.125		-1.281	4.01				
	(0.13)		(0.65)	(0.83)		(15.63)*	(1.45)	(0.44)	(2.35)*		(0.93)	(0.09)	0.999	8846.0	1.79	113.1
B7.	20.5		16.49	0.0273	0.133	0.838		-16.85	0.103		-1.973	15.27				
	(0.08)		(0.60)	(0.61)	(0.18)	(18.74)*		(0.65)	(1.99)**		(-1.48)	(0.36)	0.999	8624.7	1.85	114.6
B8.	25.2		15.89	0.023		0.843		-16.97	0.102	- 1.246	-1.582	8.13				
	(0.10)		(0.59)	(0.52)		(19.24)*		(0.66)	(2.02)*	(1.67)**	(-1.21)	(0.19)	0.999	8919.3	1.79	112.7

S estimated standard deviation about the regression line

Figures in parenthesis below each coefficient are the t-ratios

* Coefficient significant at 0.05 significance level

** Coefficient significant at 0.10 significance level

APPENDIX I
DATA DEFINITIONS AND SOURCES

All the data used in this study were taken mostly from several issues of the *CBN Annual Report and Statement of Accounts* and the *Economic and Financial Review* and are quarterly, covering the period 1961 (III) to 1983 (IV). Lagged values of the variables therefore cover the period 1961 (II) to 1983 (III). Quarterly GDP figures from 1961 to 1982 were constructed by a colleague in the department and made available to me. While the GDP quarterly figure for 1983 was constructed by me.* All stocks are measured at the end of the period (in this case at the end of each quarter) and the interest rate data (lending rates) are averages. The precise definitions of some variables are as follows:

XLA = excess liquid assets (or excess reserves) in ₦ million defined as total liquid assets (LA) minus statutory minimum reserve requirement against total deposits.

XLR = excess liquidity ratio (in per cent) defined as the ratio of excess liquid assets to total deposit liabilities of commercial banks.

LA = total liquid assets (in ₦ million) defined as the sum of vault cash, balances with CBN, net inter-bank balances (excluding balances with CBN), net Money at call, outstanding treasury bills, treasury certificates, Bills discounted, eligible development stocks, bankers' unit fund, and certificate of deposits.

RL = average lending rate (in per cent) defined as the average of the rates on first class advances, produce advances and other advances at the end of each quarter.

RC = rate of interest on competing assets (in per cent) which is the average of the interest rates on treasury bills and 1-year and 2-years treasury certificates at the end of each quarter.

QR = required reserves (in ₦ million) defined as 25 per cent of total commercial banks deposits (i.e. minimum required reserves)

LR = liquidity ratio (in per cent) which is the ratio of liquid assets to total deposits.

Y = a proxy for productivity (in ₦ million) defined as GDP at current prices.

LQ = domestic liquidity (in ₦ million) defined as the sum of currency outside bank, demand deposit, Time and Savings deposits in commercial banks excluding government deposits.

EA = level of economic activity (in per cent) defined as ΔY, that is $(Y_t - Y_{t-1}) \quad Y_{t-1} \times 100$

C = cost per naira of deposit defined earlier on.

The subscripts d and s denotes demand and supply respectively.

While the subscript -1 denotes lagged value of relevant variable.

*I am grateful to Mr. J. O. Asogu, Head, Econometrics Office for making the quarterly GDP figures available to me for use in this study. See Appendix II for the procedure used in constructing quarterly GDP for 1983.

APPENDIX II

1. The quarterly GDP figures for 1983 was constructed using the relation:

$$Y = f(X)$$

where Y = annual GDP

X = annual value of exports

to establish the simple correlation coefficient between Y and X; recognizing that over the years exports (X) alone contributed more to GDP than any other component.

Given the high-correlation coefficient between Y and X and given the constraint that

$$X = x_1 + x_2 + x_3 + x_4 = \sum_{i=1}^{4} x_i$$

and $Y = y_1 + y_2 + y_3 + y_4 = \sum_{i=1}^{4} y_i$

if Y_is are known.

Since X, Y, x_is are known, to construct the quarterly GDP (Y_is) we used the relation

$$Y_i = \frac{Y}{X} x_i \text{ for } i = 1,2,3,4$$

so that $Y = \sum_{i=1}^{4} y_i = \sum_{i=1}^{4} Y/X\, x_i = Y/X \sum_{i=1}^{4} x_i$

$$= Y/X\,(x_1 + x_2 + x_3 + x_4)$$

Annual GDP figure and the corresponding quarterly export figures used for the construction were obtained from Document of IMF, Nigeria: Report for 1983 Article IV Consultation.

2. Loan figures for 1960–1966 first and third quarters were estimated by the author, since they were not available, using trend interpolation by regressing outstanding loan for each quarter, L_t, on time t for the period 1960(I) – 1966(III) with 1960 (I) = 0 and 1966 (III) = 26 to obtain the trend equation below:

$L_t = 65.5920 + 7.9337\ t$

We then substituted the corresponding value of t for the first and third quarters for each year to the trend equation to obtain the outstanding loan for the corresponding quarter. For example, for 1960 (1), t = 0, so that

$L_{1960\,(I)} = 65.5920 + 7.9337(0) \approx$ ₦65.59 million

1960 (III), t = 2, and

$L_{1960\,(III)} = 65.5920 + 7.9337(2) \approx$ ₦81.46

and so on, until 1966 (III) where t = 26 and

$L_{1966\,(III)} = 65.5920 + 7.9337(26) \approx$ ₦271.87 million

The values obtained compared very well with figures for second and fourth quarters obtained from CBN publications.

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