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An Econometric Analysis of the Determinants of Investments by Insurance Companies in Nigeria

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AN ECONOMETRIC ANALYSIS OF THE DETERMINANTS OF INVESTMENTS BY INSURANCE COMPANIES IN NIGERIA*

In spite of the importance of insurance companies as non-bank financial intermediaries, insurance sector modelling has not been in the mainstream of econometric research into the financial sector in Nigeria. Analyses of the insurance sector have so far focussed on qualitative assessments of growth trends and sectoral behaviours patterns in the industry[1]. Discussions in those studies have, for instance, suggested a number of factors that may influence the size and pattern of investments of the companies. There has been no model designed to determine the relative impact of those factors on insurance investments and their possible linkages between the insurance sector and the real sectors of the economy. The purpose of this study is to develop such a model. The econometric equations thus complement institutional studies of insurance industry behaviours.

A second objective of the insurance sector model is to permit forecasting of fluctuations in the funds flows of that sector. Such forecasts can be useful for both policy-makers and insurance companies themselves in formulating informed courses of action. Finally, simulations with the model may indicate the effects of proposed economic policies on the insurance sector.

The paper is divided into two parts. Part I discusses the concept of financial intermediation. Part II outlines the model of determinants of investments by the insurance industry and summarises the main findings and policy recommendations of the study.

Data for the Study

The analysis of insurance investments is based on a thirteen-year data series (1969-1981) compiled from the insurance companies' annual returns to the Insurance Division, Federal Ministry of Finance. The choice of 1969 as the base year for the analysis stems from the consideration that insurance business in Nigeria became significantly regulated as from that year, following the enactment of the Companies Act 1968. Unavailability of data does not permit the extension of the time profile for the analysis beyond 1981.

Investment data are in consolidated form for 27 insurance companies operating in the country in 1969 through 59 in 1976 to 84 in 1981. Data consolidation has been done in line with the three categories of insurance companies identified as follows: firstly, insurance companies that engage solely in the underwriting of life insurance policies; secondly, those dealing in casualty or non-life[2] insurance, and finally, those that operate both life and non-life business[3].

Limitations to the Data

The data for the study are subject to errors since they were derived from returns on annual surveys of the insurance sector. The data for the last three years, 1979-1981, are also provisional estimates as a few insurance companies had not sent in their survey returns at the time of data consolidation for the entire insurance industry.

A rather theoretical limitation is inherent in the use of time series data themselves. The problem here is that in time series data, most of the economic variables are more correlated with each other than in cross-section data. This greater multicollinearity in time series, particularly one having lagged dependent variables as in this study, means that a bias is introduced into standard errors and t-ratios. Thus statistical significance of the coefficients cannot be accurately determined. Fortunately, for the study, the problem of multicollinearity is generally mild except in the extreme cases of equations 41, 47, 49 and 55 where the problem is clearly present as R^2 is very high but none of the regression coefficients is statistically significant on the basis of the conventional t-test.

PART I

The Concept of Financial Intermediation

Insurance companies as financial intermediaries, perform the economic function of channelling funds from surplus to deficit sectors of the economy. Thus insurance companies provide an outlet for the savings of surplus sectors and a source of loanable funds for those sectors that desire to borrow. The borrower in turn provides security or securities which are held by the insurance companies. Through the lending-borrowing process and the resultant creation of debt instruments or securities by the borrowers of funds, insurance companies thus engage in financial intermediation.

Of course, the lending-borrowing process could take place without intermediation. Thus financial intermediation is an operation not merely that of being a middleman but that of actually generating a new type of asset, the securities, e.g. bonds, mortgages, stocks, ordinary shares and other earning assets.

In the literature attempts have been made to gauge the extent of financial intermediation in an economy. Towards this end, Shaw[4] introduced the related concept of "financial deepening", defined as the ratio of financial assets of financial institutions to Gross National Product (GNP). This ratio has been referred to by Goldsmith[5] as the financial intermediation ratio, thus corroborating Shaw's view that financial deepening is a measure of financial intermediation.

Financial intermediation tends to increase as the economy grows and develops. In the process of economic development,

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[1]See Falegan, J. I. "Insurance and the Capital market", Central Bank of Nigeria, Bullion, C.S.S. Press, Lagos, Vol. 8 No. 2, April-June 1983. Lijadu, Y. "Insurance Industry and Capital Market Development", Central Bank of Nigeria, Bullion, C.S.S. Press, Lagos, Vol. 8 No. 1, Jan-March 1983. Omoruyi, S.E. and Demuren, O.A. "The Growth of Insurance Business in Nigeria, 1969-1978" Central Bank of Nigeria, *Economic and Financial Review*, Vol. 18, No. 1 June 1980.

[2]Non-life insurance, often referred to as general insurance, includes policy coverage for fire, accident, motor vehicle, workmen's compensation, marine aviation and miscellaneous.

[3]See Omoruyi, S. E. and Demuren, O. A., Ibid p.21 for further details of the structure of insurance industry.

[4]Shaw, E. S., *Financial deepening in Economic Development*, New York, Oxford University Press, London, 1973.

[5]Goldsmith, R, *Financial Structure and Development*.

financial assets get diversified through transformation of maturities from short to long-term by financial institutions. The diversification provides opportunities for the development of secondary markets in which long-term securities may be traded. The resultant broadening of the financial assets enhances the growth of financial deepening and/or intermediation. However, the expansive influence of assets diversification on financial intermediation may be eroded by inflation. High rates of inflation drive holders of assets out of financial assets into holding real assets, thus leading to financial disintermediation.

In what follows in Part II an analysis is attempted of the patterns of investments in the securities emanating from financial intermediation by the insurance companies.

PART II

The Model

Before discussing the explanatory variables it is perhaps necessary to say something about what assumptions underlie the model. First, since for the most part the liability structure of the insurance industry has remained constant over the sample period, the equations developed below do not attempt to measure explicitly the asset-liability interaction effect. However, it is important to recognise that this interaction does underlie the selection by the companies of a preferred investment set within which the allocation of funds is carried out. Second, considering that the measurement of risk in economic time series analysis is always problematic and that no really effective method has been developed for doing so, the model assumes implicitly that the relative risk of various asset types has remained constant over the sample period.

Selection of Variables

Many variables were tested to measure their explanatory power on insurance companies' acquisition of various asset types. One such variable was Lf/GDP, life fund deflated with respect to GDP. This variable was employed in all the asset functions in life business to capture the impact of funds availability on asset acquisitions by life insurance companies. The counterpart funds for general insurance business was total assets of non-life business as a proportion of GDP, represented by TANL/GDP.

Another index of funds availability is the premiums/claims (P/C) ratio. The extent to which life, non-life and all insurance companies are capable of making long-term funds available for investment in the capital market is indicated by this ratio. The higher P/C ratio gets the more favourably placed are the insurance companies in their ability to feed the market with investible funds. Thus the relevant variable, P/C, was employed as PL/CL to reflect its life-insurance ratio and PNL/CNL as its non-life counterpart ratio.

It is believed that insurance companies adjust their holdings of each asset by a fixed proportion, say B, of the change they would need to reach their desired holdings of the asset in question. In other words, insurance companies' investment behaviour follows some stock adjustment pattern in achieving their investment portfolio mix[6]. To capture this tendency, the lagged form of the dependent variable has been included in each asset function, e.g.

$(GS1/GDP)_{t-1}, \left(\frac{SSB1}{GDP}\right)_{t-1}, \left(\frac{M11}{GDP}\right)_{t-1}$ etc.

Of great importance is the profit motive in decisions to invest in one asset type or the other. Data on insurance companies' profits were, however not available for the study. It was therefore decided that a simple average of interest rates on government securities, commercial bank deposits and loans and deposits with the Federal Savings Bank, r, be included in the asset equations to serve as proxy for return on investments. Even so, data constraints have precluded our using a more desirable average, namely, the weighted average of interest rates.

Several restrictive government legislations were passed at different times during the study period. Essentially such Acts were designed, *inter alia,* to set limits to and offer guidelines on, insurance companies' investments in assets. In order to capture the possible impact of such legislative changes on insurance companies' investment behaviour, a dummy variable, DM, has been included in each of the asset functions as an argument to represent the years in which the legislations were enacted.

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[6]Suppose that the long-run desired holdings of an asset X at time t is defined as

$$X_t^* = X^*(Z_1, Z_2, Z_3)$$

Then the actual stock adjustment process is assumed to be

$$X_t = X_{t-1} + B(X^* - X_{t-1})$$

where x_t is the actual stock of asset X at timet.

Substituting X* into the adjustment equation and simplifying, we obtain

$$X_t = B X^*(Z_1, Z_2, Z_3) + (1-B) X_{t-1}$$

which can be rewritten as

$$X_t - X_{t-1} = B X^{1}(Z_1, Z_2, Z_3) - BX_{t-1} \text{ or}$$
$$X_t = BX^*(Z_1, Z_2, Z_3) - BX_{t-1}$$

In general,

$$X_t = X(Z_1, Z_2, Z_3, X_{t-1})$$

This is the approach taken in our formulation

Formally, the relationships, in ratio as well as level data, are rendered in the following set of equations:

LIFE

$$\frac{GSl}{GDP} = a_o + a_1\left(\frac{Lf}{GDP}\right) + a_2R + a_3DM + a_4\left(\frac{Pl}{Cl}\right) + a_5\left(\frac{GSl}{GDP}\right)_{t-1} + U_1 \quad (8)$$

$$\ln(GSl) = b_o + b_1 \ln(Lf) + b_2R + b_3DM + b_4 \ln\left(\frac{Pl}{Cl}\right) + b_5 \ln(GSl)_{t-1} + U_2 \quad (9)$$

$$\frac{SSBl}{GDP} = C_o + C_1\left(\frac{Lf}{GDP}\right) + C_2R + C_3DM + C_4\left(\frac{Pl}{Cl}\right) + C_5\left(\frac{SSBl}{GDP}\right)_{t-1} + U_3 \quad (10)$$

$$\ln(SSBl) = d_0 + d_1 \ln(Lf) + d_2R + d_3DM + d_4 \ln\left(\frac{Pl}{Cl}\right) + d_5 \ln(SSBl)_{t-1} + U_4 \quad (11)$$

$$\frac{Mll}{GDP} = f_o + f_1\left(\frac{Lf}{GDP}\right) + f_2R + f_3DM + f_4\left(\frac{Pl}{Cl}\right) + f_5\left(\frac{Mll}{GDP}\right)_{t-1} + U_5 \quad (12)$$

$$\ln(Mll) = g_0 + g_1 \ln(Lf) + g_2R + g_3DM + g_4 \ln\left(\frac{Pl}{Cl}\right) + g_5 \ln(Mll)_{t-1} + U_6 \quad (13)$$

$$\frac{CBl}{GDP} = h_0 + h_1\left(\frac{Lf}{GDP}\right) + h_2R + h_3DM + h_4\left(\frac{Pl}{Cl}\right) + h_5\left(\frac{CBl}{GDP}\right)_{t-1} + U_7 \quad (14)$$

$$\ln(CBl) = k_0 + k_1 \ln(Lf) + k_2R + k_3DM + k_4 \ln\left(\frac{Pl}{Cl}\right) + k_5 \ln(CBl)_{t-1} + U_8 \quad (15)$$

NON-LIFE

$$\frac{GSn}{GDP} = L_0 + L_1\left(\frac{TANL}{GDP}\right) + L_2R + L_3DM + L_4\left(\frac{PNL}{CNL}\right) + L_5\left(\frac{GSn}{GDP}\right)_{t-1} + U_9 \quad (16)$$

$$\ln(GSn) = m_o + m_1 \ln(TANL) + m_2R + m_3DM + m_4 \ln\left(\frac{PNL}{CNL}\right) + m_5 \ln(GSn)_{t-1} + U_{10} \quad (17)$$

$$\frac{SSBn}{GDP} = n_0 + n_1\left(\frac{TANL}{GDP}\right) + n_2R + n_3DM + n_4\left(\frac{Pnl}{Cnl}\right) + n_5\left(\frac{SSBn}{GDP}\right)_{t-1} + U_{11} \quad (18)$$

$$\ln(SSBn) = p_0 + p_1 \ln(TANL) + p_2R + p_3DM + p_4 \ln\left(\frac{Pnl}{Cnl}\right) + p_5 \ln(SSBn)_{t-1} + U_{12} \quad (19)$$

$$\frac{MLn}{GDP} = q_0 + q_1\left(\frac{TANL}{GDP}\right) + q_2R + q_3DM + q_4\left(\frac{PnL}{CNL}\right) + q_5\left(\frac{Mln}{GDP}\right)_{t-1} + U_{13} \quad (20)$$

$$\ln(MLn) = s_0 + s_1 \ln(TANL) + s_2R + s_3DM + s_4 \ln\left(\frac{Pnl}{Cnl}\right) + s_5 \ln(mln)_{t-1} + U_{14} \quad (21)$$

$$\frac{CBn}{GDP} = t_0 + t_1\left(\frac{TANL}{GDP}\right) + t_2R + t_3DM + t_4\left(\frac{PnL}{CnL}\right) + t_5\left(\frac{CBn}{GDP}\right)_{t-1} + U_{15} \quad (22)$$

$$\ln(CBn) = u_0 + u_1 \ln(TANL) + u_2R + u_3DM + u_4 \ln\left(\frac{Pnl}{Cnl}\right) + u_5 \ln(CBn)_{t-1} + U_{16} \quad (23)$$

COMBINED LIFE AND NON-LIFE

$$\frac{GSC}{GDP} = v_0 + v_1 \left(\frac{Lf + TANl}{GDP}\right) + v_2 R + v_3 DM + v_4 \left(\frac{Pl + PNl}{Cl + CNl}\right) + v_5 \left(\frac{GSC}{GDP}\right)_{t-1} + U_{17} \quad (24)$$

$$\ln (GSc) = w_0 + w_1 \ln (Lf + TANl) + w_2 R + w_3 DM + w_4 \ln \left(\frac{Pl + PNl}{Cl + CNl}\right) + w_5 \ln (GSc)_{t-1} + U_{18} \quad (25)$$

$$\frac{SSBC}{GDP} = x_0 + x_1 \left(\frac{Lf + TANl}{GDP}\right) + x_2 R + x_3 DM + x_4 \left(\frac{Pl + PNl}{Cl + CNl}\right) + x_5 \left(\frac{SSBC}{GDp}\right)_{t-1} + U_{19} \quad (26)$$

$$\ln (SSBc) = y_0 + y_1 \ln (Lf + TANL) + y_2 R + y_3 DM + y_4 \ln \left(\frac{Pl + PNl}{Cl + CNl}\right) + y_5 \ln (SSBc)_{t-1} + U_{20} \quad (27)$$

$$\frac{Mlc}{GDP} = z_0 + z_1 \left(\frac{Lf + TANl}{GDP}\right) + z_2 R + z_3 DM + z_4 \left(\frac{Pl + PNl}{Cl + CNl}\right) + z_5 \left(\frac{Mlc}{GDp}\right)_{t-1} + U_{21} \quad (28)$$

$$\ln (MLc) = \psi_0 + \psi_1 \ln (Lf + TANl) + \psi_2 R + \psi_3 DM + \psi_4 \ln \left(\frac{Pl + PNl}{Cl + CNl}\right) + \psi_5 \ln (Mlc)_{t-1} + U_{22} \quad (29)$$

$$\frac{CBc}{GDP} = \gamma_0 + \gamma_1 \left(\frac{Lf + TANl}{GDP}\right) + \gamma_2 R + \gamma_3 DM + \gamma_4 \left(\frac{Pl + PNl}{Cl + CNL}\right) + \gamma_5 \left(\frac{CBC}{GDP}\right)_{t-1} + U_{23} \quad (30)$$

$$\ln (CBc) = \varnothing_0 + \varnothing_1 \ln (Lf + TANl) + \varnothing_2 R + \varnothing_3 DM + \varnothing_4 \ln \left(\frac{Pl + PNl}{Cl + CNl}\right) + \varnothing_5 \ln (CBc)_{t-1} + U_{24} \quad (31)$$

In these equations, all regression coefficients are expected to be positive. A list of the variables and their definitions are as follows:

GSL = Government securities (Life)
GSN = Government securities (non-life)
R = simple average rate of interest
DM = Dummy variable (1969, 1976 = 1; other years 0)
Lf = Life funds
Cl = Claims on life insurance business
CnL = Claims on non-life business
SSBL = Stocks, shares and bonds in life business
SSBn = Stocks, shares and bonds in non-life business
Mll = Mortgages and loans in life business
Mln = Mortgages and loans in non-life business
CBl = Cash and bills receivable in life business
CBn = Cash and bills receivable in non-life business
TANl = Total non-life assets
U = Error term

Regression equations were run over the sample period 1969-1981.

Regression Results[7]

Government Securities (Life)

$$\frac{GSl}{GDP} = -0.00019 + 0.2466^{*}\left(\frac{Lf}{GDP}\right) - 0.00003R + 0.0001DM$$
$$(0.30159)\quad (2.3374)\qquad (0.2977)\quad (0.5826)$$
$$+0.00003\left(\frac{Pl}{Cl}\right) + 0.0636\left(\frac{GSl}{GDP}\right)_{t-1} \quad (32)$$
$$(1.1459)\qquad (0.1540)$$

$R^{-2} = 0.6188$
$DW = 2.0495$
$SEE = 0.000155 \qquad F_{(5,6)} = 1.9486$

Equation 32 represents a rather poor fit linking the ratio of government securities held by the life insurance companies to GDP, to the relevant explanatory variables. With the exception of the proxy variable for impact of funds availability, Lf/GDP, which is significant, the coefficients of all the other variables are not significantly different from zero. However, all have the expected signs, except the yield or return on investment variable, R, which is negative.

The negative sign for the coefficient of R probably underscores the fact that the prevailing low interest rates in Nigeria do not encourage insurance companies' investments in securities beyond the statutory minimum. The R^2 is low at 61.9 per cent and the F-ratio is also uncomfortably low, suggesting that the coefficients taken together are hardly statistically different from zero.

Consequently, a log-linear specification of the securities function was attempted. The results of the estimated equation are as follows:

$$\ln(GSl) = -2.3247^{*} + 0.9880^{*}\ln(Lf) + 0.0194R \quad (33)$$
$$(3.3530)\quad (1.9871)\qquad (0.2259)$$
$$+0.1338DM + 0.4505\ln\left(\frac{Pl}{Cl}\right) - 0.0586\ln(GSl)_{t-1}$$
$$(0.9264)\qquad (1.5545)\qquad (0.1468)$$

$R^{-2} = 0.9781$
$DW = 1.4976$
$SEE = 0.1252 \qquad F_{(5,6)} = 99.3477$

Obviously equation 33 fits the data much better than equation 32 an indication here also that the relationship is non-linear. This is evidenced by the high R^{-2} and the F-ratio. All the variables are correctly signed, and the proxy variable for impact of funds availability, Lf, remains statistically significant.

[7]The asterisk * denotes significance at 0.05 probability level; ** denotes significance at 0.01. Figures in parentheses represent absolute values of t-statistics.

Stocks, Shares and Bonds (Life)

$$\frac{SSBl}{GDP} = -0.00007 + 0.2080^{*}\left(\frac{Lf}{GDP}\right) - 0.000012R + 0.00016DM \quad (34)$$
$$(0.2749)\quad (3.4569)\qquad (0.2679)\quad (1.4327)$$
$$-0.00001\left(\frac{Pl}{Cl}\right) + 0.3798\left(\frac{SSBl}{GDP}\right)_{t-1} \ldots\ldots\ldots\ldots$$
$$(0.8979)\qquad (0.1456)$$

$R^2 = 0.6618$
$DW = 2.0598$
$SEE = 0.000088 \qquad F_{(5,6)} = 5.3066$

In equation 34, the measure of funds availability, Lf/GDP, is significant while all the other explanatory variables are not. All the variables are correctly signed except the interest rate, R, and other index of funds availability, Pl/Cl, which have the wrong signs. The regressors explain not less than 66 percent of the variation in the dependent variable.

However, the log-linear specification of shares, stocks and bonds function in undeflated explanatory variables produces a better fit than the linear equation 35. The R^2 has been boosted to about 90 per cent and the F-ratio becomes high. Even so, the index of funds availability, In(Lf), only remained significant but all variables have signs as expected. The results are as follows:

$$\ln(SSBl) = 0.01362 + 0.4184^{*}\ln(Lf) + 0.02162R \quad (35)$$
$$(0.1647)\quad (2.5698)\qquad (0.1148)$$
$$+0.2034DM + 0.4013^{*}\ln\left(\frac{Pl}{Cl}\right) + 0.3265\ln(SSBl)_{t-1} \ldots\ldots\ldots$$
$$(1.6436)\ (1.8496)\qquad (0.2234)$$

$R^2 = 0.9017$
$DW = 1.9865$
$SEE = 0.0769 \qquad F_{(5,6)} = 251.6698$

Mortgages and Loans (Life)

$$\frac{M11}{GDP} = -0.00034 + 0.0762\left(\frac{Lf}{GDP}\right) + 0.00004R + 0.0002DM \quad (36)$$
$$(0.8788)\quad (0.8103)\qquad (0.6128)\quad (1.1319)$$
$$+0.00002\left(\frac{Pl}{Cl}\right) + 0.5377^{*}\left(\frac{M11}{GDP}\right)_{t-1}$$
$$(1.1462)\qquad (2.1184)$$

$R^2 = 0.6890$
$DW = 2.0823$
$SEE = 0.00013 \qquad F_{(5,6)} = 2.6585$

$$\ln(M11) = -1.15012 + 0.9124^{*}\ln(Lf) - 0.1087R + 0.1710DM \quad (37)$$
$$(1.1733)\quad (2.6258)\qquad (1.0448)\quad (0.8889)$$
$$+0.0316\left(\frac{Pl}{Cl}\right) + 0.2152\ln(M11)_{t-1} \ldots$$
$$(0.0957)\qquad (0.7393)$$

$R^2 = 0.9649$
$DW = 1.6092$
$SEE = 0.16925 \qquad F_{(5,6)} = 61.5741$

In equation 36, the mortgages and loans function exhibits a poor fit as evidenced by the low r^2 and F-ratio. However, all the variables are correctly signed. The coefficient of the lagged value of mortgages and loans holdings is significantly

different from zero. This reflects the desire by life insurance companies to maintain some balance in their portfolio composition through stocks adjustment.

However, the log-linear version (equation 37) of the mortgages and loans function in undeflated variables produces a better fit than equation 36. Both R^2 and F-ratio are high. The regression explains some 96 per cent of variation in the dependant variable. The positive coefficient on the lagged value of mortgages and loans holdings in both equations 36 and 37 confirm the relevance of stock adjustment specification as a factor influencing the investment behaviour of life insurance companies. The measure of availability of investible funds, In(Lf), is significant and the sign of its coefficient conforms to *à priori* expectation. The other variables are also correctly signed except that the interest rate variable has the wrong sign. The negative sign for the coefficient of the interest rate variable probably reflects the disincentive effects of the prevailing low rates of interest in Nigeria, at least in the sample period, on investment in mortgages and loans.

Cash and Bills receivable (Life)

$$\frac{CBI}{GDP} = -0.00069 + 0.09302\left(\frac{Lf}{GDP}\right) - 0.00007R + 0.0005DM \quad (38)$$

(0.2919) (0.4349) (0.4849) (1.6193)

$$+0.00007\left(\frac{Pl}{Cl}\right) + 0.8389^{*}\left(\frac{CBI}{GDP}\right)_{t-1}$$

(0.8973) (1.8047)

$R^2 = 0.6939$
DW = 2.4445
SEE = 0.0003 $F_{(5.6)} = 2.7201$

$$\ln(CBl) = -0.9914 + 0.3622\ln(Lf) + 0.0203R - 0.1828DM \quad (39)$$

(1.1509) (1.3401) (0.1777) (0.7724)

$$+0.7656^{*}\ln\left(\frac{Pl}{Cl}\right) + 0.1948\ln(CBL)_{t-1}$$

(2.0825) (0.5841)

$R^2 = 0.8840$
DW = 1.4953
SEE = 0.1893 $F_{(5.6)} = 17.7735$

The log-linear equation 39 represents a better fit for the cash and bills receivable function than the linear equation 38.

Equation 39 explains not less than 88 per cent. of the variation in the dependent variable. An index of funds availability, In $\left(\frac{PI}{Cl}\right)$, is significant and correctly signed. The stock adjustment variable, in both the log-linear and linear expressions of the cash and bills receivable function, has the correct sign. Although the stock adjustment variable is not significant in the log-linear equation, it is significant in the linear equation at a probability level of 0.10 which, however falls short of the acceptable level for testing an hypothesis.

Government Securities (non-life)

$$\frac{GSn}{GDP} = -0.00107 + 0.1040^{*}\left(\frac{TAN1}{GDP}\right) - 0.00004R \quad (40)$$

(0.5550) (3.3991) (0.3257)

$$-0.0003DM + 0.00003\left(\frac{Pnl}{Cnl}\right) + 0.4148\left(\frac{GSn}{GDP}\right)_{t-1}$$

(0.9565) (0.7067) (0.6892)

$R^2 = 0.8259$
DW = 2.0467
SEE = 0.00019 $F_{(5.6)} = 11.4135$

$$\ln(GSn) = -2.0342 + 1.1349\ln(TAN1) - 0.0107R - 0.1044DM \quad (41)$$

(0.9507) (1.5669) (0.0542) (0.1559)

$$-0.4196\ln\left(\frac{Pnl}{Cnl}\right) - 0.1561\ln(GSn)_{t-1}$$

(0.1529) (0.1828)

$R^2 = 0.9309$
DW = 2.03865
SEE = 0.31666 $F_{(5.6)} = 30.6528$

Stocks, Shares and Bonds (non-life)

$$\frac{SSBn}{GDP} = -0.0015^{*} + 0.4198^{*}\left(\frac{TAN1}{GDP}\right) - 0.0002^{*}R - 0.0001DM \quad (42)$$

(2.0332) (2.4745) (3.4060) (0.8413)

$$+0.0002\left(\frac{Pnl}{Cnl}\right) + 0.6838^{**}\left(\frac{SSBn}{GDP}\right)_{t-1}$$

(1.5039) (4.0749)

$R^2 = 0.7337$
DW = 1.7329
SEE = 0.0001 $F_{(5.6)} = 8.5784$

$$\ln(SSBn) = -0.8870 + 0.4208^{*}\ln(TAN1) + 0.1166R \quad (43)$$

(1.2583) (2.5745) (1.2703)

$$-0.0066DM + 0.0541\left(\frac{Pnl}{Cnl}\right) + 0.3397(SSBn)_{t-1}$$

$-(0.0397)$ (0.1353) (1.2315)

$R^2 = 0.9741$
DW = 1.8247
SEE = 0.1344 $F_{(5.6)} = 83.8254$

Mortgages and Loans (non-life)

$$\frac{Mln}{GDP} = -0.00017 + 0.1295^{**}\left(\frac{TAN1}{GDP}\right) + 0.00001R - 0.00003DM \quad (44)$$

(0.2750) (7.1596) (0.1554) (0.2459)

$$-0.00012\left(\frac{Pnl}{Cnl}\right) - 0.2239\left(\frac{Mln}{GDP}\right)_{t-1}$$

(0.8061) (0.8660)

$R^2 = 0.9611$
DW = 1.5699
SEE = 0.000096 $F_{(5.6)} = 55.48298$

$$\ln(M1n) = \underset{(2.1359)}{-3.0057^{*}} + \underset{(2.6183)}{1.2078^{*}}\ln(TAN1) + \underset{(0.3769)}{0.0652R} \quad (45)$$

$$-\underset{(0.4692)}{0.1555DM} - \underset{(0.3584)}{0.4562}\ln\left(\frac{Pnl}{Cnl}\right) - \underset{(0.3282)}{0.1616}\ln(M1n)_{t-1}$$

$R^2 = 0.9572$
$DW = 1.4156$
$SEE = 0.2701 \quad F_{(5,6)} = 50.2063$

Cash and Bills Receivable (non-life)

$$\frac{CBn}{GDP} = \underset{(3.0405)}{-0.0049^{**}} + \underset{(5.7947)}{0.1691^{**}}\left(\frac{TANl}{GDP}\right) - \underset{(2.0903)}{0.0002^{*}}R - \underset{(2.2812)}{0.0005^{*}}DM \quad (46)$$

$$+ \underset{(4.7610)}{0.0016^{**}}\left(\frac{Pnl}{Cnl}\right) + \underset{(5.7603)}{1.1807^{**}}\left(\frac{CBn}{GDP}\right)_{t-1}$$

$R^2 = 0.9650$
$DW = 1.5851$
$SEE = 0.1342 \quad F_{(5,6)} = 61.7315$

$$\ln(CBn) = \underset{(0.2277)}{-0.19282} + \underset{(1.2053)}{0.4660}\ln(TAN1) - \underset{(0.8457)}{0.0709R} \quad (47)$$

$$-\underset{(0.1193)}{0.0206DM} + \underset{(0.5631)}{0.3914}\ln\left(\frac{Pnl}{Cnl}\right) + \underset{(0.9867)}{0.4882}\ln(CBn)_{t-1}$$

$R^2 = 0.9812$
$DW = 1.5851$
$SEE = 0.1342 \quad F_{(5,6)} = 115.7341$

The results of determinants of investments in assets by non-life insurance companies are presented in equations 40 through 47. The linear equations seem to represent the better specifications than the log-linear ones. A major factor that explains investments in various assets in the sample period has been availability of investible funds, as measured by (TAN1)/GDP and (Pnl)/Cnl). These indicators of funds availability are, for most of the regressions, significant and have the expected signs. The coefficient of multiple determination, adjusted for degrees of freedom (R^{-2}), range from 73.4 for stocks, shares and bonds to 98.1 percent for cash and bills receivable. By and large, the F-ratios are also high. Most of the variables consistently maintain the correct signs, nevertheless, the interest rate variable has a wrong, negative sign, suggesting the disincentive effects on investments of low interest rates prevailing in Nigeria, at least during the sample period.

Government Securities (Life and non-life)

$$\frac{GSl + GSn}{GDP} = -0.00132 \times \underset{(0.5245)}{0.1307^{*}}\left(\frac{Lf + TANl}{GDP}\right) - \underset{(0.9337)}{0.0002R} \quad (48)$$

$$-\underset{(0.8502)}{0.00009DM} + \underset{(1.049)}{0.0004}\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + 0.5993\left(\frac{GSl + GSn}{GDP}\right)_{t-1}$$

$R^2 = 0.8054$
$DW = 1.7657$
$SEE = 0.00027 \quad F_{(5,6)} = 10.1058$

(49)

$$(\text{In}(GSl + GSn) = -1.1074 + 0.7682\text{In}(Lf + TANl) - 0.0238R + 0.0573DM$$
$$(1.2727)\quad (1.7686)\qquad\qquad (0.2712)\quad (0.2827)$$
$$+ 0.0633\text{In}\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + 0.1797\text{In}(GSl + GSn)_{t-1}$$
$$(0.930)\qquad\qquad (0.3627)$$

$R^2 = 0.9749$
$DW = 1.8409$
$SEE = 0.1542 \qquad F_{(5.6)} = 86.4330$

Stocks, Shares and Bonds (Life and non-life)

(50)

$$\frac{SSBl + SSBn}{GDP} = -0.00006 + 0.0588\left(\frac{Lf + TANl}{GDP}\right) - 0.0003R + 0.00014DM$$
$$(0.0719)\quad (3.0892)\qquad\qquad (0.2488)\quad (0.6759)$$
$$+ 0.000012\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + \overset{**}{0.6171}\left(\frac{SSBl + SSBn}{GDP}\right)_{t-1}$$
$$(0.0908)\qquad\qquad (3.7852)$$

$R^2 = 0.7977$
$DW = 2.9806$
$SEE = 0.00017 \qquad F_{(5.6)} = 9.6761$

(51)

$$\text{In}(SSBl + SSBn) = 0.0277 + \overset{*}{0.4486}\text{In}(Lf + TANl) + 0.0296R + \overset{*}{0.2072}DM$$
$$(0.0559)\quad (2.8349)\qquad\qquad (0.6407)\quad (2.2422)$$
$$- 0.4035\text{In}\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + \overset{*}{0.3958}\text{In}(SSBl + SSBn)_{t-1}$$
$$(1.8123)\qquad\qquad (1.8312)$$

$R^2 = 0.9918$
$DW = 1.9856$
$SEE = 0.0754 \qquad F_{(5.6)} = 268.7798$

Mortgages and Loans (Life and non-life)

(52)

$$\frac{Mll + Mln}{GDP} = 0.0009 + \overset{**}{0.1331}\left(\frac{Lf + TANl}{GDP}\right) - 0.00008R + 0.0002DM$$
$$(1.4963)\quad (8.2134)\qquad\qquad (1.1261)\quad (1.4489)$$
$$- 0.0001\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + 0.0617\left(\frac{Mll + Mln}{GDP}\right)_{t-1}$$
$$(1.2173)\qquad\qquad (0.3768)$$

$R^2 = 0.9648$
$DW = 2.1949$
$SEE = 0.0001 \qquad F_{(5.6)} = 61.3755$

(53)

$$\text{In}(Mll + Mln) = -0.9467 + \overset{**}{0.9280}\text{In}\left(\frac{Lf + TANl}{GDP}\right) - 0.0577R + 0.1555DM$$
$$(1.3432)\quad (4.0208)\qquad\qquad (1.0486)\quad (1.3455)$$
$$- 0.3980\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + 0.0692\,\text{In}(Mll + Mln)_{t-1}$$
$$(1.3962)\qquad\qquad (0.2854)$$

$R^2 = 0.9915$
$DW = 2.5034$
$SEE = 0.0955 \qquad F_{(5.6)} = 258.9926$

Cash and Bills Receivable (Life and non-life)

(54)

$$\frac{CBl + CBn}{GDP} = -0.0026 + \underset{(1.8042)}{0.2157}^{**}\left(\frac{Lf + TANl}{GDP}\right) \underset{(3.3337)}{-0.0005}^{**}R + \underset{(2.1010)}{0.0006}^{*}DM$$

$$+ \underset{(4.1602)}{0.0009}\left(\frac{Pl + Pnl}{Cl + Cnl}\right) + \underset{(5.7621)}{0.8018}\left(\frac{CBl + CBn}{GDP}\right)_{t-1}$$

$R^2 = 0.9263$
$DW = 3.2071$
$SEE = 0.00023 \quad F_{(5,6)} = 28.6455$

(55)

$$\ln(CBl + CBn) = \underset{(0.2684)}{0.1226} + \underset{(1.8243)}{0.8657}^{*}\ln\left(Lf + TANl\right) \underset{(0.3965)}{-0.0288}R - \underset{(0.3046)}{0.0349}DM$$

$$+ \underset{(0.0819)}{0.0243}\ln\left(\frac{Pl + Pnl}{Cl + Cnl}\right) \underset{(0.1203)}{-0.0768}\ln(CBl + CBn)_{t-1}$$

$R^2 = 0.9904$
$DW = 3.0709$
$SEE = 0.0812 \quad F_{(5,6)} = 227.5958$

The results of the analysis of determinants of investments of all insurance companies (life and non-life) are presented in equations 48 through 55. As in the case of investment functions for non-life insurance companies, the linear specification of investment functions for all insurance companies (life and non-life) fits the data better than the log-linear one. The linear regressions have desirable goodness of fit characteristics, with R^2 ranging from 79.8 to 96.5 per cent. The F-ratios are also high, indicating joint-significance of regression coefficients. Again, availability of funds, like in previous investment analysis for life or non-life, is a major factor positively influencing variation in asset holdings by the insurance industry. Thus the coefficients of the measures of funds availability, (Lf + TANl)/GDP or ln(Lf + TANl) or $\left(\frac{Pl + Pnl}{Cl + Cnl}\right)$ are, by and large, significantly different from zero and have the correct *a priori* signs, in most of the equations. Asset holdings by all insurance companies are also influenced by previous levels of holdings of assets, especially with respect to holdings of stocks, shares and bonds as well as cash and bills receivable.

An important result of the regressions has been the negative coefficient of the interest rate or yield variable, R. The negative sign suggests, as noted above for the various investment components, that probably the prevailing low interest rates in the country, particularly in the sample period, have had a constraining effect on overall investments in assets by insurance companies. In the case of holdings of cash and bills receivable, in particular, the interest rate is highly significant and has the wrong, negative sign.

Summary and Conclusion

This paper has discussed the determinants of investments by the insurance industry in Nigeria in the period 1969-1981. It indicates the considerations that lead to the allocation of investible funds among alternative asset groups. Equations have been presented to explain net acquisitions of four major

assets – government securities; stocks; shares and bonds; mortgages and loans; and cash and bills receivable.

The results of regressions indicate that the log-linear specification of the insurance company investment model fits the investment data of the life insurance companies. In the case of the non-life and the combined life and non-life insurance companies, respectively, the linear function, however, represents a good fit. The explanatory power of the log-linear equations for the life companies ranged between 88.4 and 97.8 per cent. The corresponding figures for the linear equations of the non-life and the combined life and non-life insurance companies ranged from 73.4 to 96.5 per cent, and 79.8 to 92.6 per cent, respectively. By and large, the F-ratios are also high, indicating joint-significance of regression coefficients.

A major factor positively influencing investment in various assets by the insurance companies has been availability of investible funds. The coefficients of the measures of funds availability adopted for the study are, for most regressions, significantly different from zero and have the correct, positive *a priori* signs. Asset holdings by both the non-life and the combined life and non-life companies are also significantly influenced by previous levels of holdings of assets, especially with regard to holdings of stocks, shares and bonds as well as cash and bills receivable. Of importance too is the interest rate variable. In most of the regressions, the coefficent of the interest rate variable is negative, suggesting perhaps that the prevailing low interest rates in the country, especially during the sample period, have some disincentive effects on insurance company investments.

However, government regulatory legislations for the insurance industry have not had a significantly constraining influence on investments by insurance companies, except in the isolated case of investments in cash and bills receivable by the combined life and non-life companies. In this latter case (equation 54), and dummy variable, employed in the regressions to capture the effects of government legislations, is significant and has a negative sign.

From these regression results certain policy implications emerge. First, in view of the fact that in most of the regressions the coefficient of the interest rate variable was negative, suggesting perhaps that the prevailing low rates of interest in the country have some disincentive effects on insurance company investment, there is need for government to move interest rates gradually upward toward their market levels. It need hardly be emphasized that pegging interest rates below their market equilibrium levels could spell doom for capital market development especially as interest rates and effective yields on securities must ideally be determined by supply and demand in a competitive market place.

Second, government regulatory legislations have not had a significantly constraining influence on eligible investments by the insurance companies; they have, nonetheless imposed some qualitative restraints in that the legislations limit the scope of insurance investments. There is therefore need for government to reconsider its policy on the direction of insurance company investment, such that insurance companies could invest in private, non-quoted companies. In this way, the breadth and depth of the capital market would be fostered.

Finally, in the regression results for the life premium function, the coefficient of the personal income tax variable was significantly different from zero and negatively signed. The negative sign for the coefficient indicates the inverse relationship between premiums and tax payments, that is, the more premiums one pays the less the tax liability. A probable implication of this result is that insurance companies could attract a wider circle of clientele for their life business than is the case at present, if adequate publicity is given to the benefits of tax deductibility of insurance premiums being made available to life policyholders.

It is important to stress, at this point, that in view of the limitations to the data spelled out earlier in the paper coupled with the fact that the model used is a single equation model, with the characteristic least squares limitations, the results from the study cannot be taken as more than tentative. It is believed, however, that these limitations are not such as to nullify the tentative conclusions reached, having regard to the high explanatory power of the regressions, the t-statistics and the F-ratios.

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Table 1

DISTRIBUTION OF INSURANCE COMPANIES BY TYPE OF BUSINESS

Type of Business	1969		1970		1971		1972		1973		1974		1975		1976		1977		1978		1979		1980		1981	
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
Wholly life	6	22.2	7	16.3	6	11.3	8	12.3	9	12.8	9	12.8	9	13.1	6	10.2	6	10.2	6	9.5	8	10.9	8	10.7	9	10.7
Wholly non-life	13	48.2	26	60.5	38	71.7	43	66.2	44	62.8	41	58.6	43	62.3	37	62.7	38	64.4	42	66.7	47	64.4	49	65.3	57	67.9
Life and non-life	8	29.6	10	23.2	9	17.0	14	21.5	17	24.4	20	28.6	17	24.6	16	27.1	15	25.4	15	23.8	18	24.7	18	24.0	18	21.4
TOTAL	27	100	43	100	53	100	65	100	70	100	70	100	69	100	59	100	59	100	63	100	73	100	75	100	84	100

Source: Federal Ministry of Finance, Insurance Division, Lagos

Table 2

INVESTMENT STRUCTURE OF INSURANCE COMPANIES IN NIGERIA

(₦ million)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979[1)]	1980[1)]	1981[1)]
Government securities	6.6	6.7	10.8	16.9	22.6	19.7	29.1	22.4	61.4	78.1	96.2	115.9	133.1
Stocks, shares and bonds	7.3	9.5	9.2	11.8	13.4	18.1	20.7	30.6	37.2	53.6	65.7	77.5	94.4
Mortgages & loans	6.3	7.6	7.4	11.6	12.9	20.1	23.9	38.1	58.1	72.9	89.1	108.2	127.6
Cash & bills receivable	16.9	20.4	30.1	33.9	45.0	47.8	64.9	82.5	129.7	144.6	177.6	209.9	239.8
Miscellaneous	1.0	2.2	3.7	9.7	14.8	33.6	48.7	67.2	121.9	174.0	217.9	262.2	312.7
Total	38.1	46.4	61.2	83.9	108.7	139.3	187.3	240.8	408.3	523.2	646.5	773.7	907.6

1) Provisional

Source: Federal Ministry of Finance Division, Lagos

Table 3

INVESTMENT STRUCTURE OF LIFE INSURANCE COMPANIES IN NIGERIA

(₦ million)

Assets	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979[1)]	1980[1)]	1981[1)]
Government securities	4.0	4.5	7.9	7.9	15.3	15.4	18.6	29.4	33.9	39.6	46.6	54.2	60.1
Stocks, shares and bonds	2.5	4.1	3.0	5.1	7.0	8.0	8.7	16.0	18.7	22.9	27.9	31.8	39.6
Mortgages & loans	4.7	5.7	5.0	5.4	9.5	15.6	18.2	27.9	35.5	36.1	42.2	49.0	56.2
Cash & bills receivable	8.0	8.8	12.4	9.6	19.4	25.9	29.5	25.7	34.0	29.4	36.3	40.5	45.9
Miscellaneous	0.6	0.9	1.4	3.4	5.7	7.0	6.7	12.4	23.1	21.9	27.0	25.9	30.6
Total	19.8	24.0	29.7	31.4	56.9	71.9	81.7	111.4	145.2	149.9	180.0	201.4	232.4

1) Provisional

Source: Federal Ministry of Finance Division, Lagos

Table 4

INVESTMENT STRUCTURE OF NON-LIFE INSURANCE COMPANIES IN NIGERIA
(₦ million)

Assets	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979[1)]	1980[1)]	1981[1)]
Government securities	2.5	2.2	3.0	8.9	7.3	4.2	10.5	13.1	27.5	38.5	49.6	61.7	73.0
Stocks, shares and bonds	4.9	5.4	6.3	6.8	6.4	10.1	12.0	14.6	18.5	30.7	37.8	45.7	54.8
Mortgages & loans	1.6	1.9	2.4	6.2	3.4	4.5	5.7	10.1	22.6	36.8	46.9	59.2	71.4
Cash & bills receivable	8.9	11.6	17.6	24.3	25.6	21.9	35.4	56.8	95.7	115.2	141.3	169.4	193.9
Miscellaneous	0.4	1.3	2.3	6.3	9.1	26.6	42.0	54.7	98.8	152.1	190.9	236.3	282.1
Total	18.3	22.4	31.6	52.5	51.8	67.3	105.6	149.3	263.1	373.3	466.5	572.3	675.2

1) Provisional

Source: Federal Ministry of Finance Division, Lagos

Table 5

EXOGENOUS REGRESSION VARIABLES

Year	GDP (₦ million)	R (%)
1969	3,549.3	4.5
1970	5,205.1	4.6
1971	6,570.7	4.8
1972	7,208.3	5.1
1973	11,223.6	5.0
1974	18,652.0	5.4
1975	21,475.1	5.1
1976	27,317.8	4.7
1977	32,051.8	4.1
1978	33,660.4	6.0
1979	39,938.6	6.0
1980	43,280.2	6.8
1981	43,450.0	6.8

Sources: Federal Office of Statistics, Lagos
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