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Investment behaviour in the Nigerian economy: a macroeconometric investigation of the impact of stabilization policies

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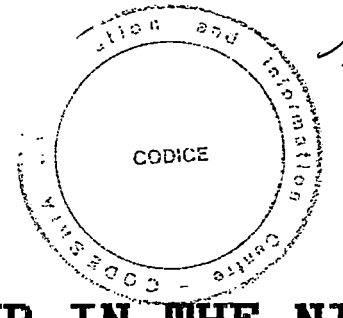

INVESTMENT BEHAVIOUR IN THE NIGERIAN ECONOMY: A MACROECONOMETRIC INVESTIGATION OF THE IMPACT OF STABILIZATION POLICIES

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INVESTMENT BEHAVIOUR IN THE NIGERIAN ECONOMY: A MACROECONOMETRIC INVESTIGATION OF THE IMPACT OF STABILIZATION POLICIES

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BY

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DEDICATION

To my Siblings

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I wish to thank my Project Supervisor, Dr. C.C. Agu for his patient guidance throughout the duration of the research. My special thanks go to my colleagues: Messrs Reginald Chima, Robert Asogwa, Benjamin Osita Onyedinma, and Onyukwu E. Onyukwu for providing me with valuable assistance. I also owe a debt of gratitude to the staff of the General Office of the Department of Economics for contributing in various ways toward the success of this research. I am most grateful to Mrs. I. Okoye and Mrs. Agu, both of the University of Nigerian Computing Centre, who kindly did the necessary computing work.

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ABSTRACT

In the study the relationship between private investment and its proximate determinants are analysed. Specifically the effects of fiscal and monetary policies on investment are investigated. The distortions in the approach to the various policies are highlighted. Simple aggregative models based on the neoclassical theory of investment are used to analyse the effects of the various policies, as well as the time structures of the response of private investment to these policies. Our findings suggest that the impacts of macroeconomic policies on private investment spending in Nigeria are small and with fairly long lags. From the findings, an argument is provided in support of the adoption of the indirect monetary control system and the liberalization of interest rates, as well as increased government capital spending, which provide the necessary complementarities with private investment.

CHAPTER ONE

INTRODUCTION

1.1 Background

The effect of macroeconomic management policies on investment behaviour has been given a considerable amount of attention in the past one and a half decades. A good portion of the literature addresses the question of the relation between economic adjustment and private investment in developing countries. Recent contributors include Blejer and Khan[1] and Serven and Solimano[2].

The current interest in the nexus between private investment and macroeconomic adjustment policies in Nigeria derives from two major considerations: namely the desire to achieve set growth targets and the reduction of unemployment. Investment spending has the potential both to accelerate the rate of growth and to create employment.

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[1]M. Blejer and Khan, "Government Policy and Private Investment in Developing Countries", IMF Staff Papers 31, no. 2, 1984, pp. 379-403.

[2]L. Serven and A. Solimano, "Private Investment and Macroeconomic Adjustment: A Survey", The World Bank Research Observer, Vol. 7 no. 1, January 1992, pp. 95-114.

In this study we shall empirically investigate the relation between private investment and macroeconomic adjustment policies in Nigeria, holding certain key issues in view including:

- the specification of the appropriate model to capture the policy environment that faces private investment in Nigeria;
- examining the time structure of the response of private investment to macroeconomic policies; and
- analyzing the institutional factors and flaws in the adopted macroeconomic policies, which have adversely affected the response of private investment to these polices and the conflicts they give rise to.

1.2 Statement of Problem

Public and private policies determine the rate at which an economy builds up its stock of capital. The interaction of fiscal and monetary policies with appropriate thrift determines how fast society builds up its stock of capital[3]. An expansionary monetary policy when combined with tight fiscal policy leads to a high level of capital formation and low consumption at full employment.

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[3]P.A. Samuelson, Economics (New York: MacGraw-Hill, 1980)., pp. 566-567.

Conversely, a mix of restrictive monetary policy will have the opposite outcome of high level consumption and low investment at full employment.[4]

Fiscal and monetary policies are instruments of economic stabilization packages used to correct macroeconomic imbalances and are bound to impact on private investment. Other instruments of stabilization policy include incomes policy, exchange rate policy and post-stabilization inflation target.[5] Economic stabilization policy normally aimed at improving the balance of payments and reducing inflation impacts upon growth through its effects on saving and investment.

Kalecki indicates that an increase in the money supplied by the banking system will lead to an increase in investment and in economic activity.[6] Credit expansion is required both to ensure the supply of funds to finance an increase in investment as well as

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[4] Ibid.

[5] See R. Dornbusch, "Policies to move from Stabilization to Growth", Proceedings of the World Bank annual Conference on Development Economics (Washington, D.C.: The World Bank, 1990) p. 21.

[6] See M. Kalecki, "A Macrodynamic Theory of Business Cycles", Econometrica, Vol. 3 July, 1935, p. 144.

to satisfy the higher transactions demand being the result of the consequent increase in economic activity and prices.[7] Kalecki asserts that:

> Another reason for the inflation of credit is the circumstance that the increase in the production of capital goods or in the consumption of capitalists ... calls for a rise of the general level of production and prices. This has the effect of increasing the demand for means of payment under the form of cash or current accounts, and to meet that increased demand a credit inflation becomes necessary.[8]

By 'credit inflation' Kalecki means an increase in the money supplied by the banking system. Both Keynes[9] and Wicksell[10]

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[7]See A.Asimakopulos, "Kalecki and Keynes on Finance, Investment and Saving", Cambridge Journal of Economics, vol. 7, 1983, p. 223.

[8]M. Kalecki, op. cit.

[9]J.M. Keynes, "The General Theory and After: Part II Defence and Development", The Collected Writings of John Maynard Keynes, Vol. xiv, London, Macmillan, 1973. (cited in Asimakopulos, op. cit.).

corroborate Kalecki's views on the importance of credit expansion in stimulating changes in investment. Keynes remarked that "unless the banking system is prepared to augment the supply of money, lack of finance may prove an important obstacle to more than a certain amount of investment decision being on the tapis at a certain time". The finance referred to by Keynes is, according to him, independent of planned saving.

The availability of both short-term and long-term finance is an important precondition for firms' decision to invest. Asimakopulos[11] asserts that firms need to be assured of the availability of long and short-term finance before they embark on the decision to invest because 'borrowing short to invest long can be very dangerous for a business enterprise'. If banks restrict their lending to short-term commitments investors are discouraged from embarking on long-term projects. This is so to the extent that speculators who finance long-term investment by buying up new issues of long-term securities depend upon bank loans to make such acquisitions.

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[10] .K Wicksell, Interest and Prices, New York, Augustus M. Kelley, 1965

[11] Asimakopulos, op. cit., p. 225.

For most of the period (1970-1988), Nigerian monetary and fiscal authorities adopted, expansionary policies oriented toward stimulating higher aggregate investment in the productive sectors. This policy direction was predicated on two objectives, namely to facilitate post-war reconstruction needs and to meet the capacity requirements of a growing economy propelled by oil earnings.

The direct monetary control mechanism characteristic of the repressed financial markets of most developing countries was adopted by Central Bank of Nigeria (CBN). This involved the prescription of aggregate credit ceilings, the application of selective credit controls and maintaining low interest rates. These controls applied to commercial and merchant banks. The preferred sectors, including industry and agriculture were favoured by the guidelines on sectoral allocation of credit. In the 1980s, 75-79 per cent of banks' loans and advances went to the preferred sectors. In 1980, merchant banks were directed to set apart a minimum of 40 per cent of their loans and advances for medium-and long-term lending.[12]

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[12]See M.O. Ojo, The Evolution and Performance of Monetary Policy in Nigeria in the 1980s, Central Bank of Nigeria: Research Dept. Occasional Paper, No.2 Feb.10, 1992. p. 11.

On the fiscal side, corporate income tax rate did not vary much during the period. It hovered around 45 per cent and varied within the range 40 to 50 per cent.[13] Inspite of the favourable policies Nigeria recorded low performance in terms of the rate of private investment leading to grave doubts about the efficacy of policy instruments adopted within the period under study. In this study therefore, we shall seek the answers to the following questions:

1. Has private investment spending responded to macroeconomic adjustment ?

2. How readily has private investment spending responded to macroeconomic adjustment ?

1.3 Objectives of the study

The main objective of this study is to empirically investigate the response of private investment to macroeconomic policies. Specifically the response of private instrument to fiscal and

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[13]See E.C. Ndekwu, Tax Structure and Administration in Nigeria (Ibadan: Nigerian Institute of Social and Economic Research, 1988) p.31.

monetary policies will be investigated. As has been mentioned fiscal and monetary policies are tools of economic stabilization policy. Stabilization policy creates changes which impinge upon investment expenditures by affecting the level of desired capital in the economy. Also the time structure of the response of investment to macroeconomic policies will be investigated.

1.4 JUSTIFICATION OF THE STUDY

Among the developing countries, there is a general drive to raise the level of capital accumulation through net investment. Net investment increases a country's stock of capital goods. Economic growth is viewed as a function of capital accumulation. Evidence from advanced, capital rich countries, however, does not wholly support the theory which ascribes a dominant role to capital accumulation in economic growth and development. The same conclusion may not apply in the case of developing economies where the level of specialisation and division of labour is low. In these countries the scope for capital to increase the level of productivity by permitting more roundaboutness in production is not inexistent. The capacity of a labour - and resource-rich country like Nigeria to produce goods and services may be enhanced by such an increase in productivity through capital deepening.

Countries are regarded as developed which have large stocks of capital. Hence the state of underdevelopment is associated with the existence of small stocks of capital leading to low capital per unit of output. This criterion is embodied in the concept of capital - output ratio.

Given the importance of investment the dearth of empirical studies on investment behaviour in the Nigerian economy is highly surprising. This study is, therefore,an attempt to contribute toward eliminating that gap.

1.5 Limitations of the Study

One limitation of the study is the use of a highly aggregated model.Ideally,three types of investment must be distinguished in order to get a clear picture of the response of investment to changes in macroeconomic policies. These are inventory investment, investment in plant and equipment by business firms or business fixed investment, and residential construction. Reliable data on these components of investment are not available for private investment in Nigeria. Also the non-availability of data on some of the explanatory variables beyond 1988 has restricted the observations used to 19 data points.

CHAPTER TWO

THEORETICAL FRAMEWORK.

The theoretical framework of investment analysis contains several alternative formulations used to explain investment behaviour. The various theories of investment behaviour are based on different assumptions and postulates regarding the determinants of investment.

In the static model investment is a function of the level of output and interest rate, written as

$$i = i(r,y).$$

Here an inverse relationship exists between interest rate and investment. An increase in interest rate causes a reduction in the equilibrium capital stock, leading to a reduction in replacement investment, so that[1] .

$$\frac{\partial i}{\partial r} < 0$$

An increase in output leads to an increase in equilibrium capital stock, so that.

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[1]See W. H. Branson, Macroeconomic Theory and Policy, (New York: Harper and Row, 1989) pp. 314 - 315

$$\frac{\partial i}{\partial y} > 0$$

Though macroeconomic in scope the static model does not fully explain the multiple influences on investment.

The Keynesian postulates on investment constitute an important part of the foundation of investment theoretical framework. The Keynesian model emphasises the influence of confidence and expectations on investment decision. Expectations underlie the computation of the marginal efficiency of capital. In the Keynesian framework investment decisions are based primarily on expectations.

In the simple accelerator theory, a change in investment expenditures is dependent upon expected change in output because firms maintain a fixed capital/output ratio. A more sophisticated accelerator model separates the effects of permanent and temporary changes in sales in the context of adaptive expectations model. Based on evidence from his study of nonresidential fixed investment, Clark supports the more sophisticated accelerator

model, which takes into account permanent output.[2]

The simple accelerator model has been criticised for not distinguishing between permanent and temporary changes in desired output levels. Failure to make this distinction could lead to wrongly conceived investment decisions by firms. If, for example, output rises, and the rise is actually permanent but is perceived as temporary by firms, they will react by adjusting their capital to temporary rather than to permanent needs. The model has limited predictive use due to the variability of the incremental capital/output ratio. The model is also criticised for assuming zero excess capacity in the consumer goods industries and excess capacity in the capital goods industries. The simple accelerator model and the more sophisticated accelerator model have been criticised for assuming that firms can close the gap between desired and actual capital levels in one period. In actual life, their is a time lag before capital projects are completed. The flexible accelerator model of investment behaviour takes into account this time lag. Also more traditional variables are included as explanatory variables in the flexible accelerator

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[2]Clark, P.K., "Investment in the 1970s: Theory, Performance, and Prediction", Brookings Papers on Economic Activity, Washington, D.C., The Brookings Institution, 1979.

investment function.

Our theoretical framework also includes the influence of fiscal and monetary policies on investment spending, which is of special significance in the context of developing countries. This is due to the characteristics of their capital and money markets and the response of private investment to economic adjustment policies.

CHAPTER THREE

LITERATURE REVIEW AND STATEMENT OF HYPOTHESES

3.1 LITERATURE REVIEW

Several alternative theories exist which differ in their postulates on investment. The differences among the competing theories stem from their having different specifications of the investment function.

In Keynes' specification, gross investment is dependent upon aggregate income and rate of interest.[1] According to the Keynesian theory the nexus between investment and the rate of interest is that investment decisions are carried out on the basis of a comparison between the rate of interest and the marginal efficiency of capital, which is the rate of return over the cost of the capital good. In Keynesian theory, investment will continue up to the point on investment demand-schedule where the marginal efficiency of capital is equal to the rate of interest. The investment-demand schedule relates interest rate to the marginal efficiency of capital.

Keynes failed to give explicit treatment to the various types

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[1]Keynes, General Theory, 1936.

of investment -inventories, plant and equipment, residential construction. It has been pointed out, however, that the Keynesian theory can treat the various types explicitly without departing from its main course.[2]

Investment behaviour is explained by an alternative theory-the accelerator model of investment. In this theory investment is explained by changes in output. According to the simple accelerator theory of investment, the change in investment expenditures is explained by the change in the desired level of output.[3] The simple accelerator model helps to provide an explanation for the procyclical nature of investment expenditures.[4] In the flexible accelerator model the time lag between expected permanent output and investment is taken into consideration. The flexible accelerator model is synthesised from the neoclassical model and an accelerator model which emphasises

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[2]See L.R. Klein, "Empirical Foundations of Keynesian Economics" in Post-Keynesian Economics, Kenneth K. Kurihara (ed) (London: George Allen and Union, 1955) p. 297.

[3]This theory is traced back to the article by J.M. Clark: "Business Acceleration and the Law of Demand: A Technical Factor in Economic Cycle', Journal of Political Economy, Vol. 25,March 1917.

[4]See R.L. Miller and R. Pulsinelli, Macroeconomics, (New York: Harper and Row Publishers).

permanent expected output as a variable.[5] In the model, current net investment is explained by the desired capital-output ratio, the last period's level of capital stock and permanent (expected) output formed from adaptive expectations process. The models is regarded as a more complete theory of investment behaviour.

One alternative approach to investment behaviour, the neoclassical approach, was pioneered by Jorgenson[6], working independently, and with Hall.[7] Desired (or optional) capital stock depends on the level of output and on the user cost of capital in this approach. An investment equation is formulated on the basis of the gap between the desired and current capital stocks. The user cost of capital is calculated from the rate of depreciation, the price of capital good and the real rate of interest.

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[5] Ibid.

[6] D.W. Jorgenson "The Theory of Investment Behaviour", in Robert Ferber, ed., Determinants of Investment Behaviour, (Cambridge, Mass: National Bureau of Economic Research, 1967).

[7] R. Hall and D.W. Jorgenson, "Application of the Theory of Optimum Capital Accumulation", in Gary Fromm, ed., Tax Incentives and Capital Spending, (Washinton, D.C: Brookings Institution, 1971).

The criticisms of this approach are that the assumptions of perfect competition and exogenously given output are inconsistent; that investment being essentially a forward-looking process, the assumption of static expectations about future prices, output and interest rates is inappropriate; and that lags in delivery are introduced in an ad hoc manner.[8]

In the neoclassical theory, the speed with which firms adjust their capital stocks to their desired levels determines the rate of investment. The desired capital stock is positively related to the level of output the firm expects to produce and negatively related to the rental or user cost of capital.[9]

Tobin's q theory is another alternative approach to investment decisions by firms.[10] The Theory emphasises the role of the stock market in providing funds for investment purpose. It is based on the comparison between the market value of a firm's

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[8]Serven and Solimano, op.cit., p. 97.

[9]R. Dornbusch and S. Fischer, Macroeconomics (New York: McGraw Hill, 1990) P. 338; A good summary of investment theory is presented in chapter 9 of this book.

[10]See J. Tobin, "A General Equilibrium Approach to Monetary Theory", Journal of Money, Credit and Banking, Feb. 1969.

existing capital stock to its replacement cost or the cost of producing it. This is known as the average q ratio. On the other hand, the ratio of the increase in the value of the firm due to the installation of an additional unit of capital to its replacement cost is known as the marginal q. Firms will increase (or decrease) their capital stock when the increase in the market value of the additional until of capital is greater (or is less than) the replacement cost. Since marginal q is not easily measured, average q is used instead.

Some problems are associated with the use of the average q. These have been identified by Abel[11], Hayashi[12], and Precious[13]. The marginal and average q will systematically differ if firms enjoy economies of scale or market power, or if they cannot sell all they want. In addition, due to the lumpiness of some investment projects, the cost of additions to a firm's

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[11]A. Abel, "Empirical Investment Equations: An Integrative Approach", Carnegie-Rochester Conference Series on Public Policy on the State of Macroeconomics, Carnegie Mellon University Centre for the Study of Public Policy and University of Rochester, 1980.

[12]F.Hayashi, "Tobins Marginal q and Average q: A Neoclassical Interpretation", Econometrica 50, no.1 pp. 213-23, 1982.

[13]M. Precious, "Demand Constraints, Rational Expectations, and Investment Theory", Oxford Economic Papers 37, Dec. 1985, pp. 576-605.

capital stock may be proportional or less than proportional to the volume of investment. In cases where disinvestment is feasible, it is costlier than positive investment because of the firm-specificity and low resale value of capital goods.

Investment behaviour is influenced by irreversibility and uncertainty, two characteristics which have been ignored by existing models. A considerable body of literature on these two characteristics of investment spending has emerged since 1980. Investment expenditures are mostly sunk costs that cannot be recovered. They are largely irreversible. Another characteristic of investment expenditures is that they can be delayed giving the firm an opportunity to wait for the arrival of new information about prices, costs, and other market conditions before investing.[14] As discussed by Pindyck [15], government regulations or institutional arrangements, firm-specificity, and low resale value of capital goods are what make an investment

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[14]R.S. Pindyck, "Irreversibility, Uncertainty and Investment", Journal of Economic Literature, Vol. xxxix No.3, Sept. 1991, pp. 1110-1111.

[15] Ibid, p. 1111.

expenditure a sunk cost and thus irreversible. Bernake[16], McDonald and Siegel[17], Bertola[18], Bertola and Caballero[19], and Pindyck[20] have pointed out that risk factors can negatively influence irreversible investment. Risk may take the forms of uncertainty regarding future cash flow, uncertainty over exchange-rates and uncertainty over tax and regulatory policy. Serven and Solimano assert that the intuitive reason for the influence of risk on irreversible investment is that if the future is uncertain, any addition to productive capacity in the current period carries the risk that the firm may find itself stuck in the future with excess capital that can only be eliminated at some cost.[21] They conclude that uncertainty may be as relevant for investment as are such conventional variables as interest rates or taxes.

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[16]B. Bernake, "Irreversibility, Uncertainty, and Cyclical Investment", Quarterly Journal of Economics, Feb. 1983, 98 (1), pp. 85-106.

[17]R. McDonald, and D. Siegel, "The Value of Waiting to Invest", Quarterly Journal of Economics, 1986, 101, pp. 707-728.

[18]G. Bertola, "Irreversible Investment" Princeton University, Dept. of Economics, Princeton, N.J., 1989.

[19]G. Bertola, and R. Caballero, "Irreversibility and Aggregate Investment", Columbia University, Department of Economics, New York, 1990.

[20] Pindyck, op.cit.

[21]Serven and Solimano, op cit., p. 98.

The disequilibrium approach views investment as being dependent upon profitability and the demand for output.[22] Malinvaud discusses the link between investment decisions and the expected degree of capital utilization in the economy on the one hand and relative prices, on the other, upon which the two stages of investment decisions - the decision about the expansion of the level of productive capacity and the decision about the capital intensity of the additional capacity- depend respectively. The criticisms of the disequilibrium models are based on the view that their assumptions regarding expectations are too simple and that they do not explain the rigidity of prices.[23]

Empirical studies on investment have generated controversy over the interest rate which was not emphasised by Keynes. From evidence provided by some empirical studies, the relation between aggregate investment and interest rate was found to be insignificant. Tinbergen[24] in his study on investment in

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[22]See E. Malinvaud, Profitability and unemployment, (Cambridge: Cambridge University Press, 1980).

[23]See Serven and Solimano, op. cit., p. 98.

[24]J. Tinbergen, Statistical Testing of Business Cycle Theories, Vol. I, A Method and Its Application to Investment Activity, League of Nations, Geneva.

selected European countries and the United States did not find any significant and consistent interest effect. Pesmazoglu studied investment behaviour in Britain and came to the same conclusion.[25] Both Tinbergen and Pesmazoglu found significant effects of profits and lagged profits. On the other hand Klein[26] found from his studies of particular American industries significant interest effect on highly durable products lasting twenty years or longer. Specifically he found significant interest elasticity of investment from his studies of railroads and electric utilities. These industries are eclipsed by others in actual investment outlay such that significant interest effect does not manifest in aggregate investment. Klein[27] concludes that it is incorrect to write off interest elasticity as nil since it is important in some sectors.

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[25]J.S. Pesmazoglu, "A Note on the Cyclical Fluctuations in British Home Investment, 1870-1913", Oxford Economic Papers, Vol. 3, 1957.

[26]L.R. Klein, "Studies in Investment Behaviour", Conference on Business Cycles, New York: N.B.E.R.

[27]L.R. Klein, Economic Fluctuations in the United States, New York, 1950.

In an empirical study, Jorgenson[28] and Siebert compared five alternative theories of investment behaviour-Neoclassical I, Neoclassical II, Accelerator, Expected Profits and the Liquidity Model - with regard to their ability to explain the investment activity of corporations. The study was based on the flexible accelerator model of investment behaviour of Chenery[29] and Koyck[30].

Their study used the criterion of minimum standard error for the fitted distributed lag functions for the alternative theories of investment behaviour. The alternative theories have different assumptions on the desired level of capital and therefore differ in their explanatory variables. In the Accelerator theory of investment behaviour, desired level of capital is assumed to be proportional to output; in the Liquidity theory of investment behaviour, desired capital is proportional to liquidity. In the Expected Profits theory of investment behaviour, desired capital is

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[28]D.W. Jorgenson and C.D. Siebert, "A Comparison of Alternative Theories of Corporate Investment Behaviour", The America Economic Review, Vol. LVIII, No.4 Sept. 1968, pp. 681-712.

[29]H.B. Chenery, "Overcapacity and the Acceleration Principle", Econometrica, vol. 20, No.1, Jan. 1952.

[30]L.M. Koyck, Distributed Lags and Investment Analysis, (Amsterdam, 1954).

proportional to the market value of the firm.

The difference between the two versions of Neoclassical theory of investment behaviour is that in the first version capital gains is included in assessing the appropriate cost of capital for investment decisions and in the price of capital services, while it is ignored in the second version.

They concluded that both of the versions of the neoclassical theories of investment behaviour are better than the rest. Using a correct specification of the lag structure, prominent difference among the alternative explanations of investment behaviour is not observable in the analysis of time series data of industry aggregates.[31]

Though it does not lend itself to empirical investigation, expectations about the future is recognised as a major influence on the inducement to invest. Keynes elaborated on the role of expectations which formed the central theme of his discourse on investment. According to Keynes, investment plans are based on

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[31]Y. Grilliches and N. Wallace, "The Determinants of Investment Revisited", International Economic Review, Vol.6, Sept. 1965.

expectations about the future.[32] The role of expectations is embedded in Keynes' principle of marginal efficiency of capital. Klein, Tinbergen and Pesmazoglu found significant relationship between share prices or yield and investment in time series studies of data from Britain and America. Share prices and yields largely reflect expected future earning and this corroborates the hypothesis of the theory of the marginal efficiency of capital.

Other empirical studies have investigated the determinants of gross and net investment expenditures. In his study, Clark[33] concluded that "output is clearly the primary determinant of nonresidential fixed investment", and that in the short-run "the effect of moderate variation in taxes and interest rate is likely to be negligible ...." In Jorgenson's[34] study, net investment is explained by after-tax user cost of capital, the previous period's capital stock and a constant times national output. The studies by Jorgenson and Clark do not emphasise the user cost of

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[32]J.M. Keynes, *General Theory*, pp 46-51.

[33]P.K.Clark, "Investment in the 1970s: Theory Performance, and Prediction",. Brookings Papers on Economic Activity, Washington, D.C., The Brookings Institution, 1979.

[34]D.W. Jorgenson, "Economic Studies of Investment Behaviour: A Survey", Journal of Economic Literature, vol.9, December 1971.

capital as a determinant of investment spending. A study by Bernake however supports the inclusion of user costs as important determinants of the short-run demand for capital goods.[35] He writes that "it is possible to conclude that high interest rates are a major source of the recent sluggishness in capital expenditures". Bernake observed that since 1979 real interest rates have been unusually high and asserts that the recent two recessions in the American economy are a result, and not a cause of the low demand for capital goods.

3.2 STATEMENT OF HYPOTHESES

The Study will be guided by the following hypotheses:

1. Ho: The interest rate variable has insignificant effect on investment expenditures in the Nigerian economy.
   H1: The interest rate variable has significant effect on investment expenditures in the Nigerian economy.

2. Ho: Investment expenditures respond sluggishly to policy

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[35]B.S. Bernake, "The Determinants of Investment: Another Look". American Economic Review: Papers and Proceedings, Vol. 73, no.2, May 1983.

variables in the Nigerian economy.

H1: Investment expenditures respond readily to policy variables in the Nigerian economy.

3. Ho: Investment expenditures are insensitive to macroeconomic adjustment policies.

H1: Investment expenditures are sensitive to macroeconomic adjustment policies.

CHAPTER FOUR

METHODOLOGY

4.1 EXAMINATION OF EXISTING ALTERNATIVE MODELS.

The Jorgenson and Stephenson Model

This model which is based on the flexible accelerator mechanism is a difference equation in net investment. It was employed by Jorgenson in his study of the American manufacturing sector and it is based on the neoclassical theory of optimal capital accumulation.[1] The model is developed from the combination of the theory of the demand for capital services, the theory of replacement investment, and the relationship between changes in the demand for capital services and actual investment expenditure.

As the starting point we state the expression for gross investment, the sum of investment for expansion of capital and replacement investment, as follows:

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[1]D. W. Jorgenson and J. A. Stephenson, "Investment Behaviour in U. S. Manufacturing, 1947 - 1960" Econometrica, Vol. 35, no.2, 1967, pp. 169-218

$$I_t = I_t^E + I_t^R \qquad (1)$$

where

I_t = current gross investment

I_t^E = current investment for expansion

I_t^R = current replacement investment

The expression relating replacement investment to past levels of capital, K_t, is written as

$$I_t^R = \delta K_t \qquad (2)$$

Replacement investment is proportional to capital stock. The rate of replacement is δ . Current net investment is proportional to changes in the desired level of capital, K+:

$$[I_t - \delta K_t] = \mu(S)\,[K_t^+ - K_{t-1}^+] \qquad (3)$$

$$\sum_{t=0}^{\infty} \mu_t = 1 \qquad (t = 0, 1, \ldots)$$

The sequence of the coefficients of the distributed lag function, μ_t, may be replaced by the ratio

$$\frac{\nu(S)}{\omega(S)}$$

under the assumption that μ_t has a rational generating function, so

$$[I_t - \delta K_t] = \frac{\nu(S)}{\omega(S)} [K_t^+ - K_{t-1}^+] \qquad (4)$$

where V(S) and $\omega(S)$ are polynomials with powers representing the coefficients of

$$[K_t^+ - K_{t-1}^+] \text{ and } [I_t - \delta K_t]$$

respectively;

$$\nu(S) = \nu_o+\nu_1 S+.....+\nu_n S^n, \text{ and}$$
$$\omega(S) = 1+\omega_1 S+...+\omega_n S^n$$

Equation 3 may then be written

$$[1+\omega_1 S+...+\omega_n S^n]\,[I_t-\delta K_t] = [\nu_0+\nu_1 S+...+\nu_m S^m]\,[K_t^+-K_{t-1}^+] \qquad (5)$$

The final form of the distributed lag function may be written:

$$\begin{aligned}&[I_t-\delta K_t]+\omega_1[I_{t-1}-\delta K_{t-1}]+...+\omega_n[I_{t-n}-\delta K_{t-n}]\\ &-V_0[K_t^+-K_{t-1}^+]+V_1[K_{t-1}^+-K_{t-2}^+]++...\\ &+\nu_m[K_{t-m}^+-K_{t-m-1}^+]\end{aligned} \qquad (6)$$

An error term, ϵ_t, is added to (6) above and the resulting stochastic expression obtained may be written:

$$\begin{aligned}[I_t-\delta K_t] &= V_0[K_t^+-K_{t-1}^+]+V_1[K_{t-1}^+-K_{t-2}^+]+...+\\ &V_m[K_{t-m}^+-K_{t-m-1}^+]-\omega_1[I_{t-1}-\delta K_{t-1}]\\ &-\omega_n[I_{t-n}-\delta K_{t-n}]+\epsilon_t\end{aligned} \qquad (7)$$

An expression for the desired level of capital may be determined from the marginal productivity condition for capital input if the

production function is of the Cobb-Douglas form. Thus

$$K_t^* = \frac{\alpha P_t Q_t}{c_t} \tag{8}$$

where α = desired capital output ratio

P_t = price of output at time t

Q_t = output at time t

c_t = rental price of capital at time t

Substituting

$$\frac{\alpha P_t Q_t}{c_t}$$

for K_t^* in equation (7), we obtain finally the empirical form of the Jorgenson and Stephenson model of investment, a distributed lag function given as follows:

$$I_t = \nu_0 \alpha \left[\frac{P_t Q_t}{C_t} - P_{t-1} \frac{Q_{t-1}}{C_{t-1}} \right] + \ldots +$$
$$\nu_m \alpha \left[\frac{P_t Q_{t-m}}{C_{t-m}} - \frac{P_{t-m-1} Q_{t-m-1}}{C_{t-m-1}} \right] \qquad (9)$$
$$- \omega_1 [I_{t-1} - \delta K_{t-1}] - \omega_n [I_{t-n} - \delta K_{t-n}] + \delta K_t + \epsilon_t$$
$$(t = 1, 2, \ldots\ldots, N)$$

where N is the number of observations

Equation (9) can be estimated by the OLS method given that the usual assumptions regarding the error term hold.[2] Given that $\{\epsilon_t\}$ denotes the sequence of random errors, it is assumed that

$$E(\epsilon_t) = 0$$
$$V(\epsilon_t) = \sigma^2 \qquad (t = 1, \ldots., N)$$

where σ^2 is a constant, and

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[2]See D.W. Jorgenson and C.D. Siebert, "A Comparison of Alternative Theories of Corporate Investment Behaviour", The American Economic Review, Vol. LVIII, No.4, Sept. 1968, p. 689.

$$Cov(e_t, e_{t-r}) = 0 \qquad (t, t-r=1, \ldots, n, r \neq 0)$$

The weights of the distributed lag function must sum to unity so that equation (9) has the restriction that

$$v_0+v_1+\ldots+v_m=1+\omega_1+\ldots+\omega_n$$

Given that

$$\{\hat{w}\}$$

is an estimator of $\{w_r\}$ and

$$\{\hat{V}_{r\alpha}\}$$

is an estimator of

$$\{\hat{V}_{r\alpha}\}$$

an estimator $\hat{\alpha}$ of α may be obtained from the following restriction:

$$\hat{\alpha} = \frac{\sum_{r=0}^{m} \hat{v}_{r\alpha}}{\sum_{r=0}^{n} \hat{\omega}_r}$$

As can be seen from equation 9, in the Jorgenson and Stephenson model current investment is a function of the value of output, lagged net investment and present capital stock. The model can be used in the study of industry groups.

The Gehrels and Wiggins Specification

Gehrels and Wiggins investigated the relationship between interest rates and manufacturers' demand for fixed capital using two alternative specifications of the investment function.[3] They compared the relative influences of two interest rates- the industrial bond yield and the three-month treasury-bill yield - on manufacturers' fixed investment using the following two-equation model:

$$I_t = b_0 + b_1 \Pi_{t-2} + b_2 P_{t-2} + b_3 R_{t-2} + b_4 Q_t + \mu_t \qquad (10)$$

$$I_t = b_0 + b_1 \Pi_{t-2} + b_2 P_{t-2} + b_3 R_{t-2} + b_4 Q_t + \mu_t \qquad (10)$$

where

[3]F. Gehrels and S. Wiggins, "Interest Rates and Manufacturers' Fixed Investment", The American Economic Review, vol. XLVII, 1957.

I_t is the current plant and equipment outlay by manufacturing firms in real terms;

π is profits deflated by whole sale price index;

R is the rate of interest, being in equation (10) the industrial bond yield, and in equation (11) the three-month treasury-bill yield; and Q is the "quick ratio"- the ratio of cash plus government securities to current liabilities for manufacturing firms only.

In the Gehrels and Wiggins investment equation, the interest rate is the only economic policy variable among the explanatory variables. Others variables capture the internal conditions within industry. The model therefore essentially relates investment outlay to constraints existing within the industry. It is narrowly based in terms of investigating the relationship between investment and macroeconomic adjustment.

The Olofin, Akinkugbe, and Ajayi Capital Formation Equation for the Nigerian Economy.

This equation is contained in the University of Ibadan CEAR-

MAC-IV model of the Nigerian economy.[4] The specification of the capital formation begins in the model with the assumption that investment decisions are a function of expected changes in output, written

$$I_t = f(V_t^e - V_{t-1}^e)$$

where

$$I_t = K_t - K_{t-1}$$

K_t = capital stock at time t

V_t^e = expected output at time t.

On the basis of Harrod's specification, it is assumed that actual change in investment is adjusted in a partial process to equilibrium desired level of investment, from the previous level of investment hence the expression.[5]

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[4]See S. Olofin et al, "Some Theoretical and Empirical Issues in Connection with the Devaluation of the Nigerian Naira", Nigerian Journal of Economic and Social Studies, vol. 28 No2. July 1986, pp 165-167.

[5]See R.F. Harrod, Towards a Dynamic Economics, (London: Macmillan, 1948) pp. 225-245.

$$\Delta I_t = \lambda (I_t^* - I_{t-1}) + u_t \qquad (12)$$

where $(0 < \lambda < 1)$ is the partial adjustment coefficient,

$$\Delta I_t = I_t - I_{t-1}$$

and

$$I_t^* = \beta (V_t^e - V_{t-1}^e) + V_t \qquad (13)$$

where $\beta > 0$ is the incremental capital output ratio. The error terms ut and vt of equations (12) and (13) are assumed to have all the classical properties.

Substituting equation (13) in equation (12), we obtain

$$\Delta I_t = \lambda [\beta (V_t^e - V_{t-1}^e) - I_{t-1} + V_t] + u_t$$

and finally

$$I_t = \lambda\beta (V_t^e - V_{t-1}^e) + (1-\lambda) I_{t-1} + \lambda V_t + u_t \qquad (13)$$

Equation (13) is stochastic and its parameters can be estimated by the OLS method given that the usual assumptions regarding the error

terms hold.

Given the assumption that government spending plays a significant role in determining the level of capital formation, an additional explanatory variable, government capital expenditure, is added to the other explanatory variables in equation (13). The final investment function is of the form:

$$I_t = \lambda\beta (V_t^e - V_{t-1}^e) + G_{t-1} + (1-\lambda) I_{t-1} + \epsilon_t \qquad (14)$$

where

G_{t-1} is government capital expenditure lagged one period, and

$$E_t = \lambda V_t + u_t$$

It is expected a priori that $\lambda\beta > 0$ and $0 < \lambda < 1$

The inclusion of government capital expenditure among the explanatory variables is tenable on the basis of the complementarity between private and government investment. The Olofin, Ajayi and Akinkugbe capital formation function (equation 14) does not capture the broad spectrum of the policy environment facing private investment in Nigeria. For instance, the influence

of monetary policy is ignored in the model.

4.2 Specification of Eclectic Model

The narrowness if the above- examined models in terms of their content of economic policy variables justifies the decision to use a broad-based model containing several equations for this study. The specification of the model is guided by the aim of capturing the broad policy framework within which firms make their investment decisions in the Nigerian economy. The following functional relation between investment and its determinants, which are based on investment theory are specified and tested:

$$I_t = b_0 + b_1 M2_t + b_2 I_{t-1} + b_3 T_t + b_4 \Delta Y_t + u_t \quad (15)$$

$$I_t = b_0 + b_1 M2_{t-1} + b_2 \Delta Y_{t-1} + b_3 I_{t-1} + b_4 T_{t-1} + u_t \quad (16)$$

$$I_t = b_0 + b_1 \Delta C_t + b_2 \Delta Y_t + b_3 I_{t-1} + b_4 R_t + u_t \quad (17)$$

$$I_t = b_0 + b_1 \Delta C_{t-1} + b_2 \Delta Y_{t-1} + b_3 I_{t-1} + b_4 R_{t-1} + u_t \quad (18)$$

$$I_t = b_0 + b_1 G_t + b_2 M2_t + b_3 \Delta Y_t + b_4 I_{t-1} + u_t \quad (19)$$

where:

I_t = current outlay on investment

$M2_t$ = broad definition of money supply - MI + quasi money

T_t = corporate income tax rate at time t

Y_t = current Gross Domestic Product

C_t = aggregate banking sector credit to the economy at time t.

R_t = interest rate- commercial banks' prime lending rate

G_t = government capital expenditure

b_o = constant term; and

b_1, b_2, b_3 and b_4 the coefficients of the explanatory variables.

The linear regression model specified above (equations 15-19) is based on the following classical assumptions of Ordinary Least Squares:[6]

(a) that the value of the error term in each period is a random real variable;

(b) that the error term for each explanatory variable is normally distributed;

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[6]See A. Koutsoyiannis, Theory of Econometrics, (London: Macmillan, 1977) pp. 55-58, and R.S. Pindyck and D.L. Rubinfeld, Econometric Models and Economic Forecasts (New York: McGraw Hill, 1991), pp. 46-50.

(c) the explanatory variables are nonstochastic variables with fixed values;

(d) the error term has zero mean value and a constant variance for all observations;

(e) the dependent variable and the explanatory variables are linearly related;

(f) the random terms of different observations are statistically independent; and

(g) there are no exact linear relationships among the explanatory variables.

For the purpose of investigating the time structure of the response of investment to its determinants, the following models are also specified and estimated:[7]

$$\Delta I_t = b_0 + b_1 \Delta M2_t + b_2 \Delta M2_{t-1} + b_3 \Delta I_{t-1} + u_t \qquad (20)$$

$$\Delta I_t = b_0 + b_1 \Delta T_t + b_2 \Delta T_{t-1} + b_3 \Delta I_{t-1} + u_t \qquad (21)$$

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[7]A similar specification was applied by R.I. Chima, An Econometric Study of the Relative Impact of Fiscal and Monetary Policies on Economic Stabilization in Nigeria (1960-1989), unpublished M.Sc. Thesis, Dept. of Econs., University of Nigeria, Nsukka, Nov. 1990.

$$\Delta I_t = b_0 + b_1 \Delta R_t + b_2 \Delta R_{t-1} + b_3 \Delta I_{t-1} + u_t \quad (22)$$

$$\Delta I_t = b_0 + b_1 \Delta C_t + b_2 \Delta C_{t-1} + b_3 \Delta I_{t-1} + u_t \quad (23)$$

$$\Delta I_t = b_0 + b_1 \Delta G_t + b_2 \Delta G_{t-1} + b_3 \Delta I_{t-1} + u_t \quad (24)$$

In equations 20-24 change in investment is regressed on two period changes in each of the explanatory variables. The previous period's change in the endogenous variable appears as an explanatory variable on the right hand side of each of the equations.

4.3 Estimation Procedure

The equations specified above (15-24) are dynamic in nature. This follows the standard theoretical assumption that the response of investment to its determinants involves lags. Both lagged dependent and independent variables constitute the regressors in the dynamic equations specified above.

Alternative methods of estimating such distributed lag models have been proposed. The method developed by Almon is used for the estimation of distributed lags models having lagged values of a

single explanatory variable, which are of the form[8]

$$Y_t = b_0 + b_1 X_t + b_2 X_{t-1} + b_3 X_{t-3} + u_t$$

Directly estimating the S+1 b's using the OLS technique leads to the problem of multicollinearity between the regressors and hence bias in parameter estimates.[9] As all the equations specified have more than one variable as the regressors, the Almon estimation technique is inappropriate for our research. The models follow the Koyck[10] scheme, so the OLS method was used to estimate them on the basis that the classical stochastic assumptions regarding the error terms hold.

4.4 Statistics for the Evaluation of Regression Results:

In order to ascertain the reliability of the regression results, standard econometric tests were employed. These include:

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[8] S. Almon, "The Distributed Lag between Capital Appropriations and Expenditures", Econometrica vol. 30, 1962, pp. 407 - 423.

9 See J. Johnson, Econometric Methods, 3rd Edition (London: McGraw Hill, 1984) p. 352

[10] L. M. Koyck, Distributed Lags and Investment Analysis Amsterdam, 1954

the Student's t statistic;

(b) test of the overall significance of the regression model using the F statistic;

(c) test for the detection of autocorrelation of the random variable (in this research Durbin's h statistic is the appropriate statistic because of the inclusion of lagged dependent variables among the regressors in the models); and

(d) test for the detection of multicollinearity among the regressors using the Klein approach.

Test (a) and (b) are statistical techniques for the evaluation of parameter estimates. They determine the degree of confidence with which the estimates may be accepted.

4.5 Data Requirements and Sources

Annual data on investment, interest rate, banking sector aggregate credit to the economy, corporate tax rate, money supply, and government expenditure on capital formation are required. Quarterly series on these variables are a better alternative but are unavailable in official publications for some of the variables.

The series on the relevant variables were obtained from various official publications namely:

1) Central Bank of Nigeria: Annual Report and Statement of Accounts (various years)
2) International Bank for Reconstruction and Development/World Bank: World Tables
3) Central Bank of Nigeria: Financial and Economic Review (various years)
4) Central Bank of Nigeria: Statistical Bulletin
5) Federal and State Offices of Statistics .

In all there are nineteen observations for each variable - the study spans the period 1970-1988.

CHAPTER FIVE

PRESENTATION AND ANALYSIS OF REGRESSION RESULTS

The results of the regression analysis based on the models of the previous chapter are presented in this chapter. The presentation is done in four parts. In part I the estimated models are presented. Part 2 discusses the explanatory variables used on the basis of the a priori theoretical relationship between investment spending and these explanatory variables. The estimates are subjected to first - and second - order tests in parts 3 and 4 respectively. Finally, the hypotheses stated in the earlier part of work are verified from the obtained results. This is done in part 5.

5.1 ESTIMATED MODELS

In 4.2 the dynamic equations relating investment to the economic variables that determine its level were specified.

The estimated models obtained from the regressions are:

$$\overline{I_t} = 4896.36 + .412M2_t + .717I_{t-1} + .146\Delta Y_t - 94.56T_t \qquad 15e$$
$$(0.05143)\ (0.19586)\ (.06137)\ (130.17517)$$

$$R^2 = 0.86$$

$$R^{-2} = 0.82$$

S.E. = 1439.53

F = 20.99

D.W. = 2.07

$$\overline{I_t} = 1527.128 + .557M2_{t-1} + .722\ I_{t-1} + .299\Delta Y_{t-1} - 31.973T_{t-1} \quad 16e$$
$$(0.05230)\ (0.19656)\ (0.10176)\ (38.26271)$$

R^2 = 0.85

R^{-2} = 0.81

S.E. = 1474.15

F = 19:85

D.W. = 1.73

$$\overline{I_t} = 938.35 + .239\Delta C_t + .112\Delta Y_t + .550I_{t-1} + 74.87R_t \quad 17e$$
$$(0.17040)\ (0.06069)\ (0.18019)\ (128.13)$$

R^2 = 0.87

R^{-2} = 0.84

S.E. = 1350.24

F = 24.33

D.W. = 1.49

$$\overline{I_t} = -396.41 \underset{(0.27332)}{-0.212\Delta C_{t-1}} \underset{(0.23299)}{+.225\Delta Y_{t-1}} \underset{(0.13204)}{.813 I_{t-1}} \underset{(160.14717)}{+190.14 R_{t-1}} \quad 18e$$

R^2 = .84630

R^{-2} = .80238

S.W. = 1492.75

F = 19.27

D.W. = 1.97

$$\overline{I_t} = 920.82 \underset{(0.28796)}{+.123 G_t} \underset{(0.07254)}{+.180 M2_t} \underset{(0.14749)}{+.587 I_{t-1}} \underset{(0.07273)}{+.169 \Delta Y_t} \quad 19e$$

R^2 = 0,85

R^{-2} = 0.81

S.E. = 1456.92

D.W. = 2.08

The figures in the brackets are the standard errors of the coefficients. In two pairs out of the five estimated models presented above two alternative lags were experimented on.

Equations (15e) and (16e) have an identical set of explanatory variables, but in equation (16e) all the explanatory variables have a one-period lag, while in (15e) all the explanatory variables except I_t-1 are current values. Also with respect to the pair of equations (17e) and (18e), which have an identitical set of regressors, two alternative lags were used. As in the previous pair all the regressors in one equation, this time (18e), are lagged one period, while in (17e) all the regressors except I_t -1 are current values.

From the two pairs of equations (15e) and (17e) are chosen for further analysis because of their better fits. Each of them had relatively higher coefficient of multiple determination and adjusted coefficient of multiple determination, R^2 and R^{-2} respectively. R^2 shows the percentage of the total variation in the dependent variable jointly explained by changes in the explanatory variables. Its value lies between 0 and 1. As the value of R^2 approaches unity, the goodness of it improves indicating an increase in the percentage of the variation in the dependent variable explained by the regression plane. The adjusted coefficient of multiple determiatnon, R^{-2}, is a more desirable measure of goodness of fit because it may rise or fall when new variables are added to the regression model while R^2 always

increases with the addition of new variables[1].

Presented here are the estimates of the distributed lag functions which relate investment to its determinants. In each equation all the variables are first- differenced.

$$\overline{\Delta I_t} = -433.0315 + 0.173\Delta M2_t + 0.433\Delta M2_{t-1} \qquad 20e$$
$$(0.17080) \quad (0.32295)$$

$$+ 0.290\Delta I_{t-1}$$
$$(0.26769)$$

$R^2 = 0.43$

$R^{-2} = 0.32$

S.E.= 1505.89

F = 3.82

D.W.= 1.71

$$\overline{\Delta I_t} = 461.020 - 18.31\Delta T_t - 272.80\Delta T_{t-1} \qquad 21e$$
$$(207.15087) \quad (206.43565)$$

$$+ 0.450\,\Delta I_{t-1}$$
$$(0.29422)$$

[1]See Pindyck and Rubinfeld, op. cit., pp. 76-83.

$R^2 = 0.22$

$R^{-2} = 0.06$

S.E. = 1771.69

F = 1.37303

D.W. = 1.52

$$\overline{\Delta I_t} = 302.5165 + 230.125\Delta R_t + 457.78\Delta R_{t-1} \quad \text{22e}$$
$$(157.03464) \quad (204.63622)$$

$$+ 0.366\,\Delta I_{t-1}$$
$$(0.32450)$$

$R^2 = 0.36$

$R^{-2} = 0.27$

S.E. = 1605.92

F = 2.77

D.W. = 1.90

$$\overline{\Delta I_t} = 595.23 + 0.497\Delta C_t - 0.616\Delta C_{t-1} \quad \text{23e}$$
$$(0.12478) \quad (0.18991)$$

$$+ 0.74\,\Delta I_{t-1}$$
$$(0.24238)$$

$R^2 = 0.58$

$R^{-2} = 0.49$

S.E. = 1300.10

F = 6.84

D.W.= 1.93

24e $\overline{\Delta I_t} = 414.65 - 0.622\Delta G_t + 0.30\Delta G_{t-1}$
(0.30055) (0.29898)

$+ 0.56\Delta I_{t-1}$
(0.31367)

R^2 = 0.21

R^{-2} = 0.05

S.E.= 1776.70

F = 1.33

D.W.= 1.46

5.2 First-Order Tests of Estimates

For this research this includes two tests of significance:

(a) test of significance of individual parameter estimates, and

(b) test of the overall significance of the regression.

Test of Significance of Parameter Estimates

The Student's t test is used for this purpose. To carry out the test the computed t value of the individual parameter estimate is compared with its theoretical value, which defines the critical region in a two-tailed test[2]. The computed t value, written t* is

[2]See A. Koutsoyiannis, op. cit., pp. 86-91.

estimated by dividing the parameter estimate by its standard error.

The null hypothesis

$H_o : b_1 = 0$

is tested against the alternative hypothesis

$H_1 : b_1 \neq 0$

where b_1 is the coefficient

The deciscion rule is:

if, at a chosen level of significance, t* falls within the critical region, the acceptance region, the null hypothesis that the parameter estimate is not significant is accepted.

The results of the test of significance of the parameter estimates of equations (15e), (17e) - chosen from the experimental specifications of the investment function, and (19e) are presented in Table 5.1. The test is carried out at 5% level of significance.

Table 5.1: Results of Test of Significance

Eqn No	Estimated Equation	t^*	Tabular t	Test result
15e	$\overline{I}$-4896.36+.412$M2_t$+.717I_{t-1}+ +.140ΔY_t − 94.56T_t			
	$M2_t$	8.01	2.131	S
	I_{t-1}	3.66	2.131	S
	ΔY_t	2.38	2.131	S
	T_t	-0.73	2.131	NS
17e	I_t-938.35+.239ΔC_t +.112ΔY_t+.550I_{t-1}+74.87R_t			
	ΔC_t	1.40	2.131	NS
	ΔY_t	1.85	2.131	NS
	I_{t-1}	3.05	2.131	S
	R_t	0.58	2.131	NS
19e	I_t-920.82+.123G_t +.180$M2_t$+.587I_{t-1} +.169ΔY_t			
	G_t	0.43	2.131	NS
	$M2_t$	2.48	2.131	S
	I_{t-1}	2.35	2.131	S
	ΔY_t	2.32	2.131	S

KEY NS = Not significant
S = Significant

Test of the Overall Significance of the Regression

The F statistic is employed in this test. It is used to test the joint hypothesis that $b_2 = b_3 = b_k = 0$, or the hypothesis that none of the regressors explain the variation of the dependent variable around its mean[a]. The F statistic is computed with the following formula:

$$F^* = \frac{R^2/(k-1)}{(1-R^2)(N-k)}$$

where k = number of the b's (including the intercept b_0)

N = number of observations in the sample

F* is the computed value of the statistic while its tabulated value is F with k-1 and N-k degrees of freedom. The two values are compared at a chosen level of significance. The deciscion rule is that if F* > F at the chosen level of significance we reject the null hypothesis that the regression is not significant and accept the alternative hypothesis that the overall regression is significant. If F*<F the null hypothesis is accepted. The results

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[a]See Pindyck and Rubinfeld, op.cit., pp. 79-80.

of the F test of the estimated models at 5% level of significance are presented in Table 5.2

Table 5.2: Results of Overall Significance Test of Regressions

Equation No	F*	F(Tabulated)	Test Result*
(15e)	20.99	3.20	S
(16e)	19.85	3.30	S
(17e)	24.33	3.20	S
(18e)	19.27	3.20	S
(19e)	20.40	3.20	S
(20e)	3.82	3.20	S
(21e)	1.37	3.20	NS
(22e)	2.77	3.20	NS
(23e)	6.84	3.20	S
(24e)	1.33	3.20	NS

*S = Significant

NS = Not Sgnificant

5.3 Second-Order Tests of Estimates

These tests determine the reliance that may be placed on the parameter estimates. The regression results are subjected to two second-order tests, namely:

(a) test for the detection of autocorrelation of the random term, and

(b) test for the detection of multicollinearity among the regressors.

Test For Autocorrelation

Durbin h statistic is used for the test. The Durbin-Waston statistic is inappropriate for the test because each of the equations specified in this research has a lagged value of the dependent variable as one of the regressors. When one or more lagged dependent variables are included among the regressors, DW statistic often tends to be closer to 2 even in the presence of seri ously correlated errors. Pindyck and Rubinfeld hold that "... one would simply look at the DW statistic as providing an indicator of serial correlation when the DW statistic is low, but this approach is strongly biased against finding serial correlation".[4].

Durbin h statistic is given by

$$h = \hat{\rho}\left(\frac{T}{1-T[Var(\hat{\beta})]}\right)^{1/2}$$

where $Var(\hat{\beta})$ is the estimated variance of the coefficient of the lagged endogeneous variable, T is the number of observations, and $\hat{\rho}$, the first-order serial - correlation coefficient is estimated from the DW statistic given that $DW \approx 2(1-\hat{\rho})$. From this we obtain

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[4]Pindyck and Rubinfeld, pp. 147-148.

$$h = (1 - \frac{DW}{2}) \left(\frac{T}{1 - T[Var(\hat{\beta})]} \right)^{1/2}$$

The test becomes inapplicable if T Var($\hat{\beta}$) > 1. As shown by Durbin, the h statistic is approximately normally distributed, therefore the normal distribution table can be used for the test. The decision rule is: if h > 1.645, the critical value of the normal distribution at 5 per cent level of significance for a one-tailed test, the null hypothesis of no serial correlation is rejected. The results of the test for autocorrelation are presented in Table 5.3 [5]

[5]See J. Durbin, "Testing for Serial Correlation in Least-Squares Regression when some of the Regressors are lagged Dependent Variables", Econometrica, vol. 38, 1970, pp. 410-421.

Table 5.3: Results of the Test for Autocorrelation

Equation No.	h	Critical Value	Result*
(15e)	- 0.293	1.645	FA
(16e)	1.141	1.645	FA
(17e)	1.796	1.645	AP
(18e)	0.080	1.645	FA
(19e)	-0.230	1.645	FA

*FA = Free from Autocorrelation

AP = Autocorrelation Present

Test for Multicollinearity

The Klein approach is adopted for the test.[6] This approach is based on the comparison between the simple correlation between any two explanatory variab les xi and xj and the overall multiple correlation of R^2. With respect to a multiple regression model, Klein advances the argu ment that collinearity among the regressors becomes problematic if [7]

$$r^2_{x_i x_j} \geq R^2_y . x_1, x_2 \ldots\ldots, x_k$$

[6]L.R. Klein Introduction to Econometrics (London: Prentice-Hall International) pp. 64, 101.

[7]See A. Koutsoyiannis, op. cit., pp 234-238.

where $r^2_{x1\ xj}$ = the simple correlation between any two regressors

$R^2y.\ x1, x2, \ldots xk$ = the multiple correlation.

Table 5.4: Results of the Tests for Multicollinearity

Eqn. No	Multiple R	r^2	Test Result
(15e)	.93	I_{t-1}, $M2_t$ = 0.72 I_{t-1}, ΔY_t = .55 I_{t-1}, T_t = .48 $M2_t$, ΔY_t = .74 $M2_t$,T_t = .31 ΔY_t, T_t = .15	FM
(17e)	.94	I_{t-1}, ΔY_t = 0.55 I_{t-1}, ΔC_t = .76 I_{t-1}, R_t = .51 ΔY_t , ΔC_t = .75 ΔY_t ,R_t = .69 ΔC_t, R_t = .70	FM
(19e)	.92	G_t , $M2_t$ = .80 G_t , I_{t-1} = .83 G_t , ΔY_t = .43 $M2_t$, I_{t-1} = .72 $M2_t$,ΔY_t = .74 I_{t-1} , ΔY_t = .55	FM

KEY FM = Free from multicollinearity

5.4 Examination of Parameter Estimates Vis-à-vis A Priori Expectations

Econometric investigations of economic phenomena normally proceed in three stages. First is the specification of the functional relation between the dependent and independent variables

based on economic theory. Second is the subjection of such theory-based formulation to empirical test using observed data. Finally, obtained parameter estimates are evaluated with respect to how their signs and magintudes conform to a priori expectations based on economic theory . Parameter estimates of the individual variables are examined below. Attempts are made to explain them in terms of policy trends and changes in the Nigerian economy.

Interest Rate

The interest rate coefficient has the wrong sign and is insignificant (see Equation 17e). This result is not surprising. Interest rates were managed under the direct monetary management techniques adopted by the Central Bank of Nigeria (CBN) for most of the period under review. The Banking Decree of 1986 and the subsequent Amendment Decree No. 3 of 1970 empowered the CBN to control and prescribe the minimum and maximum interest rates for the banking system.[8] Section 14 of the Decree contains the provision that:

> "the rate of interest charged on advances, loans or credit facilities or paid on deposits by any licensed bank shall be linked to the minimum rediscount rate of the Central Bank subject to stated minimum and maximum

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[8]See C.C. Agu, "Interest Rates Policy and its Attendant Distortions", in Distortions in the Nigerian Economy, Proceedings of the Nigerian Economic Society Annual Conference Calabar, May 12-16, 1987, p. 2

> rates of interest. When so approved, the rates shall be the same for all licensed banks provided that differential rates may be approved for various categories of banks to which this decree applies;" and moreover "The interest rate structure of each licensed bank shall be subject to the approval of the Central Banks."

Under the direct monetary control system interest rates were administratively fixed with the authorities maintaining a low and inflexible interest rate policy. Typical of the financial repression found in many developing countries, real rates remained negative. The study by Agu provides evidence that real rates on both time and savings deposits were predominantly negative between 1970 and 1985[9]. Direct control on interest rates was abolished effective from August 1, 1987 and the minimum rediscount rate, which determined the rate charged by the commercial banks was raised from 11 to 15 per cent.[10]

Low interest rate policy was seen as a strategy for increasing the rate of investment, ensuring sectoral diversity of investment, and forestalling any inflationary pressures that any

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[9]Ibid, p. 11.

[10]Central Bank of Nigeria, Annual Report and Statement of Account, 1987, P. 59.

liberalization might bring about.[11] This policy option led to negative results. Low interest rates and the consequent higher demand for credit ushered in pervasive demand for collateral by financial intermediaries. Other extraneous factors like nepotism and patronage influenced more the credit decisions of financial intermediaries and may have helped to weaken the link between interest rates and investment during the period. Furthermore, it can be argued that the practice of setting both monetary and interest rate targets under direct monetary control rendered ineffective the transmission process which enables monetary policy changes to manifest themselves through the response of interest rates. The sign of the interest rate coefficient can, therefore, be regarded an evidence of clear interest insensitivity of investment.

Money Supply

As shown by the result money supply significantly affects investment spending. Though the sign of its coefficient corresponds to a priori expectations, the effect of money supply is small (see equations 15e and 17e). A probable explanation can be

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[11]S.P. Leite and V. Sundararajan, "Issues in Interest Rate Management and Liberalization", IMF Working Paper, March 1990, P. 1.

advanced. Since monetary policy has a lagged effect, the impact of lagged values of money supply may be more robust than that of the current values which have been used in the specifica tion of the investment equations.

Furthermore the small effect of current money supply may have been the result of rigidities in the monetary system such as the credit market lag of monetary policy, which is the lapse between a monetary policy change and its effects on interest rates and other financial assets.[12] During the period under review, Nigeria adopted a discretionary monetary policy regime under the direct control system. Monetary changes were countercyclical and with the low nominal interest rates, commercial banks extended mainly short-term credit which is unsuitable for productive economic activities. This may have contributed to the weakening of the links between money supply and investment. The policies adopted by the Nigerian monetary authorities led to low savings mobilization, inefficient resource allocation and the stunted growth of money and capital markets.[13]

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[12]See Dwayne Wrightsman, An Introduction to Monetary Theory and Policy, Third Edition (New York: The Free Press, 1983)p. 324.

[13]C.N.O. Mordi, "Distortions in the Nigerian Economy Through Interest Rate Policy: An Empirical Analysis" in Distortions in the Nigerian Economy, Proceedings of the Nigerian Economic Society Annual Conference Calabar, May 12-16, 1987, p. 1.

Aggregate Banking Sector Credit to the Economy

The coefficient of aggregate credit has the right sign but changes in aggregate credit did not significantly affect investment (see equation 17e). This is consistent with an earlier finding by Odedokun that credit is not a significant determinant of the general state of the economy.[14] A possible explanation for the result could be that annual changes in aggregate credit were not substantial.

During the period under review the Nigerian monetary authorities adopted an expansionary credit policy predicated on the overall objective of accelerated economic development. Selective credit controls were used to direct more credit in favour of the preferred sectors of the economy, mainly the productive sectors. The practice of selective credit control involved the issuance of guidelines on sectoral allocation of credit to the banking system. Agricultural production and the industrial sector were favoured.

Selective credit control measures included extensive directives and prescriptions to commercial and merchant banks with

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[14]Odedokun, M.O., "The Impacts of Fiscal Variables, Financial Variables and Composition of Financial Aggregates on Nigerian Economy", Savings and Development Quarterly Review, No. 2, vol. 12, 1988.

respect to the maturity structure of loans and advances, the grace periods of the loans to agricultural enterprises, and the proportion of credit extended to small-scale enterprises.[15]

One of the problems facing the use of selective control is the noncompliance with the prescriptions and directives of the monetary authorities. A combination of low fixed lending rates and a high rate of default on loans make the banks more willing to suffer penalties than to extend credit to certain categories of entrepreneurs. Futhermore, pervasive credit rationing within the banking system also undermined the efficacy of selective credit control.

Government Capital Expenditure

Government expenditures on capital projects in Nigeria are basically aimed at boosting private sector capital formation. Over the decades both the federal and the state governments have directed outlays toward the provision of roads, electricity, industrial estates and equipment leasing operations.

The regression results show that government capital expenditure did not significantly affect investment. This finding

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[15]M.O., "The Evolution and Performance of Monetary Policy in Nigeria in the 1980s" C.B.N., Research Dept. Occasional Paper, No.2, Feb. 1992.

contradicts some earlier evidence. Blejer and Khan[16] using cross-country data reported the finding that government investment in infrastructure is complementary with private investment. Also Musalem found public and private investment to be complementary in a time-series study of investment in Mexico.[17]

The poor performance of government capital expenditure as a regressor can be explained by the long lags between budgetary announcements and the completion of infrastructural projects. In the intervening periods contracts have to be negotiated, necessary equipment have to be imported or ordered locally and construction and installation works have to be completed. All these introduce lags between government budgetary allocations for infrastructural development and their impacts on investment. Our computation shows that on the average a period of 10 months elapses before government capital expenditure impacts on investment.

5.5 Speed of Adjustment and Half-Lives

Investment responds to changes in its proximate determinants

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[16]M. Blejer and M. Khan, "Government Policy and Private Investment in Developing Countries", IMF Staff Papers 31, No 2 1984, pp. 379-403.

[17]A. Musalem, "Private Investment in Mexico: An Empirical Analysis", PRE Working Paper 183, World Bank, Latin Americaand the Caribbean Country Department II, Washington, D.C., 1989.

after some lag. The time structure of the responses of investment spending to its determinants is of critical importance for designing short-run economic stabilizing policies. According to Jorgenson and Stephenson:[18]

> A counter-cyclical policy predicated on the stimulation of investment expenditures requires a relatively short lag between changes in the policy instrument and actual investment. If the lag between policy changes and investment is long a counter-cyclical policy based on stimulating investment expenditures may have an adverse effect on economic stability.

To compute the lag between investment and its determinants we adopted a simple formulation for calculating the speed of adjustment applied by Ajayi in a study on money supply in Nigeria.[19] This formulation is based on the stock-adjustment framework. The starting point is the assumption that there is a gap between the actual holdings of any particular asset and its desired level at any particular point in time. It is further assumed that the change from one period to the next is a fraction of the difference

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[18] D.W. Jorgenson and J.A. Stephenson, "The Time Structure of Investment Behaviour in the United States Manufacturing 1947-1960", *Review of Economics and Statistics*, Vol. 49, 1967, p. 16.

[19] S.I. Ajayi, *Money in a Developing Economy: A Portfolio Approach to Money Supply Determination in Nigeria* (Ibadan: Ibadan University Press, 1978) pp. 55-57.

between the actual and desired values.

The relationship between current and desired investment, for instance, can be expressed thus:

$$\gamma I_t - \gamma (I_t^* - I_{t-1}) + u_t \qquad 25$$

where

I* = desired level of investment

It-1 = actual level of investment in period t-1, and

ut = stochastic error term

Desired level of investment is a function of income and other relevant variables, and can be written

$$I_t^* - \alpha + \beta Y_t \qquad 26$$

From equations (25) and (26) we obtain

$$\Delta I_t - \gamma + \gamma\beta Y_t + \gamma I_{t-1} + u \qquad 27$$

where γ is the partial adjustment coefficient indicating the proportion of the gap between the actual and desired levels of the dependent variable that is closed in one period. The speed of adjustment is faster, the closer γ is to one. The speed of adjustment γ is one minus the coefficient of the lagged dependent

variable.

The half-life, which is the number of periods required to close one half of any gap between the desired and the actual stocks is a convenient statistic for summarising the implications of a given values of speed of adjustment.

Consider the following dynamic equations

$$I_{t+n-1} = \gamma I^* + (1-\gamma) I_{t+n-2} \qquad 28$$

and

$$I_{t+n-2} = \gamma I^* + (1-\gamma) I_{t+n-3} \qquad 29$$

with successive substitution we obtain

$$\begin{aligned} I_{t+n-1} &= \gamma \sum_{i=0}^{n-1} I(1-\gamma)^i I^* + (1-\gamma)^n I_{t-1} \\ &= [1-(1-\gamma)^n] I^* + (1-\gamma)^n I_{t-1} \\ &= I^* + (1-\gamma)^n (I_{t-1} - I^*) \end{aligned} \qquad 30$$

The half-life is obtained by solving for the value of n such that

$$I_{t+n-1} = I - \frac{1}{2}(I_{t-1} - I^*)$$

that is the value of n such that $(1-\gamma)^n = 1/2$.

From which we have

$$n = -\frac{\ln(1/2)}{\ln(1-\gamma)}$$

$$= -\frac{.693}{\ln(1-\gamma)}$$

For the regression results, the speed of adjustment and half-life are presented in Table 5.5 below

Table 5.5: Speed of Adjustment and Half-Life

Estimated Equation	Coefficient of lagged dependent variable	Speed of adjustment	Half-life	Lag Months
$\Delta I_t = b_0 + b_1 \Delta M2_t + b_2 \Delta M2_{t-1} + b_3 \Delta I_{t-1} + u_t$	0.29	0.71	2.02	24
$\Delta I_t = b_0 + b_1 \Delta T_t + b_2 \Delta T_{t-1} + b_3 \Delta I_{t-1} + u_t$	0.45	0.55	1.16	14
$\Delta I_t = b_0 + b_1 \Delta R_t + b_2 \Delta R_{t-1} + b_3 \Delta I_{t-1} + u_t$	0.37	0.63	1.50	18
$\Delta I_t = b_0 + b_1 \Delta C_t + b_2 \Delta C_{t-1} + b_3 \Delta I_{t-1} + u_t$	0.74	0.26	0.51	6
$\Delta I_t = b_0 + b_1 \Delta G_t + b_2 \Delta G_{t-1} + b_3 \Delta I_{t-1} + u_t$	0.56	0.44	0.84	10

5.6 Verification of Hypotheses

The first hypothesis states that the interest rate variable has insignificant effect on investment expenditures in the Nigerian economy. This hyposthesis can be verified by the examination of the coefficient of interest rate (Equation 17e). Though the size of the interest rate coefficient is large relative to those of the other regressors, this outcome can be regarded as spurious on the basis of the argument presented in 5.4. When subjected to the test of significance which is based on the division of parameter estimate by its standard error, it was found to be insignificant. Thus the null hypothesis of interest insensitivity of investment in the Nigerian economy is supported by evidence.

Also evidence has provided some support to the second null hypothesis - that investment expenditures respond sluggishly to policy variables in the Nigerian economy. From the computation of the speed of adjustment and half-life, it can be seen that except for the banking system credit to the economy which impacts on investment spending after at least six months, investment responds to its other determinants with longer lags: money supply (24 months), corporate tax rate (14 months), interest rate (18 months), and government capital expenditure (10 months). The second

alternative hypothesis is verified with respect to the banking system's credit to the economy and government capital expenditure, which impact on investment with six- and eight-month lags respectively. Conversely, the second null hypothesis is verified by the lags with which investment responds to money supply, corporate tax rate, and interest rate.

The third null hypothesis, which states that investment expenditures are insensitive to macroeconomic adjustment policies is strongly supported by evidence. From the test of significance of the regressors, only the coefficient of money supply is found to be significant, while those of the other macroeconomic policy variables (corporate tax rate, banking system 's credit to the economy, interest rate, and government capital expenditure) are insignificant.

CHAPTER SIX

Implications of the Results

A consideration of the policy requirements for boosting private investment in Nigeria calls for close examination of the following pertinent questions:

(a) What suggestions flow from our analysis for improving the response of private investment to macroeconomic adjustment ?

(b) Are there some general principles which must be kept in view ?

(c) What lessons are there to be drawn from experience ?

According to Serven[1] and Solimano,"... macroeconomic restraint, especially when sharp and protracted, has an overly adverse impact on capital formation in the short term". Since 1986, Nigeria has been pursuing a programme of structural adjustment and liberalization, therefore, policy choice must be consistent with the spirit and philosophy of transition.

6.1 Monetary Policy Implications

Our analysis have shown that a low interest rate policy depressed investment spending. With financial repression (negative real interest rates) and the consequent pervasive credit rationing

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[1]L. Serven and A. Solimano, "Economic Adjustment and Private Investmet", Finance and Development, IMF/World Bank, September 1992, p. 45.

by financial institutions, small borrowers' access to credit was restricted, thereby reducing the volume of credit. Due to credit rationing small firms rely more on retained earnings for financing than large established firms, which are more likely to obtain credit.

Arguably, because of negative real interest rates, borrowers have been constrained more by the access to credit than by its cost. Thus a strong case is made for keeping real interest rates positive. Already recent trends in monetary management in Nigeria underscore the desire by the CBN to establish real interest rates in line with the financial liberalization, which the ongoing programme of structural adjustment made imperative. As has already been mentioned, direct control on interest rates was abolished on 1st August, 1987. This led to a sharp rise in interest rates. Previously fixed at 10.50 per cent in 1986, commecial banks' lending rate rose sharply to 17 per cent in 1987 with the decontrol. Between 1987 and 1990 there was a sharp upward trend in interest rates which caused the monetary authorities to impose a ceiling of 21 per cent on lending rate. The maximum spread between lending and deposit rates allowed was 5 per cent. In the 1992 Budget, a full deregulation of interest rates was announced in line with the objective of achieving external balance.

Interest rates liberalization predicated on the attainment of real interest rate is strongly supported by this study. A gradual liberalization of interest rates is recommended. This recommendation is justified by two consierations. First is that the present inflation rate is high and unsteady. An important precondition for interest rate liberalization is a stable economic environment. Second is that in a period of transition to market - based system of monetary control, sudden high positive real interestfollowing a sustained period of negative real interest rates could lead to a decline in the rate of capital formation.

For interest rate liberalization to succeed strict banking supervison and prudential regulations must be ensured.[2] This is very important in an unstable macroeconomic environment during transition from the direct to the indirect monetary control system. Market-based determination of interest rates is likely to restore the transmission mechanism of monetary policy by permitting monetary policy changes to impact on macroeconomic aggregates through changes in interest rates. In this framework, the Central Bank will have to choose between interest rate and money supply

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[2]D. Villanueva and A. Mirakhor, "Interest Rate Policies, Stabilization, and Bank Supervision in Developing Countries: Strategies for Financial Reforms, unpublished manuscript, International Monetary Fund, 1990, p. 18.

targets. When market determination of interest rates is adopted, monetary (credit) components are allowed to adjust freely to changes in the market. With this, monetary (credit) targets have a better chance of being attained.

Complete liberalization of interest rates could lead to serious inflationary pressure and a reduction of the profitability of the private business sector as Indonesia's experience has shown.[3] This possibility lends strong support to a programme of gradual liberalization of interest rates keeping real rates positive.

6.2 Fiscal Policy Implications

Our analysis recommend greater commitment to the expansion of public sector investment in infrastructure. Also policies toward reducing the lag of impact of government capital expenditure should be vigorously pursued. Public investment in infrastructure are complementary with private investment. By reducing the capital costs to private firms they act as a boost to private investment.

In the context of financial liberalization public expenditure not directed toward infrastructural development could lead to the "crowding out" of private investment by pushing up interest rates and diverting credit away from the private sector. This must be

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[3]Villanueva and Mirakhor, op. cit, p. 17.

guarded against by policy makers because with financial liberalization government may have to rely more on open market sources of finance than on low-interest government instruments. The issuance of these instruments charaterised the distorted financial market of the direct monetary control era in Nigeria. Governments source funds from the capital and money markets in order to finance deficits. Thus public sector fiscal balance helps to create the conducive environment for the growth of private investment.

CHAPTER SEVEN

SUMMARY AND CONCLUSIONS

The study set out to investigate the relationship between private investment and its proximate determinants in the Nigerian economy namely interest rate, banking system's aggregate credit to the economy, income, government capital expenditure, corporate tax rate, and money supply. Of the determinants interest rate, banking system's aggregate credit to the economy, corporate tax rate, and government capital expenditure did not significantly impact upon private investment during the period. The regressions carried out show that changes in income were an important determinant of investment, confirming the accelerator theory. Also money supply performed well in explaining private investment.

Contrary to earlier held a priori expectations, the study shows that investment expenditures were insensitive to interest rates. Therefore, the theoretical arguments used to justify the policy of low interest rates are not supported by evidence.

One important implication derived from the study for the improvement of the response of private investment to macroeconomic adjustment is the need for interest liberalization within the framework of overall financial liberalization. Interest rate liberalization will: lead to positive real interest rates - to

which investment expenditures respond- and thereby enhance the availability of credit to investors; restore the transmission channel of monetary policy, and enhance savings mobilization for investment.

The time dimension of the response of private investment to its determinants was investigated. The computations done show that investment responded sluggishly to its determinants. Plausible explanations for this were advanced with respect to individual factors.

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APPENDIX

1: Gross Domestic Private Investment
(Millions of Current Naira)

1970	1,216.7
1971	1,791.8
1972	2,087.1
1973	2,370.5
1974	2,703.9
1975	4,195.3
1976	6,348.6
1977	6,795.4
1978	6,940.1
1979	6,767.9
1980	6,121.3
1981	9,051.6
1982	6,603.6
1983	5,008.0
1984	3,676.1
1985	5,297.3
1986	7,050.1
1987	9,820.3
1988	15,301.3

Source: Computed from

(1) International Bank for Reconstruction and Development/World Bank, *World Tables* 1989/90 Edition.

(2) Central Bank of Nigeria: *Economic and Financial Review* (various years).

2: Government Capital Expenditure
(N Millions)

1970	221.0
1971	173.8
1972	451.3
1973	565.7
1974	1549.4
1975	3518.2
1976	4241.9
1977	5442.3
1978	5197.0
1979	4837.5
1980	8395.6
1981	5696.9
1982	7950.3
1983	5868.5
1984	5411.0
1985	7613.3
1986	9076.8
1987	6372.5
1988	8340.1

Source: Central Bank of Nigeria: *Economic and Financial Review* (various years).

3: Money Supply (M2)*
(N Million)

1970	949.3
1971	1,003.3
1972	1,161.3
1973	1,414.0
1974	2,156.2
1975	3,622.4
1976	5,278.9
1977	7,057.5
1978	7,699.5
1979	9,857.4
1980	14,397.4
1981	15,584.1
1982	16,894.0
1983	19,368.9
1984	21,600.5
1985	23,818.6
1986	24,592.7
1987	29,994.6
1988	42,780.3

Source: Central Bank of Nigeria, *Statistical Bulletin* Vol. 2, No. 2, Dec., 1991.

*Money Supply (M2) is composed of MI and Quasi Money.

4: Corporate Income Tax Rate
(Percentage Points)

1970	40
1971	40
1972	45
1973	45
1974	45
1975	40
1976	40
1977	40
1978	50
1979	50
1980	45
1981	45
1982	45
1983	45
1984	45
1985	45
1986	45
1987	45
1988	45

Source: E.C. Ndekwu (1988) *Tax Structure and Administration in Nigeria*, (Ibadan: N.I.S.E.R.).

5: Interest Rate (Commercial Banks' Prime Lending Rate)
(Percentage Points)

1970	7
1971	7
1972	7
1973	7
1974	7
1975	6
1976	6
1977	6
1978	7
1979	7
1980	7.5
1981	10.5
1982	9.5
1983	9.5
1984	9.5
1985	9.5
1986	10.5
1987	20.5
1988	16.3

Source: Central Bank of Nigeria: *Annual Report and Statement of Accounts* (various years).

6: Banking System's Credit to the Economy (Aggregate Credit)
(₦ Million)

1970	1,140.4
1971	1,122.6
1972	1,269.2
1973	1,342.5
1974	- 463.9
1975	488.6
1976	2,617.3
1977	5,529.4
1978	8,059.9
1979	8,855.2
1980	10,780.1
1981	16,261.4
1982	21,899.7
1983	28,178.4
1984	31,136.5
1985	32,680.3
1986	36,820.3
1987	42,082.0
1988	57,326.3

Source: Annual Report and Statement of Accounts (various years)