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Effects of Irreversibility and Macroeconomic Uncertainty on Aggregate Private Investment in Nigeria, 1970-2001

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EFFECTS OF IRREVERSIBILITY AND MACROECONOMIC UNCERTAINTY ON AGGREGATE PRIVATE INVESTMENT IN NIGERIA (1970 - 2001)

BY

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A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, FACULTY OF SOCIAL SCIENCES, OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA, IN PARTIAL FULFILMENT OF THE CONDITIONS FOR AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (PH.D) IN ECONOMICS.

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CERTIFICATION

This research study by Benjamin Ayodele **FOLORUNSO** has been carried out under my supervision and being approved for the Department of Economics, Obafemi Awolowo University, Ile-Ife.

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DEDICATION

This research study is devoted to:

The **Almighty God** in Whom I put my trust;

My mother, Mrs. Janet Olatundun Aderibigbe, for all she cares;

My son, Israel; and

Those whose dreams are yet to come true.

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ABSTRACT

The study investigated the determinants of aggregate private investment and examined private investment decisions in the face of uncertainty. Specifically, it analyzed the effect of irreversibility on private investment decisions. It also examined how various dimensions of macroeconomic uncertainty affected private investment decisions in Nigeria. The trend patterns of Nigeria's private investment spendings were also analyzed.

The study covered a period of thirty-two years starting from 1970 to 2001. Annual and quarterly time series data were employed. The time series data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, Federal Office of Statistics (FOS), World Banks publications and IMF International Financial Statistics Yearbooks. Descriptive methods of analysis were employed in trend analysis while Error Correction Modelling (ECM) techniques were adopted in the estimation of the specified aggregate private investment models. Both nominal and real private investment models were examined using the logarithmic and growth rate formulations. The time series properties of variables were ascertained using the Dickey-Fuller (AD), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests.

The study showed that private investment behaviour of the Nigerian economy was highly unpredictable during 1970-2001 period. It was, however, more unstable in real private investment than its nominal counterpart. At 5 per cent level of significance, it was found that public investment, income, real interest rates, credit to private sector and debt variables explained about 80 per cent variation in private investment. Private investment in Nigeria was affected positively by income, public investment and credit to private sector while it was negatively affected by real interest rates and the size of debt. The negative sign of irreversibility measure, though not significant, revealed that there was reluctance on the part of private sector as regards investment spendings. It was also revealed that increased

uncertainty depressed level of private investment in the Nigerian economy between 1970 and 2001. Indeed, inflation rates, exchange rates, interest rates and fiscal deficits uncertainties were most detrimental to private investment recovery in Nigeria. For the Nigerian economy to achieve a 20 per cent increase in private investment, the overall level of uncertainty must be reduced by at least 5 per cent.

The study concluded that high levels of uncertainty indicators caused private investment to decline between 1970 and 2001. Irreversibility affected the timing of private sector investment spendings only in the short run. Finally, macroeconomic uncertainty during 1970-2001 made private investors less eager to invest. Thus, irreversibility and aggregate uncertainty impacted negative effects on private investment spendings in Nigeria.

CHAPTER ONE

INTRODUCTION

1.1 Background Introduction:

One of the central problems confronting most countries, whether developed or developing, is that of sustainable economic growth. The issue is, however, more serious for economies of most developing countries leading to different monetary and fiscal actions being advocated. Recent theoretical approaches, typified by endogenous growth models, suggest that high investment rates can result in a permanent increase in an economy overall growth rates (Romer, 1986; Lucas, 1988). In these models, investment is identified as a fundamental factor in economic growth. Indeed, endogenous growth model of Barro (1996) widely applied to explain growth in developed and developing countries shows that growth is enhanced by lower government consumption, higher level of investment and improvements in the terms of trade (Barro, 1996). In contrast to developed countries, where growth problems were viewed in the Keynesian sense of too much saving and too little spending, investment and hence, economic growth in developing countries were constrained by the insufficiency of savings (James, *et al*, 1987). In this context, evidence from development experiences strongly suggests that the best performing countries, even among the developing countries, have achieved better status on the basis of high rates of savings and investment (Oyejide, 1998).

Among the factors that are theoretically expected to promote domestic output in an economy is the currency devaluation or depreciation. The depreciation of a country's

currency, either through a gradual downward floating of the exchange rate or via an immediate outright devaluation of the currency, is normally expected to, among other favourable effects, promote the country's domestic output. Such growth would usually be attained through an increase in the country's exports (which would be cheaper in foreign countries) and its multiplier effects would be increases in investment, income, capital utilization, employment generation and spendings in both exporting and non- exporting sectors of the economy (Caves and Jones, 1973; Obaseki and Bello, 1996).

The continued disappointing and low level of economic growth witnessed by developing countries call for investigation of the phenomenon in recent years. For instance, most of the empirical literature on Africa's dismal economic performance in recent years draws attention on the determinants of growth (see World Bank, 1994; Easterly and Levine, 1997; Collier and Gunning, 1999). World Bank (1994) observes that high degree of exchange rate over-valuation, excessive indebtedness and substantial country risk for investment were factors that hampered growth in sub-Saharan African countries. It has, however, been observed that inefficiencies as well as structural constraints could result in a condition of decreasing marginal productivity of capital. Barring structural impediments, investments generate employment, which could enhance level of output in the economy. Examining Africa's dismal economic performance, Collier and Gunning (1999) observe that for African countries to achieve economic recovery and accelerated growth, emphasis must be placed on investment while savings are pre-requisite to increased investments.

The Nigerian economic situation has, indeed, been very disappointing. After over four decades of political independence, the country is still plagued with both the internal and external distortions. As regards external front, the country has been saddled with the problems of increasing foreign debt and balance of payments dis-equilibrium, even before stabilization and adjustment era. On the internal scene, the economic problems have equally been seen to be severe. Those identified problems include reduced export earnings, heavy internal debt burden, low savings and investment, growing and disturbing rates of inflation and unemployment, low productivity, fiscal crises and low purchasing power of currency (Ndebbio and Ekpo, 1991). These problems have brought about a rapid decline in the overall economy and the standard of living of people in Nigeria.

The most chronic and intractable of these afore-mentioned problems are inflation, fiscal crises, low levels of savings and investment. Between 1970 and 2001, deficit-GDP ratio remained high exceeding the conventional 3.0 per cent. During 1970-79 period, deficit-GDP ratio was 7.2 per cent, which reduced to 5.2 per cent between 1980-85 and later increased to 8.4 per cent between 1986-89 and fell back to 6.1 per cent between 1990-2001. The average rates of inflation which was 15.0 per cent during 1970-79 rose to 18.5 per cent between 1980-85 which rose again to 24.1 per cent between 1986-89 and during 1990-2001 period, the rate has increased to almost 34.0 per cent. Between 1990 and 2001, the rates of inflation were predominantly in the double-digit range with the figure as high as 72.8 per cent in 1995, except for 1997, 1999 and 2000 when the values were as low as 8.5 per cent,

6.6 per cent and 6.9 per cent respectively. During the stabilization era (1978-1986), the absolute value of fiscal deficit was significantly high as it jumped from 4-digit to 5-digit million marks. Fiscal deficit-GDP ratios were also on the high side during the entire period except for few years. The rates of inflation during the stabilization era remained permanently on the double-digit range except for 1982, 1985 and 1986 with 7.7 per cent, 5.5 per cent and 5.4 per cent respectively. Thus, it is correct to say that negative indices, especially that of fiscal deficits and high inflation rates did not abate during the period of stabilization.

Evidence from Table 1 indicates that Nigeria's domestic savings have been low and inadequate to fund and sustain the level of investment that is required for the country's economic growth targets and potentials. The savings rate fell consistently from 28.6 per cent between 1970-79 to 10.9 per cent between 1980-85 period. The rate rose slightly to 14.3 per cent between 1986-89 and fell again to 10.7 per cent between 1990-2001 period. The high rate of savings in the economy during 1970-79 period was mainly as a result of the good economic climate prevailing then, as reflected by the growth rate of economic activities. Thereafter, the performance of the savings rate has been very dismal. Indeed, between 1980-85 period, it continuously decelerated, perhaps due to the serious economic recession of the time. The savings-GDP ratios were even negative for some years during this period. The ratio of savings to GDP is low compared to the over 30.0 per cent range for other developing countries with growing economies. The same experience was recorded between

1990 and 2001 partly as a result of the other indices of macroeconomic instability in the system such as inflation and interest rates. In 1995 for instance, Nigeria's savings/GDP ratio was only 12.5 per cent compared to 42.0 per cent for Malaysia, 34.0 per cent for South Korea, 33.0 per cent for Indonesia, 50.0 per cent for Singapore, 35.0 per cent for Thailand, 26.0 per cent for Chile, 34.0 per cent for Iran, and 30.0 per cent for Saudi Arabia (see World Bank, 1998).

Table 1: Selected Nigeria's Macroeconomic Indicators (1970-2001)

Period	Real GDP growth rate (%)	Investment/ GDP ratio (%)	Consumption/ GDP ratio (%)	Savings/ GDP ratio (%)	Fiscal Deficit/ GDP ratio (%)	Inflation Rate (%)	Capacity Utilization (%)	Foreign Direct Investment (%)
1970-1979	5.8	25.9	71.4	28.6	7.2	15.0	74.0	4.5
1980-1985	-0.9	14.1	89.1	10.9	5.2	18.5	42.7	2.1
1986-1989	5.6	7.5	85.7	14.3	8.4	24.1	39.4	1.5
1990-2001	2.8	9.3	89.3	10.7	6.1	33.8	35.2	1.8

Sources: CBN Statistical Bulletin (various years)
CBN Annual Reports and Statement of Accounts

Investment-GDP ratio remained quite low from 1970 to 2001 while capacity utilization, which was 74.0 per cent in the 1970s, stood below 40 per cent in the 1980s and just a little above 35.0 per cent in the 1990s. Investment-GDP ratio was 26.9 per cent while consumption-GDP ratio was 71.4 per cent in the 1970s. During the first half of 1980s, investment-GDP ratio fell drastically to 14.1 per cent while consumption-GDP ratio increased to 89.1 per cent. The second half of 1980s also recorded a drastic fall in investment-GDP ratio to 7.5 per cent while consumption-GDP ratio remained as high as

86.0 per cent. Between 1990-2001 period, investment-GDP ratio was 9.3 per cent while consumption-GDP ratio was 89.3 per cent. For the period 1970-79, foreign direct investment grew by 4.5 per cent. It declined to 2.1 per cent between 1980-85 and registered a growth rate of 1.5 per cent for the 1986-1989 period. Between 1990-2001 period, its foreign direct investment only grew at 1.8 per cent. The decline for the period 1980-85 can be attributable to both fall in oil prices in 1980s and the uncertainty created in the domestic economy.

The growth rate of real GDP was impressive during the oil boom period of the 1970s. The real GDP growth rate was 25.0 per cent in 1970 and 11.7 per cent 1974. During 1970-79 period, real GDP annual growth rate was 5.8 per cent. In early 1980s, the growth rate of real GDP became negative. For instance, growth rate of real GDP was -26.8 per cent in 1981, -5.4 per cent in 1983 and -5.1 per cent in 1984. On the annual level, real GDP growth rate was -0.9 per cent during 1980-85 period. Between 1986-89, real GDP growth rate was 5.6 per cent and later reduced to 2.8 per cent during 1990-2001 period. The annual real GDP growth rate of 2.8 per cent is not satisfactory enough compared to 3.9 per cent for industrial countries, 4.8 per for developing countries, 4.2 per cent for Africa, 7.1 per cent for Asia, 4.1 per cent for Middle East and 4.6 per cent for Latin America.

In August 1986, the Nigerian government introduced Structural Adjustment Programme (SAP), which was meant to address certain imbalances and distortions in the

economy. Specifically, SAP was introduced in order to reverse the negative trend of real GDP growth rate of the early 1980s. Throughout the adjustment period, the rate of inflation remained quite high reaching 40.9 per cent in 1989, 72.8 per cent in 1995 and 18.9 per cent in 2001. The rate of unemployment appeared disturbing as the economy has been at full-employment output, except for the period between 1980 and 1985. After the introduction of SAP, the Nigerian government similarly embarked upon large fiscal deficits. In 1986, deficit-GDP ratio was 11.3 per cent, 8.5 per cent in 1990, and 15.5 per cent in 1993 and later reduced to 9.5 per cent in 1999. By 2001, deficit-GDP ratio has drastically reduced to 4.5 per cent due partly to expenditure control and revenue mobilization efforts. Regardless of the adjustment programme, investment-GDP ratio in the late 1980s and 1990s still remained low while capacity utilization was around 35.2 per cent with balance of payments (BOP) in dis-equilibrium during most periods. The selected important macroeconomic indicators in Table 1 show that economic fundamentals in the Nigerian economy were moving in the wrong directions. The discomfort index, which was high throughout the period 1970-2001, confirms partly that the Nigerian economy is not performing satisfactorily.

Interest rates are key price factors with respect to decisions on financing physical investment. Positive real interest rates generate positive returns on investment and savings, which enhance growth. In Nigeria, the Minimum Rediscount Rate (MRR) serves as the nominal anchor, and prior to 1996, it was negative in real terms and culminating in

discouragement of financial intermediation as the propensity to consume and import were stimulated. These developments encouraged inefficient investments and lured banks into unproductive lending and non-performing loans in their portfolios. Between 1970-79 period, minimum rediscount rate (MRR) was 7.0 per cent, 9.5 per cent between 1980-85, 15.0 per cent for the period between 1986-89 while it increased to 22.5 per cent between 1990-2001. It is, however, observed that real interest rates became positive between 1996 and 2000 following the liberalisation policy in 1994 and the resultant increase in MRR. It is also observed that policy reversals in the early 1990's militated against the ability of interest rate to send adequate signals to the markets. The intermediation margin of 16.6 percentage points in 1998 suggests the inefficiency of the banking sector in providing financial services that encourage investment to generate economic growth.

Nigeria, like most other developing countries, is in serious need of sustainable economic growth. Increase in output of goods and services for consumption has been regarded as important ingredient in enhancing economic growth. In an attempt to promote economic development in Nigeria, the adoption of productive resources, mainly capital and labour, has greatly been emphasized. However, the efficient and effective use of capital resources for greater productivity, for instance, requires that private investment should be encouraged. This view might not be unconnected with the postulated positive relationship between investment and economic growth (Greene and Villanueva, 1991; Obadan and Odusola, 1999). Indeed, recovery in private investment has been described as a key factor in

sustaining future growth in developing countries, including Nigeria (Khan and Reinhart, 1990; Levine and Renelt, 1992; Chhibber and Pahwa, 1994; Schmidt-Hebbel *et al*, 1996; Chete and Akpokodje, 1997; Folorunso and Akinlo, 1999). The finding might have necessitated the current wave of privatization programmes and investigations of the predictors of private investment decisions in most developing countries.

The process of attracting private investments in any country is usually affected by both macroeconomic and political considerations. A country in which there is political instability or a threat of nationalization without adequate compensation is more of a risk to an investor and therefore less attractive to private investment than a country offering political stability and a guarantee of property. Given the turbulent social, economic and political situations before May 1999 general election in Nigeria, some of the existing private investors were already divesting their investment interests (Dike and Bogunjoko, 1997). Indeed, series of political and macroeconomic instability measures have been singled out as having the most deleterious effect on the Nigerian economy (Chete and Akpokodje, 1997; Busari and Olaniyan, 1998). Also, the recent investment literature suggests that the economic and political instabilities suffered by many African countries including Nigeria posed a strong deterrent to private investment take-off (World Bank, 1994).

The Nigerian government in an effort to finding a lasting solution to the economic problem and for the purpose of attracting private capital introduced the Structural Adjustment Programme (SAP) in July 1986. The aspect of SAP policy measure that affects

the private investment decisions has to do with exchange rate, domestic and external trade liberalization and financial sector deregulation and reforms of public macroeconomic policy. For instance, in order to encourage production and private investment projects, government lowered taxes and increased incentives for the productive sector of the economy. In addition to this, government is embarking on a programme of privatization and commercialisation of publicly owned enterprises.

However, the option to invest by private sector, on one hand, is highly sensitive to a number of risk factors, such as future prices of products, market demand for the products, cost of inputs, the exchange rate, choice of trade regime and macroeconomic policy reforms, all of which are partly under government control and are, indeed, potentially reversible. Private investment, on the other hand, takes time to build and it is highly irreversible (Aryeetey, 1994; Dixit and Pindyck, 1994; Pattillo, 1998). This implies that the initial capital invested is partly sunk or cannot be recovered fully when sold. In the face of uncertain macroeconomic conditions, undertaking irreversible investment by private sector is costly since it may pay to wait for the resolution of the source of uncertainty (Dixit and Pindyck, 1994; Servén, 2002). Thus, the option to invest by private sector is valuable and costly. Indeed, irreversibility does not only affect sector-specific investment, it also affects non-sector-specific investment. However, once an individual or firm makes its decision or option to invest, it eliminates the possibility of waiting for new information that may resolve that uncertainty.

Uncertainty, which is defined as the absence of complete information or knowledge about how investment returns are determined, has therefore, been described as major obstacle to investment decision by many researchers (Arrow, 1968; Hartman 1972; Baldwin, 1982; Abel, 1983; Bertola, 1988; Pindyck, 1988; Bertola and Caballero, 1994; Abel and Eberly, 1994 and 1995). However, the conventional investment theory paid little attention to this fact and indeed to the links between uncertainty and investment decisions from private sector. In most of the recent empirical literature on investment, evidence shows that if investment is costly or impossible to reverse, investors have an incentive to wait by postponing commitment in order to avoid costly mistakes (Kumar and Mlambo, 1995; Hadjimichael and Ghura, 1995; Servén, 1997). The empirical evidence, therefore, indicates that no matter how uncertainty is defined, it is a strong obstacle in investment decision. This conclusion has important implication for Nigeria, especially in its drive for private investment through privatization programme during the 2001-2010 decade.

Given that the optimal investment decisions are determined by the interaction of irreversibility, uncertainty and option value of waiting factors mentioned above, the question that readily comes to mind is what effects would irreversibility and uncertainty have on private investment decisions in Nigeria. Following Dixit and Pindyck (1994), this study, therefore, discusses and applies new theoretical approach of "call option" to private investment decisions in Nigeria, emphasizing the effects of irreversibility and macroeconomic uncertainty on private investment.

1.2 Statement of Research Problem:

Prior to the adoption of Structural Adjustment Programme in 1986, the Nigerian economy was confronted with inappropriate domestic policies coupled with external shocks. The era witnessed heavy government participation in the overall economic activity. This is seen in massive expansion of the public sector through the establishment of a large number of state enterprises. The situation during this period gave rise to a severe economic predicament with deteriorating performance in all sectors of the economy. For instance, the Nigerian government embarked upon large fiscal deficits, which were mainly financed through borrowing from the domestic banking system. The deficit financing then led to high rates of inflation, interest rates, unemployment rates and over-valued exchange rates for the national currency.

Despite structural reforms supported by the IMF and the World Bank, Nigeria's economy continued to be confronted with a number of constraints. Among the constraints are the level of savings and investment that are too low to allow for self-sustained growth. Some of the factors accounting for the low level of savings in Nigeria include high incidence of poverty and low nominal disposable income, underdeveloped savings channels reflecting underdeveloped capital markets, financial sector distress, conspicuous consumption and unfavourable economic environment characterized by high unemployment and inflation.

World Bank (1991) observes that the level of domestic savings and investment are inadequate to fuel the growth needed to raise the living standard and generate sufficient productive employment. The Bank also observed that major share of the additional savings and investment required must come primarily from the private sector.

The low savings and investment ratios in Nigeria during 1970-2001 period are indications of the shallowness of the financial market and overall decline in economic activity. In Nigeria, the problems of low investments are central to the explanation of low growth. Gross domestic investment-GDP ratio averaged 10.8 per cent between 1980-99 while savings-GDP ratio averaged 13.5 per cent in the same period. Indeed, investments declined substantially in Nigeria over the years and were below savings with large gaps. In 1997, World Bank (1999) reports that gross domestic investment as a proportion of GDP averaged 22.0 per cent for low-income countries, 26.0 per cent for middle-income countries and 18.0 per cent in high-income countries. Gross domestic savings relative to GDP averaged 17.0 per cent, 26.0 per cent and 22.0 per cent for low-income, middle-income and high-income countries respectively.

In order to encourage and stimulate both the foreign and domestic private investment deliberate government policies were implemented. The intervention of government, however, worsened the distortions in the economy and destroyed any private incentives to produce, save and invest. For instance, the deregulation of foreign exchange market was embarked upon in 1986. Despite such well-established potentially beneficial effects of

currency devaluation on growth and investment, the emphasis on its adoption and implementation in Structural Adjustment Programme is marred with controversy. Indeed, the output-enhancing effect of currency depreciation is not entirely guaranteed in the literature. For example, Krugman and Taylor (1978), Ekpo (1993) and Ubok-Udom (1999) show the existence of evidence against devaluation and suggest discontinuity of devaluation exercise in the theory of structural adjustment. The point of contention on Africa and, indeed Nigeria, is that the peculiar nature of the African economy has reduced the efficacy of currency depreciation in bringing about beneficial effects. Some possible and observed adverse effects were even pointed out ranging from low capacity utilization, high unemployment and inflation rates, low investments, low performance of the overall economy, and instability in the foreign exchange markets. The overall implication seems to be that there has been a general tendency in the Nigerian economy for currency devaluation to retard investment and output growth and currency appreciation to promote growth and investment. This, indeed, runs contrary to theoretical expectations.

International comparisons suggest that the problem of low investment is central to the explanation of low growth witnessed in sub-Saharan Africa and Nigeria in particular (Hernandez-Cata, 2000). The ratio of private investment to GDP for Nigeria as shown in Table 2, fluctuated around 5.0 per cent which is far below 14.7 per cent attained in Latin America, 18.0 per cent for Europe, 26.1 per cent for East Asia, 13.2 per for South Asia, 12.3 per cent for Middle East, 12.8 per cent for North Africa and 9.5 per cent for sub-Saharan

Africa. In comparisons with other African countries, the Nigeria's private investment-GDP ratio of 4.7 per cent for 1990s is also far short of 10.1 per cent for Kenya, 5.4 per cent for Malawi, 19.0 per cent for Mauritius, and 12.0 per cent for South Africa. The evidence in Table 2 clearly supports the view that the private investment in Nigeria is not satisfactory enough to meet the required growth rate. The private investment-GDP ratio of 4.7 per cent in recent Nigeria's time fall short of average of 16.6 per cent, 11.5 per cent and 12.8 per cent for the global, sub-African and North African ratios respectively. This trend poses a serious threat to the developmental effort of the Nigerian government and, therefore, calls for proper investigation of the determinants of private investment.

Table 2: Private Investment as a Share of GDP (in percentages)

Region	1970-79	1980-89	1990-99
East Asia	17.8	18.7	23.3
South Asia	7.0	8.5	10.2
Europe	12.3	12.9	17.8
Middle East	12.4	12.1	12.3
North Africa	10.5	13.6	12.8
Latin America	12.5	12.3	13.3
Sub-Saharan Africa	12.9	9.5	9.5
1. Kenya	12.7	11.6	10.1
2. Malawi	8.7	5.4	5.4
3. Mauritius	18.8	14.0	19.0
4. Nigeria	8.1	5.5	4.7
5. South Africa	13.9	13.7	12.0
Global	12.5	12.5	13.2

Source: International Financial Statistics Yearbook (various years)

Table 3 shows figures for aggregate private investment in Nigeria between 1970 and 2001. It is observed that private investment, as a per cent of total investment, is not up to 50.0 per cent. Private sector investment was at the level of =,N165.6m in 1970 while it rose to =,N1462.9m in 1975 and increased further to =,N3256.1m in 1980. On the average, the annual growth rate of private investment was 21.0 per cent during the 1970-1980 decade. This upward trend in private investment was, however, reversed during the first half of the 1980-1990 decade. Indeed, private investment that was =,N3291.8m in 1981 fell drastically to =,N1432.4m in 1985, which was even below the 1975's level.

The downturn of private investment during this period was as a result of the global economic recession as well as oil glut experience, which discouraged private investment in Nigeria during this period. In addition to this is the debt crisis, which triggered a protracted period of macroeconomic instability leading to a drastic fall in investment rate. During this period, the average annual growth rate of private investment which was significantly negative stood at -11.7 per cent. With the introduction of Structural Adjustment Programme in 1986 which led to the deregulation of virtually all the sectors of the Nigeria's economy, the downward trend of private investment has, however, been reversed. In 1990 for instance, private investment was =,N15883.2m representing 41.9 per cent of total investment while it increased to =,N76392.4m in 1995 representing 24.2 per cent of total investment. It increased further to =,N220124.4m representing 35.2 per cent and =,N231742.3m representing 38.3 per cent of total investment in 2000 and 2001 respectively.

Table 3: Private and Public Investment in Nigeria (1970-2001)

Year	Private investment (N,=m)	Public investment (N,=m)	Private Investment as a % of Total Investment	Public Investment as a % of Total Investment	Private Investment as a % of GDP	Public Investment as a % of GDP
1970	165.6	604.7	21.5	78.5	3.2	11.6
1974	1284.7	1826.0	41.3	58.7	7.0	10.0
1975	1462.9	3818.3	27.7	72.3	7.0	18.2
1980	3256.1	7315.6	30.8	69.2	6.6	14.7
1985	1432.4	4990.8	22.3	77.7	2.0	7.0
1987	4891.0	12210.3	28.6	71.4	4.6	11.4
1990	15883.2	22024.2	41.9	58.1	6.2	8.5
1995	76392.4	239278.7	24.2	75.8	3.9	12.2
1997	113702.8	321940.0	26.1	73.9	4.0	11.3
2000	220124.4	405229.0	35.2	64.8	7.1	13.0
2001	231742.3	373329.0	38.3	61.7	7.2	11.7

Sources: CBN: Statistical Bulletin (2001)
IMF: International Financial Statistics (2002)
World Bank: African Development Indicators (2002)

In general, Table 3 presents a gloomy investment situation in recent years, which rendered productive capacity at a very minimal level with its resultant effect of worsened economy. Despite economic reforms, the effects on private investment recovery have been weak and slow. In 1970's, the average ratio of private investment to GDP stood at 8.1 per cent while it fell to 5.5 per cent and 4.7 per cent in 1980's and 1990's respectively.

The investment-growth literature emphasizes the key role of investment in economic development. The sluggish and negative growth rate of investment in Nigeria, therefore, has a lot of implications. Decline and low growth rate of investment over the years partly

explain the slow growth rate of output particularly since 1980s (Folorunso and Akinlo, 1999). A significant recovery in private investment, in particular, is required to bring about a meaningful resurgence in output growth. For private investment to be recovered, there is a dire need for proper investigation of its determinants in Nigeria. The continued instability in Nigerian economy cannot be separated from certain intractable problems ranging from high level of inflation, interest and unemployment rates, low capacity utilization, fiscal indiscipline, to mention but few.

Results from recent studies have indicated that investors in LDCs, and particularly Africa, face high risks which are inflated by the general lack of publicly provided contract enforcement, poor infrastructure and by the vagaries of the macroeconomic environment, including policy instability (Aryeetey, 1994; World Bank, 1994; Easterly and Levine, 1997; Collier and Gunning, 1999a and 1999b). Indeed, since the beginning of the SAP in 1986, policy uncertainty has dampened private investment in Nigeria (Busari and Olaniyan, 1998; Akpokodje, 1998). This alone might have led investors to adopt wait-and-see attitude towards investment decision-making. In addition, the uncertainty created by macroeconomic instability, high inflation and some inconsistency in policy implementation created an environment of uncertainty for investors for the past three decades in the Nigeria.

The slow growth rate of output experienced by Nigeria, however, could partly be explained by decline in aggregate private investment and low investment-GDP ratio during 1980-2000 period (Chete and Akpokodje, 1997). For any meaningful resurgence in output

growth, therefore, a significant recovery of private investment is required. Indeed, the weakness in private investment in Nigeria since 1985 has been an important policy concern as reversing the poor investment record was considered a major key to the strategy for achieving the accelerated growth objective (Chhibber and Pahwa, 1994). This particular finding alone calls for a thorough examination of the determinants of private investment in Nigeria.

Some economic considerations that may influence private investment decision, as established in the literature include the country's market potentials and the size as measured by the Gross Domestic Product (GDP) growth and cost of capital. Other factors are availability of labour, low labour cost and the rate of inflation. A further consideration is the investment climate as dictated by the degree of indebtedness, the balance of payments position, array of incentives provided to investors and the state of infrastructural development. Another major determinant of rate of private investment is the expected future profitability of the investment as compared to alternative possibilities at home or any foreign country. However, of all these factors, macroeconomic policy uncertainty and political instability remain perhaps the most serious factors inhibiting private investment (Rodrik, 1991; Aryeetey, 1994; Servén, 1997; Iyoha 1998). A country desirous of attracting private investments must therefore create a favourable political and economic environment for would-be investors.

On the whole, the above scenario and results of previous studies do bring a negative association between private investment performance and measures of macroeconomic and political instability and institutional weakness. However, these studies are just on bivariate correlations, and one may wonder to what extent macroeconomic and political instability continue to be negatively associated with private investment once other standard investment determinants are taken into consideration. Indeed, some readers might interpret that uncertainty makes investors less eager to invest thereby advocating for government policy intervention to stimulate investments. This would be a hasty reaction. These issues raised above seem to be important tasks in the context of the current policy discussion on the causes of Nigeria's dismal growth performance over the last three decades. In order to assess these issues, empirical studies on the effect of uncertainty on private investment spendings in Nigeria need to be undertaken.

The optimal private investment decisions, as explained by Dixit and Pindyck (1994), are determined by the interaction of three major characteristics. First, investment is partially sunk or completely irreversible implying that initial cost of investment is at least sunk. Second, there is uncertainty concerning the future rewards from the investment. Third, investment can be delayed in order to obtain more information about the future. In addition to this, the recent literature has shown that the option value of waiting can be considerable, especially in a highly uncertain environment like Nigeria, then uncertainty becomes a powerful obstacle to investors in Nigeria. Indeed, when there is uncertainty and investment

projects are irreversible, waiting for more information has a value because it helps to avoid costly mistakes should the projects be revealed as unprofitable due to adverse events. The existing literature on investment reveals that the value of waiting can be tremendously high even with moderate uncertainty. Thus, the latter becomes a powerful investment deterrent even under strict risk-neutrality (Servén, 1997).

Recent studies have indicated that the lost option value or opportunity cost of investment can be large and that investment theory that ignores such issue can be grossly misleading. This is the case in Nigeria where this issue has not been extensively captured even now when all sectors of the Nigerian economy is being privatized. Also, the existing economic literature indicates that there are not many empirical investigations of investment irreversibility and investment behaviour under uncertainty in developing countries in general and Nigeria in particular. Where investigations have been made, they are often concerned with the investment decision from the microeconomic point of view thereby making the sign of the overall effect of uncertainty still ambiguous. However, the question of primary interest, from the macroeconomic point of view, is to determine what effects will irreversibility and macroeconomic uncertainty bear on aggregate private investment in Nigeria. In other words, how will investors, who we presume to be risk-averse or neutral, behave when investment is highly irreversible given condition of uncertainty concerning future? Thus, the empirical study addresses the following research questions:

1. Why have conventional investment models failed to explain or predict the

investment behaviour of private sector in Nigeria?

2. Does the relationship between uncertainty and investment rate in Nigeria change when irreversibility of investment is considered?
3. What effects will irreversibility and macroeconomic uncertainty have on private investment spendings in Nigeria?

The study provides answers to these puzzles and other relevant issues related to investment decisions and the behaviour of private investment spendings in Nigeria. Specifically, the study determines constraints to private investment spendings in Nigeria.

1.3 Objectives of the Study:

The broad aim of this research study is to investigate how investment decisions and the level of private investment in Nigeria are influenced by macroeconomic uncertainty, irreversibility and other macroeconomic factors. The specific objectives of the study are to:

i. examine the trend of private investment spendings in Nigeria;
ii. identify the determinants of aggregate private investment decisions in Nigeria;
iii. determine how the irreversibility of an investment expenditure affects the decision to invest by private sector in Nigeria; and
iv. find the empirical relationship between macroeconomic uncertainty and aggregate private investment in Nigeria.

1.4 Justification of the Study:

The importance of investment decisions in economic development cannot be

overemphasized. Nigeria, like many African countries, has entered the post structural adjustment phase. Despite one and a half decades of profound macroeconomic adjustments, the record of private investment recovery has been disappointing. This disappointing trend in private investment has generated debate and interest in the determinants of private investment in developing countries leading to alternative theories reflecting societal peculiarities and paradigmatic conjectures (World Bank, 1993; Greene and Villanueva, 1991; Servén and Salimano, 1992; Chete and Akpokodje, 1997). In Nigeria, the resurgence of private investment has been emphasized as a key factor for economic growth sustainability (Chhibber and Pahwa, 1994). This view is connected with the postulated positive relationship existing between investment and growth. Hence, there is great need for the re-examination of the determinants of private investment in Nigeria.

The recent economic literature has also focused on how uncertainty affects investment when capital expenditures are largely sunk or irreversible. In analysing private investment in developing countries, a recent study of Hadjimichael *et al* (1995) concludes that "the most important impact of policies on private investment behaviour was through their effect on macroeconomic instability and uncertainty". Existing studies, indeed, indicate that the impact of uncertainty may be so large to discourage private investment decisions with its attendant depressing effect on economic growth. It is therefore noted that these aspects of irreversibility and uncertainty have not been captured adequately in the estimated aggregate private investment equation for Nigeria. Indeed, there is a near complete absence

of studies on Nigeria that is devoted explicitly to the exploration of the issues raised in the recent investment literature.

This study, therefore, seems relevant in the context of the current policy discussion on the causes of Nigeria's dismal growth performance over the last three decades. The resumption of sustained growth will undoubtedly require a substantial investment expansion that has to come primarily from the private sector as being reflected in the privatisation policy of the Nigerian government in recent time. Indeed, the study is expected to provide improved understanding of investment decisions by the private sector, which will accelerate the disengagement of public sector from the business scene in Nigeria and speed up the process of privatization of the Nigeria's public enterprises for accelerated economic development.

1.5 Scope of the Study:

Taking cognisance of the existing studies in developed and developing countries, the study attempts to investigate the determinants of private in Nigeria between 1970 and 2001 using option value theory of investment. The study, unlike the previous ones on Nigeria, focuses mainly of the effects, which irreversibility and macroeconomic uncertainty bear on private investment in Nigeria. The choice of 1970-2001 is based on the availability of data while the choice of private investment is based on its importance as an engine of growth in most economies of the world. The study is primarily concerned with private investment,

which is generally conceptualized in terms of physical capital formation rather than human capital. This definition follows directly from the neoclassical production function of mainly capital and labour with investment adding to the existing capital stock.

Evident in the economic literature is the recognition of the fact that there is little empirical evidence of the effect of uncertainty and irreversibility on investment decisions at the macroeconomic level. The study therefore attempts to investigate the nature of the relationship between private investment, uncertainty and irreversibility in Nigeria. In an attempt to do this, the study focuses on the recent investment literature that highlights irreversibility and the option value of waiting and explores at length the empirical link between macroeconomic uncertainty and aggregate private investment in Nigeria.

In addition to this, new empirical measures of uncertainty will be examined and the search for additional determinants of private investment in Nigeria will be of paramount importance in this study. A thorough empirical reassessment of the determinants of aggregate private investment in Nigeria will be sought for in this study. In order to achieve this, the study will employ both the annual and quarterly Nigeria's time series data from 1970 to 2001.

1.6 Plan of the Study:

Chapter one introduces the study while **chapter two** provides a comprehensive

review of the existing literature on investment determinants as well as the empirical relationship between uncertainty and private investment decisions. The theoretical issues as regards investment decisions from private sector are examined in **chapter three**. **Chapter four** discusses the research methodology focusing on the time series property, cointegration and error correction modelling (ECM) techniques employed in the study. **Chapter five** considers and analyzes private investment trend in Nigeria during the period under investigation. While **chapter six** discusses and analyzes the results of private investment models specified, **chapter seven** concludes the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction:

This chapter focuses on the review of existing investment literature. The review of literature is carried out in three different sections with emphasis on the conventional determinants of investment spendings. Emphasis is also placed on how irreversibility and uncertainty affect decisions to invest. In this regards, Section 2.2 focuses on empirical evidence in developed countries while Section 2.3 focuses on evidence from developing countries. Section 2.4 concentrates on critical review of those empirical studies on Nigeria. In all these sections, measures of irreversibility and uncertainty are examined.

2.2 Evidence of Investment Determinants in Developed Countries:

Most of the empirical literature on investment emphasizes the relationship between output growth and investment. Indeed, increase in investment rate has been described as a key factor in sustaining economic growth. This view is as a result of the postulated positive relationship between investment and economic growth. In the light of empirical evidence, it is clear that raising investment ratios must be an integral part of any strategy to enhance growth. Focusing on the role of investment in economic development, most previous studies on investment therefore identified savings mobilization as only option for investment expansion. For instance, it is assumed in the model of Mckinnon (1973) that investment and in particular, domestic investment, is lumpy and self-financed hence, it cannot be

materialized unless adequate savings are accumulated in the form of bank deposits. Also, in the model of Shaw (1973), financial intermediaries through debt intermediation promote investment, which in turns raise the level of output. Likewise, in the model of Kapur (1976) and Mathieson (1980) financial intermediaries promote investment through the provisions of both long-term and short-term working capital, which in turns, raise output and growth. Following Mckinnon (1973) and Shaw (1973), Hadjimichael *et al* (1995) and Schmidt-Hebbel *et al* (1996) also reported that savings mobilization is crucial for investment expansion.

The role of profitability and output demand in investment decisions has also been greatly emphasized in the literature. For instance, Malinvaud (1980) and Sneezens (1987) explain that investment is a function of profitability and costs (such as labour and relative cost of capital) as well as the level of capacity utilization. Fazzari *et al* (1988) also identify financial factors such as the availability of internal finance and access to capital markets. The early investment literature also supports the view that investment decisions will be influenced by uncertainty about future conditions. This view is found implicitly in early adjustment costs models and Tobin q-models. For instance, Hartman (1972) and Abel (1983) find that for a perfect competitive firm with a linear homogeneous production function and strictly convex adjustment costs, increased demand uncertainty increases investment. Indeed, they find that uncertainty over future input and output prices can increase the value of marginal unit of capital and increase the level of investment.

Brainard *et al* (1980) in their study employ a sample of 187 firms to assess the effect

of a Capital Asset Pricing Model (CAMP) on investment level. The proxies for uncertainty are based on measure of risk of investment and obtain mixed results. Their cross-sectional regressions yielded both positive and negative coefficients on risk. Ferderer (1993) uses risk-premium to measure uncertainty and finds that uncertainty has a negative and statistically significant effect on investment spending. He concludes that uncertainty has a larger negative effect than that of the cost of capital ratio or average q. Some other studies have used backward looking measures for uncertainty. For instance, Pindyck (1986) employs variances of lagged stock returns as uncertainty proxy. He finds a negative relationship between uncertainty and investment. Using a panel data on USA firms, Leahy and Whited (1996) employ a volatility forecast from variance of the firm's daily stock returns as uncertainty measure. They find that uncertainty of expected asset value is negatively related to firm investment.

The recent analytical and empirical literatures in developed countries have also paid considerable attention on the impact of uncertainty on investment. A considerable attention has also been paid on the analytical and theoretical issues in a new approach, which sees investment as a financial call option. Following Dixit and Pindyck (1994) discussion on the issue of irreversibility and uncertainty, some empirical studies have been attempted but still lagging behind the analytical discussion. This may be due to the difficulty encountered in turning the range of inactivity before investment decisions are triggered into an empirical model of investment expenditure. Theoretically, uncertainty can affect investment via different channels, most of which operate in mutually opposing direction. Hence, the overall

sign of uncertainty on investment can only be determined empirically.

However, the literature on irreversible investment and uncertainty is concerned with the proposition that the timing of investment may be altered by uncertainty about future conditions. Indeed, studies by Bernanke (1983) and MacDonald and Siegel (1986) have shown that the presence of irreversibility may lead to postponement of investment decisions. With increasing uncertainty (measured by the increasing variance in the distribution of the future rate of return from the project) the value of the "call option" to delay an investment project increases and the decision to invest is delayed. Thus, increased uncertainty, all things equal, will reduce the current level of investment.

The optimal irreversible investment studies concerning firms facing uncertainty were first investigated by Bertola (1988) and Pindyck (1988). They both analyze the case of a firm operating under a decreasing returns technology and facing a downward demand schedule. These two studies as well as Bertola (1989) consider a model with completely irreversible investment with either imperfect competition or decreasing returns to scale. They find that increased uncertainty decreases irreversible investment.

Caballero (1991) considers a model with asymmetric adjustment costs, which incorporates both the Hartman-Abel and Pindyck-Bertola cases. He finds that neither imperfect competition nor decreasing returns to scale (not asymmetric adjustment costs or the irreversibility of investment) plays a central role for the inverse relationship between uncertainty and investment as reported by Pindyck (1988) and Bertola (1989). Pindyck (1993) however shows that with complete irreversibility, convex adjustment costs are not

necessary for bounded investment and uncertainty does not affect investment if an industry faces a downward sloping demand curve; even if the firms behave perfectly competitively.

Hahm (1996) in his study examines the effects of output demand uncertainty on investment. His findings indicate that even without the irreversibility of investment, increased output demand uncertainty may decrease investment under perfect competition. This shows that irreversibility is not necessary for a negative relationship between investment and uncertainty even in a fully neoclassical competitive model. This finding runs contrary to that of Hartman (1972) and Abel (1983). The result of his study also shows that output demand uncertainty never affects investment if the industry faces a perfectly inelastic labour schedule. The study further finds that neither the strict convex adjustment costs nor irreversibility of investment are needed for bounded investment. He is, however, of the view that the sign of the effect of uncertainty about industry demand on the level of a firm's investment can be negative or positive depending on whether industry demand is inelastic or elastic and this holds without irreversibility of investment. The result also shows that downward sloping industry-level demand alone (without strictly convex adjustment costs, decreasing returns to scale, downward sloping firm-level demand, or irreversibility of investment) is sufficient to ensure bounded firm-level investment. It is also reported that investment is independent of uncertainty if labour supply to the industry is perfectly inelastic, even though uncertainty affects the growth rate of investment. Contrary to Pindyck (1993), a negative relationship between uncertainty and investment can occur even without the irreversibility of investment.

Carruth, Dickerson and Henley (1998) examine the determinants of aggregate investment spending in the UK for industrial and commercial company (ICC) sector by focusing on the role of real profits (internal funds) and uncertainty. Employing multivariate cointegration techniques to discover a parsimonious dynamic model, their results indicate that increased uncertainty has led to increased volatility in investment. Indeed, the model result shows that real profits and the real price of gold can enhance the explanation of investment spending by the ICC sector.

The basic models of irreversible investment as discussed in theory, however, focused on output demand and/or prices as the basic sources of uncertainty. The adoption of output demand as the only source of uncertainty is, however, put into question. This criticism comes from the fact that there are other uncertainty measures, which influence investment decisions. Indeed, uncertainty emanating from other sources can have exactly the same effect on irreversible investment decisions as an expanding literature has underscore. For instance, Tornell (1990) and Ingersoll and Ross (1992) examine the consequences of interest rate uncertainty in a context in which future investment returns are known. They confirm that interest rate uncertainty creates a value of waiting and that a decline in interest rates accompanied by an increase in their volatility can actually reduce investment. Thus, the stability of interest rate might be more important than their level in promoting aggregate private investment.

By employing data from a survey amongst a panel of Dutch firms, Lensink, Steen and Sterken (2001) investigate whether the investment-uncertainty relationship depends on

the size of the firm. They find that uncertainty has a positive effect on investment of small firms, whereas it is negative for large firms. This finding supports the view that both small and large Dutch firms do not seem to be financially constrained and that sunk costs are much higher for large than for small Dutch firms.

In an attempt to find whether uncertainty increases or decreases the accumulation of capital, Henley *et al* (2002) observe that the relationship depends on whether uncertainty in question is industry-wide or firm specific. They show that the impacts of firm-specific and industry-wide uncertainty on investment will be different. They confirm also that the effect of industry-specific uncertainty is stronger in concentrated industries.

Cassimon *et al* (2002) examine the effects of uncertainty on investment behaviour using firm-level data for a sample of Belgian manufacturing firms. The general results indicate that uncertainty matters but the sign of the effect and its magnitude depend largely on the measures employed and their definitions. It is also shown that uncertainty has an impact on the decision to invest and to a much lesser extent on the amount of investment. They indicate that the difference between reversible and irreversible is crucial. Indeed, they show that the impact of volatility on irreversible investment is far larger than on reversible investment. They also confirm that the amount of reversible investment will increase with higher volatility.

2.3 Evidence of Investment Determinants in Developing Countries:

The investment literature on developing countries examines the role of investment in

the growth process. For instance, Barro (1996) and Collier and Gunning (1999) examine a near-global sample of countries while Ghura and Hadjimichael (1996) examine only African countries. A large number of combined cross-sectional time series econometric models find a positive and significant relationship between the rate of growth of real GDP and the ratio of investment to output. This supports the view in developed countries that investment is an engine of growth. The implication derived from this finding is that investment recovery is highly necessary for accelerated growth in developing countries of the world. This, therefore, calls for proper investigation of investment determinants. Investigation, however, reveals that investment-GDP ratio in most developing countries is low.

Many economic analysts such as Krugman (1988), Sachs (1989), Borensztein (1989) and Dooley (1990) are of the view that poor investment and growth of less developed countries, since the onset of the global debt crisis in 1982 can be attributed in part to the dis-incentive effect of their external debt burden. This debt overhang hypothesis posits that accumulated external private debts of these countries retard future output and thus discourage private investment. Specifically, these authors found that debt overhang had an adverse effect on private investment.

Complementing a time series analysis with cross-sectional one, Asante (2000) examines the determinants of private investment behaviour in Ghana. The results of the study indicate that the growth of real credit to the private sector has positive and significant effect on private investment. The study shows that private investment and public investment are complementary to each other. The econometric results suggest that the military

takeovers may have created a climate hostile to private investment in Ghana. Also, the time series analysis indicates that the restrictive trade regime of the past has had a detrimental effect on private investment while the survey results support trade liberalization with moderation. Lagged private investment-GDP ratio is also found to be positive and highly significant. The beta coefficients reveal that most important variables, in terms of the magnitude of their influence on private investment, are the trade regime, growth of real credit to private sector, macroeconomic and political instability. However, the individual components of macroeconomic instability are found to be insignificant. The survey analysis shows that official attitude towards private investors and lack of credibility in government policies hinders private investment.

There are not many empirical investigation of investment behaviour under uncertainty in developing countries. This is connected with the nature of risk and uncertainty measurements, which are usually complicated in such economies. Indeed, most existing studies of investment behaviour in LDCS are often at micro-level surveys of entrepreneurs and their attitude to risk and investment decision-making. Some few other investigations are just cross-country studies, which examine how measures of instability affect gross investment. Most of these instability measures are, however, ambiguously defined.

For instance, using pooled data from seven annual observations of 60 Less Developed Countries, Stewart and Venieris (1985) argue that instability would affect the productive capacity of a country through its effect on the country's aggregate saving. It was

expected that an increased socio-political instability would decrease saving through its effect on the risk and expected return on saving and expected future income. The result of the study indeed indicates a highly significant negative relationship between savings and measures of socio-political instability. They conclude that even modest level of instability, compounded over time, could result in falling far short of meeting otherwise attainable development plans. The direction of total effect of income on saving was however regarded as ambiguous which has to be determined empirically.

In more recent studies by Barro and Lee (1994) and Kumar and Mlambo (1995), they provide a comprehensive empirical investigation of the determinants of private investment in 40 Sub-Saharan African countries over 1970-93. The two studies identify macroeconomic instability variables, which are proxied by the inflation rate and the variability of the fiscal deficit and the terms of trade as having negative effect on the level of investment. Barro and Lee (1994) also include restrictions on political and civil liberties, as a measure of political instability and find a negative effect on investment spendings. Knack and Keefer (1995) in their study employ an indicator of property rights (for instance, government repudiation of contracts, expropriation risk and rule of law) as a measure of political instability while Easterly and Levine (1997) in their comparative analysis of growth in Africa adopt ethnic division indicator. The results of their studies indicate a consistently strong and negative impact of inflation, while the other two proxies for macroeconomic instability also carry the expected negative signs but only become statistically significant after 1980. In addition, the two political indicators also have the expected negative signs, although on the whole the

measure of civil liberties appears to exert a stronger impact on investment that the measure of political rights.

In addition to these identified indicators of macroeconomic and political instability variables, some of the recent studies including Bank (1994) and Servén (1997) included number of assassinations, coups d'etat, constitutional changes and war dummy (civil or international) as measures of socio-political instability and institutional quality. To them, unlike macroeconomic instability indicators, a higher value of political indicator represents better score[1]. In the studies of World Bank (1989) and Fry (1997), they also postulate that higher real interest rates exert a positive impact on the average productivity of physical capital, thus, discouraging investors from investing on low return projects. Most recent studies on investment, however, focused on the Africa's poor private investment performance over the last three decades. Indeed, the attention of researchers in this area is on the main roles that uncertainty and instability play on investment decisions taking several other investment factors into consideration. For instance, Ghura and Greene (1993) examine the macroeconomic performance in 33 sub-Saharan African countries over the period 1972-1987. They report that real exchange rate volatility, which is measured by the coefficient of variation, has a strong adverse impact on the (aggregate) investment/GDP ratio. They also confirm that real exchange rate misalignment variable (measured by the black market premium) has a significant negative effect on investment.

[1] For macroeconomic instability indicators, a higher value is an indication of worse situation.

Also, Hadjimichael and Ghura (1995) investigate empirically the private investment performance of thirty-two African countries over the 1986-92 period. In the model adopted in their study, they employ variabilities of inflation and the real exchange rate as measures of macroeconomic uncertainty. They confirm that each of the two uncertainty proxies has a strong adverse effect on investment. In addition to these, they employ the index of political and civil liberties as measure for the definition of property rights and their result indicates a positive but insignificant effect on investment.

Easterly and Rebelo (1993) employ standard deviations of trade and domestic taxes for 74 countries between 1970-1988 and find a negative relationship between uncertainty and private investment. Also, Aizenman and Marion (1996 and 1999) adopt standard deviations of residual of AR(1) process of nominal money growth and real exchange rates for 46 LDCs between 1970-1972. They find negative effects of volatility measures on private investment/GDP ratio. These findings are in harmony with those reported by Ghura and Greene (1993) and Hadjimichael *et al* (1995). Ramey and Ramey (1995), however, employ standard deviation of GDP growth for 92 countries for the period 1960-1985 and find that uncertainty has no significant negative effect on private investment. In a related study, Rodrick (1991) uses a model in which investment involved has sunk costs of entry and exit (i.e., investment are highly irreversible). He reports that favourable capital reform would not create positive investment if it is not fully credible. Therefore, for investors to take investment decision, the returns on capital should be high enough to cover the investors' losses that would arise should reversal take place. In addition, the study views that the

absence of credibility associated with an unstable policy administration environment could have comparable effect on savings and investment. Examining the same issues, Hassett and Metcalf (1994) examines the case of uncertain tax policy as investment deterrent. They show that an increase in the volatility of investment credit has the usual effect of raising the hurdle rate required by investors to undertake irreversible projects. The study, however, concludes that the overall impact of tax policy on investment generally depends on the specific form of tax uncertainty. The study indeed shows that tax policy reversal could delay investment, which indicates that policy stability is a necessary condition in order to rectify poor private investment situation in developing countries of the world[2].

Sharing the same viewpoint Aryeetey (1994) in his study of private investment under uncertainty attributes poor private investment in Ghana since 1992 to uncertainty arising from Ghana's Economic Recovery Program. Adopting savings as measure of private investments, the study shows that the poor growth in private investment may be attributed to the perception of uncertainty in the political and economic environment since 1982. He shows that the uncertainty is derived from the low credibility of government; as it has been unable to assure investors that earlier decisions that showed a bias against private wealth will not be repeated. He then concludes that economic incentives arising from reforms do not provide guarantees against poor credibility.

The implication of this finding is that uncertainty may also be policy-induced and

[2] For further discussion on the uncertain tax-policy impact on investment see Hubbard (1994).

that uncertainty faced by investors is the imperfect credibility of policy reforms. Indeed, favourable investment policy reforms are expected to increase expected returns but if investors have pessimistic attitude or believe that reform measures would be reversed, the reforms could increase uncertainty and retard investment. This is simply because the probability of policy reversal creates a value of waiting for investors facing irreversible investment. Hence, investors' perception about the probability of policy reversal becomes an important factor in investment function. In fact, lack of confidence in policy reforms creates low and delayed investment in which investors take time in order to get confidence that reforms will not be reversed. World Bank (1993) indeed observed that the "investment pause" often witnessed after structural adjustment programmes in Less Developed Countries is as a result of wait-and-see attitude on the part of investors as regards such policy measures. Measures of investors' perception are however subjective and indeed ambiguous.

Pattillo (1998) in her study uses panel data on Ghanaian manufacturing firms to test predictions from models of irreversible investment under uncertainty. She employs the expected variance of demand as a measure of uncertainty. In constructing the expected variance of demand, information on the entrepreneur's subjective probability distribution over future demand for the firm's products is employed. Empirical results of the study support the prediction that firms wait to invest until the marginal revenue product of capital reaches a firm-specific hurdle level. Moreover, higher uncertainty raises the hurdle level that triggers investment and also that uncertainty has significant negative effect on

investment level with a greater adverse effect for firms with more irreversible investment.

A corollary to the low private investment rates is the perception by the domestic and foreign investors of the low risk-adjusted rates of returns on capital. A collection of studies edited by Collier and Patillo (2000) provide considerable evidence for the risky business environment in Africa. They opine that large fiscal deficits often discourage private investment through increased cost of capital. Thus, fiscal deficits create distortions and permit capital at the expense of growth. Another obstacle to growth and recovery in investment in sub-Saharan Africa, as observed by these authors, are international trade restrictions. For instance, Rodrik (1998) finds that trade policies in the region has significantly discouraged growth, hence the need for trade liberalization which will enhance growth.

Taking cognisance of the above-mentioned shortcoming, Servén (1997) explains that certainty and stability as regards macroeconomic variables and political situation in the host country are important factors determining foreign direct investment (FDI). As a complement to these studies, he provides a useful empirical link between instability and investment in Africa by adopting a comparative perspective. Indeed, he is of the opinion that huge incentives may not stimulate investors to give up their option to wait and commit themselves to irreversible investment in an uncertain environment. Adopting cross-country perspective, the comparative evidence reveals that sub-Saharan Africa stands out for the volatility of the terms of trade and real exchange rates, and for her poor indicators in terms of

property rights and civil liberties. Based on a large sample of developing country data, the study has shown that these and other indicators of instability and institutional quality are negatively related to private investment. The implication of this result is that sub-Saharan Africa may have much to gain from progress in reducing economic and political instability and improving her institutions.

2.4 Evidence of Investment Determinants in Nigeria:

In Nigeria, Dike (1994) focuses on the shape and character of he expansion path of the Nigerian economy by specifying models of the determinants of GDP growth instability. The result of this study indicates that the sources of GDP growth instability are found in the instability of export growth and investment expansion. This finding, indeed, conform to findings in similar studies on growth instability in LDCs. The implication derived from this finding is that it is necessary to adopt a policy regime that pursues export expansion and stable high rates of investment expansion for growth enhancement in Nigeria. The study however suggests that the sustenance of investment expansion lies in high rate of domestic saving coupled with heavy inflows of external capital, which supports evidence from both developed, and developing countries.

Given the suggestion of inflow of external capital to complement domestic savings, Dike and Bogunjoko (1997) investigate the mechanisms through which the benefits of Multinational Corporations (MNCs) can accrue to Less Developed Countries (LDCs), and Nigeria in particular, and suggest policies that can be effected to maximize foreign direct

investment (FDI) into LDCs. They also look at the nature of MNCs and how they differ from Uni-national Corporations (UNCs) as well as the foreign exchange effects of FDI. They conclude that MNCs direct investment contributes significantly to economic development of LDCs through additions to domestic value-added or factor incomes, expanding foreign exchange capacities through export development, and production spillovers. The message derived from this conclusion is that foreign capital is highly needed to complement domestic capital for rapid economic growth in LDCs. This study, like that of Dike (1994 and 1995), however, failed to identify or investigate those factors influencing or retarding investment expansion in Nigeria.

Taking the shortcoming of the previous studies into consideration, Chete (1998) explores the determinants of foreign direct investment in Nigeria. The need to consider simultaneously the economic and political determinants of foreign investment decisions is the focus of his study. His work claims merit on the use of error-correction modelling approach and a closer attention to an investigation of the time series properties of macroeconomic variables using cointegration techniques. He observes that the acutely low level of domestic investment makes it compelling to attract significant foreign direct investment to augment aggregate investment in the short run. Using a mix of economic variables and proxies for political impulses, the results generally validate theoretical and anecdotal priors. Indeed, foreign direct investment is sensitive to the real growth and lending rates, rates of inflation and the level of public investment. He also finds that intermittent coups d'etat and the civil war have tended to scare away potential investors.

In a similar study, Ekpo (1997) examines the relationship between foreign direct investment (FDI) and some macroeconomic variables in Nigeria. The empirical results covering the period 1970-1994, suggest that high debt service and low credit ratings discourage foreign investors. Foreign private investors were also found to be sensitive to real per capita income and rates of inflation in Nigeria. He therefore suggests that government must put in place appropriate policies the will reduce the rates of inflation, debt service and increase income per capita if foreign direct investment is to be attracted into the Nigerian economy. The impact of such policies will be to improve the country's credit rating with the inherent positive multiplier effects on the Nigerian economy. Both Ekpo (1997) and Chete (1998) only examine factors influencing foreign direct investment (FDI) in Nigeria. The investment decision of private sector in the domestic economy is of paramount importance, which requires proper investigation.

In a similar study by Akinlo (2003), the impact of foreign direct investment on capital accumulation, total factor productivity and economic growth was estimated. Panel data are provided for a sample of 12 African countries in the period 1990-2001. The results show that the stock of FDI has a positive impact on economic growth. In addition, exports and the stock of private investment have significant positive effects on growth. These results suggest the need to attract more foreign investment to Africa through appropriate fiscal, monetary and institutional policies among others.

Ekpo (1996) in his study, however, examines the determinants of private investment in Nigeria with particular reference to the effects of the debt service burden. Using data

from 1960 to 1996, findings from estimates support the existence of debt overhang thesis. It is also revealed that macroeconomic instability, measured by the standard deviations of some macroeconomic variables, has adversely affected private investment in Nigeria. It is therefore advocated that to control inflation and ensure the resumption of private investment growth for the future, effective debt management strategies and credible macroeconomic policies should be adopted.

Some other economic analysts such as Chhibber and Pahwa (1994) and Iyoha (1997) are of the view that poor investment in Nigeria is attributed in part to the dis-incentive effect of the external debt burden. This debt overhang hypothesis posits that accumulated external private debts of these countries retard future output and thus discourage private investment. Specifically, these authors found that debt overhang had an adverse effect on private investment. These studies, however fail to recognize other standard factors, which might have influenced private investment decisions in LDCS.

In their effort to search for causes of poor record of private investment in Nigeria, Chete and Akpokodje (1997) empirically investigate the macroeconomic determinants of private investment using Nigeria data. The results of their study reveal that a combination of internal disequilibria and external shocks account for the slow pace of private investment resurgence. The study therefore advocates for perfect synchronization of monetary, fiscal trade and exchange rate policies of government in a mutually reinforcing manner in order to facilitate the attainment of the objectives of price stability, higher rates of investment and growth.

The output and investment-enhancing effects of currency depreciation is not entirely guaranteed in the literature. For instance, Ekpo (1993) and Ubok-Udom (1999) show the existence of evidence against devaluation and suggest discontinuity of devaluation exercise in the theory of structural adjustment. Some observed adverse effects were even pointed out ranging from low capacity utilization, high unemployment and inflation rates, low investments, low performance of the overall economy, and instability in the foreign exchange markets. The overall implication seems to be that there has been a general tendency in the Nigerian economy for currency devaluation to retard investment and output growth and currency appreciation to promote growth and investment. This, indeed, runs contrary to theoretical expectations.

Adopting a modified version of the flexible acceleration theory of investment, Folorunso and Akinlo (1999) investigate the determinants of private investment in Nigeria between 1970-1994. The result of their econometric test indicates that expected oil wealth variable has an adverse effect on private investment in Nigeria. The implication of this result is that public investment has been substituted for private investment in Nigeria. Also, changes in the interest rate in an unorganized market impacts negative effect on private investment implying that the Nigerian government should discourage private sector recourses to unorganized market for credit. In order to achieve accelerated growth, they suggest that government expenditure should be concentrated on projects that are complementary to that of private sector and not substitutes.

The major shortcoming of all the above-reviewed studies is their strong emphasis on

the effects of the conventional investment factors such as income (measured by the level of gross domestic product), costs of capital (proxied by interest rates), public investment and the level of debt outstanding. Not only this, the OLS estimation technique adopted in most of these studies may be inadequate given the time series property of the data employed. In addition, virtually all the studies reviewed above fail to examine the effects of other standard macroeconomic variables on private investment spendings. For instance, most studies exclude the effect of credit to the private sector. Moreso, the effects of uncertainty that emanates from both political and macroeconomic instabilities as well as investment irreversibility are never discussed. Indeed, all these studies fail to recognize macroeconomic uncertainty and instability, which might have hindered private investment decisions in LDCS.

Busari and Olaniyan (1998) consider the impact of some dimensions of uncertainty on investment rates in Nigeria. The results of the study indicate that in both the bivariate and multivariate frameworks, inflation uncertainty and fiscal deficit uncertainty impact negatively and significantly on private investment decision. The study also indicates a weak negative relationship between exchange rate uncertainty and private investment decision. They recommend that relevant authorities must strive to reduce macroeconomic policy uncertainty if efforts directed at improving private investment are to yield any positive result. How this should be done is not, however, discussed in their study.

The above-reviewed studies, however, indicate that the investment-uncertainty

relationship is strongly influenced by the nature of elasticity of demand, market structure, nature of costs of adjustment, returns to scale and whether investment is reversible or not (degree of reversibility). Thus, the sign of the overall effect of uncertainty on investment as observed by Servén (1998) is still ambiguous and can only be assessed empirically. This study, therefore, fills the gap by examining the effects of macroeconomic uncertainty on investment in the case of Nigeria. The issue of irreversible investment under the condition of certainty and uncertainty, as noted by many economists is not yet established in Nigeria.

The major shortcoming of the above studies is that the battery of diagnostic tests to which the preferred equations were subjected produced some conflicting and indeed contradictory results. This may be a result of the econometric approach adopted by the authors. Another major shortcoming of this study lies in the empirical measures of uncertainty, especially macroeconomic, political and social instability. For instance, some authors use measures such as the coefficient of variation, standard deviation, variance, etc of a given data set as uncertainty measure. It is, however, observed that the nature of data set is important in the construction of uncertainty measure. While some measures are adequate for cross-section data others are suitable for time series data. While some are relevant for firm-level data some others are better for aggregate data. These issues are properly addressed in this study.

Researchers are, therefore, sceptical about the generalization of most of these results mainly because of the growing problem associated with cross-country studies. For instance, can these findings be true for aggregate private investment behaviour in Nigeria? If true,

then these findings have important implication for Nigeria in its drive to achieve accelerated growth through private sector. Indeed, Mlambo (1997) calls for country-specific studies in order to overcome the problem. In addition, there is need to search for additional or deeper determinants of investment in Nigeria. In fact, specification of private investment at the macroeconomic level in Nigerian is currently of paramount importance. This study also fills the gap in this area.

2.5 Conclusion:

The review of literature clearly indicates that the effect of uncertainty on investment is still ambiguous. The effect can be positive or negative irrespective of investment proxy used. Also, the studies reviewed above have only been concerned with the investment decision from the only microeconomic point of view. With the exception of few studies, the effect of uncertainty on private investment from aggregate point of view is not yet fully established. In addition, the measure of irreversibility has posed difficult. The study fills this gap.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.1 Introduction:

This chapter discusses theoretical foundations upon which the study is based. Section 3.2 concentrates on the conventional theory of investment while section 3.3 focuses on the option value approach of investment and examines how it is applicable to the current study. In this regard, the chapter brings into focus the issue of how irreversibility and uncertainty affect the decision to invest by the private sector.

3.2 Conventional Investment Theory:

Generally, the flexible accelerator theory of investment and its modified versions remained perhaps the most widely adopted theories of investment among economic researchers (see Henry and Von Ungern-Sternberg, 1981; Nickell, 1978 and 1985 and Henry and Minford, 1988). The accelerator theory posits that the decision to invest rests on the assumption that discrepancy exists between the actual capital stock and desired capital stock. Thus, investment is explained largely on input-output relationships. Relating the desired stock of capital from private sector (KP^*) to the level of output (Y), we then have:

$$KP_t^* = \alpha Y_t \quad \text{.....(3.1)}$$

where α, defined as the accelerator coefficient or capital-output ratio, is a constant whose value lies between 0 and 1 (i.e., $0 \leq \alpha \leq 1$).

Taking the preceding period (t-1) and relating the actual capital stock (KP) to the level of output (Y), we have:

$$KP_{t-1} = \alpha Y_{t-1} \quad \text{.....(3.2)}$$

Removing equation (3.2) from (3.1) gives us private investment (PI) relation in equation (3.3) as follows:

$$PI_t = KP_t^* - KP_{t-1} = \alpha(Y_t - Y_{t-1}) = \alpha \Delta Y_t \quad \text{.....(3.3)}$$

Equation (3.3) indicates that changes in private capital stock (i.e., gross private sector investment, (PI), is a linear function of output changes (Δ Y) and α is capital-output ratio.

The neoclassical theorists, however, argue that a simple bivariate investment specification of equation (3.3) excludes substitution possibilities among factor inputs. Hence, neoclassical economists modify the accelerator model by suggesting that factor prices (i.e., the user cost of capital) should be included as a determinant of investment decision. Since the early 1960s, the neoclassical analytical research into the conventional investment function has followed two main approaches. At one level is the traditional capital theory of Jorgenson (1963) in which the optimal investment rule is for private investor to equate the marginal revenue product with the Jorgenson's user cost of capital[3]. The neoclassical model of investment behaviour from Jorgenson (1963) suggests that desired private capital stock is determined by output and the user cost of capital which is expressed as:

[3] See Nickel (1978) on the discussion of Jorgenson's approach

$$KP_t^* = \frac{\alpha Y_t}{C_t^{\delta}} \quad \text{.....(3.4)}$$

where KP^* and Y are as earlier defined, α is a constant, C is the user cost of capital and δ is the elasticity of substitution. Substituting private sector investment for private capital stock, we obtain the following long run relationship of the form:

$$\log PI_t = Q_0 + Q_1 \log Y_t + Q_2 \log C_t \quad \text{.....(3.5)}$$

Another approach to the determination of aggregate investment behaviour is the one presented by Tobin (1969), which focuses on capitalized value of the marginal unit of capital relative to its replacement cost[4]. The model explains that investment should be increasing in the ratio of the equity value of the firm (investor) to the replacement cost of the capital stock (i.e., ratio of the future marginal returns on investment to the current marginal cost of investment). This ratio is known as "Q-ratio" or "average Q". Consequently, the investment function can be expressed as follows:

$$\log PI = \beta \log Q \quad \text{.....(3.6)}$$

where β is strictly positive parameter. Hence, investment should be undertaken and capital stock increased if Q is greater than 1 and vice versa for values of Q less than 1. Hayashi (1982) and Abel (1983) have shown that if there are adjustment costs, then investment is dependent on the level of marginal Q. Marginal Q is however unobservable but Hayashi (1982) has shown that marginal Q and average Q are equal when the production function

[4] See Abel (1990) on extensive discussion of Tobin-q approach

and adjustment costs functions follow certain homogeneity conditions.

As evident in equations (3.5) and (3.6), the long run private investment models are based on simple accelerator model which are consistent with profit maximization subject to constant return to scale and constant elasticity of substitution production function. In these two equivalent approaches, costs of adjustment, which are typically assumed to be convex, are expected to transform the static problem to the dynamic setting involving expectation about the future (Dixit and Pindyck, 1994). Short run dynamics may be added to form models in error correction format (see Byrne and Davis, 2003).

However, the basic premise upon which the conventional investment theory is based is that investment decision is costlessly reversible (i.e., investment decision can be reversed without incurring any cost). It then follows that disinvestment can occur any time an investor is facing a worse situation. Following this assumption, investment spending is undertaken when the Net Present Value (NPV) of a project is positive, and if otherwise, no investment will take place. The implication of this rule is that an investor will either invest or not as there is no room for postponement of investment spending. For instance, consider an investment project whose purchase price is p_k and whose future return is uncertain due, perhaps, to uncertainty about the price of the project's output, market demand or policy reforms of the government. An investor will undertake investment project if the resultant marginal addition to the capital stock has a positive net present value. Let assume again that if investment takes place now, the project will yield R_0 at the end of this year and then an uncertain return R in each succeeding year. From this information, the expected

value of the future return is $E_0(R)$ hence, the net present value of the anticipated stream of cash flows is:

$$NPV_0 \equiv -p_k + \frac{1}{1+r} R_0 + \left[\frac{1}{1+r}\right]^2 \sum_0^{\infty} (1+r)^{-i} E_0[R] \quad \text{.....(3.7}a\text{)}$$

$$NPV_0 \equiv -p_k + \frac{1}{1+r}\left[R_0 + \left(\frac{1}{r}\right) E_0[R]\right] \quad \text{.....(3.7}b\text{)}$$

where "r" is the discount rate or the real rate of return on alternative asset. Given the relation in equation (3.7b), the net present value (NPV) rule recommends that investors will undertake the project if NPV > 0 which is expressed as:

$$(R_0 - rp_k) + \left(\frac{E_0[R] - rp_k}{r}\right) > 0 \quad \text{.....(3.8)}$$

where $\mathbf{rp_k}$ is the Jorgenson's user cost of capital[5].

Given the implicit assumption that investment decisions are fully reversible, then the future does not matter and the optimal investment decision is to invest now if the current return exceeds the user cost of capital (i.e., $R_0 > rp_k$). This is simply because investment decision can be reversed if events turn out adversely. So, the underlying principle is the basic net present value rule in which investment spending is undertaken if NPV is positive and if the investment spending is irreversible, it is assumed that it is a now or never decision.

[5] Recall that $E_0(R) \equiv \Pr[R > rp_K] E_0[R | R > p_K] + \Pr[R \leq rp_K] E_0[R | R \leq p_K]$

This implies that if investors do not undertake investment now, they will not be able to do it in the future.

Although some investment decisions follow these patterns, most of them do not. This is due to the fact that irreversibility and the possibility of postponement are very crucial features of most investment decisions in reality (Dixit and Pindyck, 1994). The recent and rapid growing literature has indicated that ability to delay irreversible investment expenditure can strongly affect the decision to invest. Therefore, the issues raised undermine the simple net present value rule and indeed the theoretical foundation of standard neoclassical investment models.

3.2 Option Approach and Irreversible Investment Theory:

The empirical failure of the conventional theory of investment and lack of realism of the assumptions upon which it rests have led to the emergence of a new approach of investment. Recently, Dixit and Pindyck (1994) have shown that the traditional investment theory overlooked certain basic features. For instance, it has now been discovered that most fixed capital investments are partly or completely irreversible implying that such investment cannot be fully recovered by selling the capital once it has been put in place. Yet in other words, the initial cost of investment is completely or partly sunk. In addition to this issue is that investment decisions are based on uncertainty about future rewards, which can only be determined using probability values of the possible outcomes. Not only this, it has been shown in the literature that investors can delay investment by postponing it in order to

acquire more information about the future. When an investor makes irreversible investment expenditure therefore, its implication is that such investor according to Dixit and Pindyck (1994) "kills" the option to invest. In other words, such investor gives up the possibility of waiting for new information that might affect the desirability or timing of the expenditure. Yet in other words, such investor cannot disinvest should market conditions change adversely and the "option" value is lost. This lost of option is a real cost which needs to be included as part of the cost of investment. Hence, Net Present Value (NPV) principle which states that investment should be made when the value of a unit of capital exceeds its purchase and installation cost should be modified in such a way that the excess of value of a unit of capital over cost must not at least be less than an option value to be lost (or equal to value of keeping the investment option alive). Given equation (3.8) above, investors will be committing to unprofitable venture if there is a chance that $R < rp_k$ (i.e., if the probability of future return falls below the user cost of capital)[6]. In order to avoid this costly mistake, investors will have to wait in order to acquire more information as regards future output prices, market demand, government policy and a host of other factors. For irreversible investment therefore, the NPV rule in equation (3.8) may be misleading and needs to be modified.

Under this new approach, the optimal investment decision balances the value of waiting for new information with the cost of postponing the investment in terms of foregone

[6] Alternatively, given $R > rp_k$, the project may still be unprofitable if net return is less than the option value lost.

returns. The intuition behind this view is that when private investors make irreversible investment expenditure, the option of waiting for new information that might influence the desirability of the investment is removed. Indeed, the recent literature has indicated that the option value of waiting can be considerable in a highly uncertain environment, and for this reason, uncertainty can become a powerful deterrent even for risk-neutral or risk-prone investors.

Given this scenario, let us assume (as an extreme case) that uncertainty will be completely removed next period, so that constant future return will be recorded. An investor will wait and undertake the project next period only if the return turns out to exceed the user cost of capital, but not otherwise. The anticipated stream of cash flows or the net present value of taking such investment next year then becomes:

$$NPV_1 \equiv \Pr[R > rp_k]\left(\frac{1}{1+r} - p_k + \left[\frac{1}{1+r}\right]^2 \sum_{0}^{\infty}(1+r)^{-i} E_0[R \mid R > rp_k]\right) \quad \text{.....(3.9)}$$

The entire equation (3.9) is multiplied by the probability (Pr) that the project's return will turn out to exceed the user cost of capital. It should, therefore, be noted from equation (3.9) that investor would make investment next year given that the probability of project's return will exceed the user cost of capital. Comparing the net present value (NPV) of the two strategies, equation (3.7b) is taken from equation (3.9) which then yield equation (3.10) as below:

$$NPV_1 - NPV_0 = \left(\frac{1}{1+r}\right)\left[\Pr[R < rp_k]\frac{E_0(rp_k - R \mid R < rp_k)}{r} - (R_0 - rp_k)\right] \quad \text{.....(3.10)}$$

It, therefore, pays to invest immediately if equation (3.10) is negative (or delay it till next period if positive) which is equivalent to the requirement in equation (3.11) as:

$$(R_0 - rp_k) > \Pr[R < rp_k] \frac{E_0[rp_k - R \mid R < rp_k]}{r} \quad \text{.....(3.11)}$$

This condition simply compares the cost of waiting {i.e., the current period net return (R_0 - rp_k) foregone by not investing} with the value of waiting which is given by the irreversible mistake that would be revealed tomorrow should future project returns fall short of the user cost of capital (i.e., $R < rp_k$). The expected present value of such a mistake is measured by the right-hand of equation (3.11) in which the mistake is made with probability $\Pr[R < rp_k]$; its expected per-period size, given today's information is $E_0[rp_k - R \mid R < rp_k]$ and since it accrues every period into the indefinite future, it has to be multiplied by (1/r) to transform it to present value term. It pays to invest immediately only if the first-period return exceeds the conventional user cost of capital by a margin large enough to compensate for the possible irreversible mistakes (i.e., if the cost of waiting outweighs the value of waiting).

Recent studies have demonstrated that the presence of irreversibility may lead to postponement of investment decisions. The irreversible theory of investment, however, suggests a greater role for uncertainty as a determinant of investment than do traditional models. In fact, empirical evidence has shown that uncertainty affects investment by affecting a critical threshold that triggers investment. With increasing uncertainty, the value of the "call option" to delay an investment project increases and the decision to invest is

delayed[7]. This is shown in Figure 1.

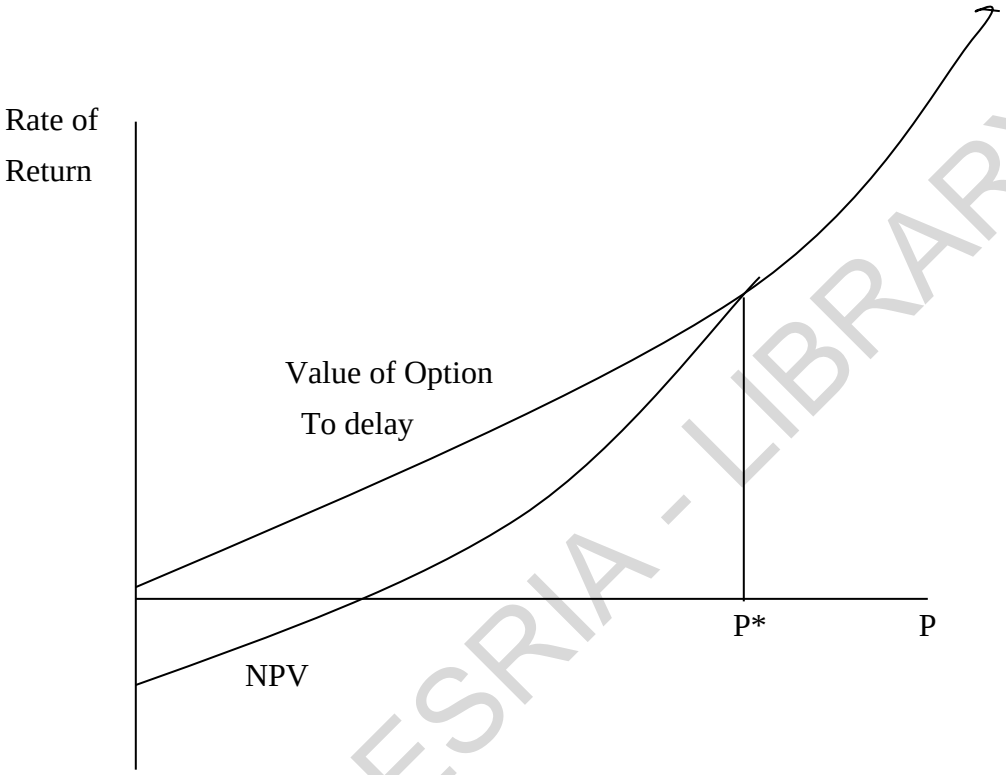

Fig 1: Option Values and Investment Decisions Under Uncertainty

The first curve indicates the conventional net present value of an investment to produce goods for sale at P. The second, option value curve, includes the value of the option to delay the project. At any level below P^*, the option to delay is more valuable than the conventional net present value, and the two curves only become equal at or above a critical

[7] An extensive survey of the literature on investment-uncertainty relationship is provided in the study of Carruth *et al* (2000).

price level, P^*. It is obvious that lower levels of actual investment than predicted by conventional theory are undertaken at prices below P^*. Dixit and Pindyck (1994) show that increased uncertainty raises the option value curve and therefore shifts outward the threshold price, P^*. Carruth, Dickerson and Henley (1998) show that negative relationship exists between uncertainty and irreversible investment.

The model of partial irreversibility as suggested by Abel and Eberly (1996), which is a generalization of complete irreversibility in Bertola (1988) and Dixit and Pindyck (1994), is employed. The private sector revenue function, R(KP,P), in terms of capital stock (KP) and demand condition (P) is modelled as having the following form:

$$\mathbf{R(KP,P) = (1/a)P^{1-a}KP^{a}} \quad \textbf{.....(3.12)}$$

where **"a"** is the share of capital stock from private sector. Equation (3.12) can be shown to nest a Cobb-Douglas production function and an iso-elastic demand curve. It is assumed that the private sector demand condition follows a Brownian motion process with drift, μ and variance, σ^2. The private sector is assumed to maximize the expected present value of sales revenue minus cost of buying capital at a price C, plus the proceeds received from selling capital at a price S, where C>S. The optimal investment strategy that maximizes total discounted profits is then expressed as:

$$V(KP,P) = \max_{\{PI(s)\}} E_t \left\{ \int_t^{\infty} e^{-r(s-t)} [(1/a)P^{1-a}(s)KP(s)ds - CdPI^{+}(s) - SdPI^{-}(s)] \right\}$$

$$\textit{Subject to } dKP(t) = \delta KP dt + PI(t) \quad \textbf{.....(3.13)}$$

where r is the discount rate, PI^+ denotes positive private investment and PI^- indicates negative private investment and δ is the rate of capital depreciation.

Abel and Eberly (1996) show that the profit maximization investment behaviour is explained in terms of current marginal revenue product of capital $P^{1-a}KP^{a-1}$ and investment and disinvestment thresholds which are represented by the investment and disinvestment user costs of capital, C_{PI} and C_{PD} respectively and two real option terms $\phi_{PI} > 1$ and $\phi_{PD} > 1$. This is illustrated in the Table 4.

Table 4: The Threshold Behaviour of Investment with Real Options

Action	Condition
Invest now if	$P^{1-a}KP^{a-1} = C_{PI}\phi_{PI}$
Do Nothing if	$C_{PD}/\phi_{PD} < P^{1-a}KP^{a-1} < C_{PI}\phi_{PI}$
Dis-Invest if	$P^{1-a}KP^{a-1} = C_{PD}/\phi_{PD}$

These thresholds provide bounds for the capital stock under partial irreversibility. Using lower case to denote logged variables, these bounds can be stated as follows:

$$\boldsymbol{P - \frac{C_{PI} + \phi_{PI}}{1-a} \leq KP \leq p - \frac{C_{PD} + \phi_{PD}}{1-a}} \quad \textbf{.....(3.14)}$$

Evidence in the recent literature of irreversible theory of investment indicates that there is little concern for modelling the determinants of the steady-state level of investment. The theory is however concerned mainly with the assumption that the timing of investment

may be altered by uncertainty about future conditions. Early adjustment costs and Tobin-q models of investment suggest that an investor will be sensitive to uncertainty about future conditions. For instance, Hartman (1972) and Abel (1983) show that uncertainty over future input and output prices can increase the value of a marginal unit of capital and the level of investment. Indeed, when investment is irreversible so that the capital cannot be resold for its full purchase price, the optimal investment rule takes on a **threshold** form. Investment will then take place when demand rises to some upper threshold while disinvestment will occur only when demand falls to some lower threshold. The existing literature indicates that uncertainty raises the upper threshold for investment and thereby reduces the long run rate of investment

Assuming we turn off the real options effect and model investor as if it has a now or never investment choice, investor will only invest when marginal revenue product of capital is equal to its Jorgenson user cost of capital, C_{PI} and only disinvest when its marginal revenue product of capital is equal to its disinvestment user cost of capital, C_{PD}. In the absence of real options, the investment rule and capital stock, KP_o, would satisfy the threshold optimality conditions presented in Table 5.

Table 5: The Threshold Behaviour of Investment without Real Options

Action	Condition
Invest if	$P^{1-a}KP_{NO}^{a-1} = C_{PI}$
Do Nothing if	$C_{PD} < P^{1-a}KP_{NO}^{a-1} < C_{PI}$

Dis-Invest if	$P^{1-a}KP_{NO}^{a-1} = C_{PD}$

These thresholds provide bounds for the capital stock with no real option under partial irreversibility, which can be expressed as:

$$P - \frac{C_{PI}}{1-a} \leq KP_{NO} \leq P - \frac{C_{PD}}{1-a} \quad \text{.....(3.15)}$$

The basic model developed by McDonald and Siegel (1986) therefore determines the optimal point to pay a sunk cost I in return for a project whose value is V {as indicated in equation (3.13)} given that V evolves according to the following geometric Brownian motion:

$$dV = \alpha V dt + \sigma V dz \quad \text{.....(3.16)}$$

where α is the drift parameter; σ is the variance or uncertainty parameter and dz is the increment of a Wiener process. Equation (3.16), which is clearly an abstraction from most real project, indicates that the current value of the project is unknown, but future values are log-normally distributed with variance that grows linearly with time horizon. Thus, although information arrives over time (investors observe V changing), the future value of the project is always uncertain.

Denoting the value of investment opportunity that is, the value of the option to invest, by F(V), we then adopt a rule that maximizes this value since the pay-off from investing at time t is V_t - I, we maximize its expected present value:

$$F(V) = \text{Max } E[(V_T - I)e^{-rT}] \quad \text{.....(3.17)}$$

where E denotes the expectation, T is the unknown future time that the investment is made, r is the discount rate and the maximization is subject to equation (3.16) for V. It is assumed that $\alpha < r$, otherwise the integral in equation (3.16) could be made indefinitely larger by choosing larger T. Thus waiting longer would always be a better policy and the optimum would not exist.

Denoting the difference $(r - \alpha)$ as δ implying that $\delta > 0$ and assuming that there is no uncertainty, that is σ in equation (3.16) is zero, there can still be a value to waiting. Then the expected value of V(t) is:

$$V(t) = E[V(t)] = V_0 e^{\alpha t} \quad \text{.....(3.18)}$$

where $V_0 = V(0)$. Thus given the current V, the value of investment opportunity assuming an arbitrary future time T is:

$$F(V) = (Ve^{\alpha t} - I)e^{-rT} \quad \text{.....(3.19)}$$

Assuming $\alpha \leq 0$, then V(t) in equation (3.18) will remain constant or fall over time and so it is clearly optimal to invest immediately if V > I, and never invest if otherwise. Hence F(V) = Max [V - I, 0]. In case $0 < \alpha < r$ then F(V) > 0 even if V < I, simply because eventually V will exceed I. Also, even if V now exceeds I, it may be better to wait rather than invest now. This is demonstrated by maximizing F(V) in equation (3.19) with respect to T. Dixit and Pindyck (1994) show that the first-order condition for maximizing F(V) is:

$$dF(V)/dT = -(r - \alpha)Ve^{-r(r-\alpha)T} + rIe^{-rT} = 0 \quad \text{.....(3.20)}$$

which then implies that:

$$T^* = \max\{(1/\alpha)\log[rI/(r-\alpha)V], 0\} \quad \text{.....(3.21)}$$

If V is not too much larger than I, then $T^* > 0$. The reason for delaying the investment in this case is that in present value terms, the cost of the investment decreases by a factor of e^{-rT} whereas the pay-off is reduced by the smaller factor $e^{-(r-\alpha)T}$. For what values of V is it optimal to invest immediately? By setting $T^* = 0$, we see that one should invest immediately if $V \geq V^*$ where:

$$V^* = \frac{r}{r-\alpha} I > I \quad \text{.....(3.22)}$$

Substituting equation (3.21) into (3.19) we obtain the following solution for F(V):

$$F(V) = \begin{cases} \left(\frac{\alpha I}{(r-\alpha)I}\right)\left(\frac{(r-\alpha)V}{rI}\right)^{r/\alpha} & \text{for } V \leq V^* \\ V - I & \text{for } V > V^* \end{cases} \quad \text{.....(3.23)}$$

Assuming the general case in which $\sigma > 0$, the problem is to determine the point at which it is optimal to invest in return for an asset worth V. Since V evolves stochastically, it will not be possible to determine a time T, instead, the investment rule will take the form of a critical value V^* such that it is optimal to invest once $V \geq V^*$. The higher the value of σ the higher the V^* and that means a greater value to waiting. It should also be noted in general that both the growth ($\alpha > 0$) and uncertainty ($\sigma > 0$) could create a value to waiting and

hereby affect investment timing.

Bernanke (1983) and Mcdonald and Siegel (1986) show that the presence of irreversibility may lead to postponement of investment decisions. With increasing variance in the distribution of the future rate of return from investment project (which is a proxy for uncertainty), the value of the "call option" to delay an investment project increases and the decision to invest is delayed or postponed. If investment project is irreversible, then the threshold return required to undertake an investment project is directly proportional to σ. Pindyck (1991) explains that the net present value (net of sunk cost I) of an investment may be positive but the irreversible nature of investment leads to the possibility of delaying the project rather than undertaking it now as indicated by the standard neoclassical theory of investment. Hence, investment in the short run may be reduced as uncertainty increases. However, the effect of uncertainty on the long run investment level is ambiguous and needs to be verified empirically.

3.4 Conclusion:

The study employs "real option" model of investment decision. The basic consequence of viewing the investment decision as exercising an investment option is straightforward and can be illustrated most simply by referring to the conventional NPV-rule. The direct pay-off from investing is given by **V-I**, where **V** is the present value of investment project and **I** is the investment cost (the classical NPV-criterion). When the pay-off is positive, it is worthwhile to invest. However, once the investment is made, the option

is gone and so the value of the option today (F_o) must be considered as an opportunity cost of investing, and hence must be added to the investment cost (I). This opportunity cost is however treated separately in order to separate its effect from the cost of capital.

CHAPTER FOUR:

RESEARCH METHODOLOGY

4.1 Introduction:

The chapter presents the methodology used to address the objectives of this study. The private investment trend analysis is carried out with the use of descriptive analytical methods. Specifically, growth rates of private investment as well as proportions of private investment in total investment and GDP are analyzed. Both the Nigeria's nominal and real private investment series are employed in the descriptive analysis presented in Chapter 5. Section 4.2 presents the aggregate private investment model specification while section 4.3 discusses the time series properties of the variables in the specified model. While section 4.4 explains Error Correction Mechanism techniques, section 4.5 considers sources of data.

4.2 Aggregate Private Investment Model Specification:

In achieving the targeted objectives, the study employs the basic idea of optimization problem only at the macroeconomic level. Following Caballero (1991), it is assumed that the private sector uses capital and other inputs to produce non-storable output. At each point in time, the private sector chooses its input to maximize its value (total revenue minus total cost). Let $R(KP_t, X_t, Z_t)$ represents the maximized value of the private sector's instantaneous operating revenue at time t where KP is the capital stock of the private sector, X is a random variable representing the demand facing the private sector, Z represents the

vector of auxiliary variables that influence private sector investment. Let assume further that the first-order and second-order partial derivatives are $R_{KP}(KP_t, X_t, Z_t) > 0$ and $R_{KPKP}(KP_t, X_t, Z_t) < 0$ respectively and the X_t evolves exogenously according to the geometric Brownian motion as:

$$dX_t = \alpha X_t dt + \sigma X_t dz \quad \text{or} \quad dX_t / X_t = \alpha dt + \sigma dz \text{.....(4.1)}$$

where α is the instantaneous drift parameter; σ is the standard deviation or uncertainty parameter and dz is the increment of a standard Wiener process with the mean, E[dz]=0 and the variance, $E[dz^2]=dt$.

The total operating cost is $C(KP_t, PI_t, X_t)$. The private sector is faced with problem of choosing capital stock over the infinite time horizon to maximize the expected present value of its operating net return. The value of private investor is thus:

$$V(KP_t, X_t, Z_t) = Max_{PI_{t+1}} \int_t^{\infty} e^{-rt} \{R(KP_t, X_t, Z_t) - C(KP_t, PI_t, X_t\} \text{.....(4.2)}$$

where r is the discount rate and the evolution of $V(KP_t,X_t,Z_t)$ is subject to the evolution of X as described in equation (4.1) above. Dropping the time subscript, the above maximization problem could be solved using the Bellman equation, which yields:

$$\mathbf{rV(KP,X,Z) = Max_{(PI)}\ [R(KP,X,Z) - C(KP,PI,X) + E(dV)(1/dt)] \text{ ..... (4.3)}}$$

The left-hand side of equation (4.3) is the required return of private sector and the right-hand side is the maximized expected return which comprises of two components; operating net profit and the expected "capital gain" represented by the change in the value of the private

investor E(dV)(1/dt). Deriving the first order conditions of equation (4.3) and solving for PI_t gives the general form of the private investment function (PI^*) as:

$$PI_t = PI^*(KP_t, X_t, Z_t) \quad \text{.....(4.4)}$$

Following Carruth *et al* (1998), the study assumes constant elasticity of substitution, constant returns to scale technology and that the demand for private capital is subject to a mean zero disturbance, (γ). The private sector demand for capital will then be expressed as follows

$$KP_t = AY_t\left[\frac{(1+1/\varepsilon)}{C_t}\right]^{\delta} E(\gamma) \quad \text{.....(4.5)}$$

where KP = capital stock of private sector, A = the scale parameter, Y = output, C = the user cost of capital, ε = output price elasticity of demand, δ = the elasticity of substitution, γ = the size of the wedge between the user cost of an extra unit of capital and its present value that arises from the option value of refraining from investing as presented in Figure 1 (i.e., irreversibility proxy), and t = period of time.

The identity describing the dynamic evolution of private capital stock indicates that private capital is acquired by undertaking gross private investment at rate PI but depreciates at a fixed proportion rate of δ. This implies that private capital evolves according to the following:

$$dKP_t = PI_t - \delta KP_t \quad \text{or} \quad PI_t = \delta KP_t + dKP_t \quad \text{.....(4.6)}$$

where PI = gross private investment, d = symbol for change, and δ = is the depreciation rate. Assuming the existence of a steady state in which private capital stock and output are

growing at a constant rate g, and then equation (4.6) becomes:

$$PI_t = (g + \delta)KP_t \quad \text{.....(4.7)}$$

Substituting equation (4.5) into (4.7) eliminates the private capital stock term, which then yields:

$$PI_t = A(g + \delta)Y_t[(1 + 1/\varepsilon)/C_t]^{\delta} E(\gamma) \quad \text{.....(4.8)}$$

Assuming that the elasticity of demand, ε, is constant then the discrete time analogue of equation (4.8) becomes:

$$PI_t = a_0 + a_1 Y_t + a_2 C_t + a_3 \gamma_t + u_t \quad \text{.....(4.9)}$$

By incorporating other auxiliary variables that influence investment in developing countries (Z), the demand facing private sector (X) and relaxing the assumptions of constant elasticity of demand and constant elasticity of substitution, the private investment demand becomes:

$$PI_t = a_0 + a_1 Y_t + a_2 C_t + a_3 \gamma_t + a_4 X_t + a_5 Z_t + u_t \quad \text{.....(4.10)}$$

where variables are as earlier defined.

Notable among the private investment determinants in equation (4.10) is the cost of capital as provided by Jorgenson (1963), which several other studies have found its coefficient to be significant (Fry, 1980; Greene and Villanueva, 1991 and Servén, 1998). Indeed, an investor that cannot reverse his/her investment decision faces a higher user cost of capital than the one with perfectly reversible investment. This implies higher investment for investors with reversible investment and lower investment for investors with irreversible investment. More uncertainty in the returns to capital increases the user cost for an investor

with irreversible investment, without affecting the user cost for investor with reversible investment (Pattillo, 1998).

Among the auxiliary determinants of private sector investment in equation (4.10) is the public investment, which has been recognized to be potentially important in private investment equation (Blejer and Khan, 1984; Oshikoya, 1994). On one hand, public investment may facilitate private investment if public and private investments are complementary. Generally, studies have found conflicting roles of public investment on private investment decision. While some studies identify a strong negative relationship between public investment and private investment, some others suggest that public investment crowds out private investment.

In addition to the effects of aggregate demand, cost of capital and public investment which apply to both the Developed countries and LDCs alike, the conventional investment models for LDCs typically include policy variables as they are seen as having significant effect on private investment (Aryeetey, 1994). Private sector in developing countries faces severe credit constraints. Considering the share of credit to the private sector as policy variable, King and Levine (1993) as well as Servén (1998) show that investment and the credit availability are positively correlated. Some other studies have used money growth as proxy for credit availability and found to have exerted positively insignificant effect on private investment.

Also, it has been established that the future recovery of private investment and growth in LDCs lies in the reduction of debt stock. Indeed, Chhibber and Pahwa (1994)

show that 50 per cent debt stock reduction will provide the necessary recovery in private investment in Nigeria. Many other economic analysts such as Wanner (1992) and Iyoha (1997) are of the view that poor investment and growth of less developed countries, including Nigeria, since the onset of the global debt crisis in 1982 can be attributed in part to the disincentive effect of their external debt burden. This debt overhang hypothesis posits that accumulated external private debts of these countries retard future output and thus discourage private investment. Specifically, these authors found that debt overhang had an adverse effect on private investment.

Uncertainty has been described as a major obstacle to private investment decisions. Indeed, a new theory linking uncertainty and investment has been developed (see Abel and Eberly, 1994, Hahm, 1996, Mason and Weeds, 2003). It is widely acknowledged that developing countries suffer a high degree of macroeconomic, social and political uncertainties. In fact macroeconomic variables such as exchange rate, interest rates and inflation rate are highly volatile. The empirical evidence also indicates that no matter how uncertainty is defined, it is a strong obstacle in private investment decisions.

Given that the demand facing the private sector is as expressed in equation (4.1) and incorporating these factors highlighted above into equation (4.10), we have a flexible accelerator investment model expressed as:

$$PI_t = a_0 + a_1 Y_t + a_2 C_t + a_3 \gamma_t + a_4 U_t + a_5 GI_t + a_6 CP_t + a_7 DB_t + u_t \quad \text{.....(4.11)}$$

where the operational measurements of variables are defined below:

PI = Naira value of aggregate Private Investment measured in log and growth rates.

Y = Aggregate demand measured by Gross Domestic Product (GDP)

C = The user cost of capital measured by real domestic interest rate which is calculated as log[(1+nominal r)/(1+inflation rate)

GI = Naira value Public Investment measured in log and growth rates.

CP = Policy variable measured by using aggregate credit to the private

DB = Debt burden (or debt service)

γ = Irreversibility proxy measured by the size of the wedge between the user cost of an extra unit of capital and its present value that arises from the option value of refraining from investing. We employ the difference between the current real interest rate (r) and the discounted value of the long-term yield (R) {i.e., NPV of yield - r}. The long-term yield is the maximum yield rate on long term loan.

U = Uncertainty measure which is derived by using Auto Regressive Conditional Hetero-scedastic (ARCH) model introduced by Engle (1983), which explicitly recognizes the difference between the conditional and the unconditional variance, is employed. In this case, the conditional variance consists of random variables in the conditioning set, such as past variances while unconditional variance being equal to the conditional variance plus error term. Specifically, the p^{th} order of ARCH model of a data generating process can be formulated using the following relation below:

$$\pi_t = \pi_{t-1} + \varepsilon_t \quad \text{.....(4.12}a\text{)}$$

$$\varepsilon_t^2 = h_t + e_t \quad \text{.....(4.12}b\text{)}$$

$$h_t = E(\varepsilon_t^2 / I_{t-1}) = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + ... + \alpha_p \varepsilon_{t-p}^2 \quad \text{.....(4.12}c\text{)}$$

where the information set, I_{t-1}, includes all information available through time t-1 and it is assumed to be white noise. The unconditional variance, ε_t^2, is interpreted as variability measure and the conditional variance, h_t, is interpreted as uncertainty measure. Final Predictive Errors (FPE) statistics is employed in order to determine the p^{th} order.

4.3 Time Series Property and Cointegration Tests:

The time series properties of the data used in equation (4.11) above will first be examined in order to eliminate any cases of spurious regression (Granger and Newbold, 1974; Phillips, 1986; Engle and Granger, 1987). Granger and Newbold (1974) have shown that ordinary least squares (OLS) parameter estimates for non-stationary series in regressions do not converge to constant and that the usual t- and F-ratio statistics do not have the limiting distribution. Hence, their use in that case generates spurious inference. The assumption that a series $\mathbf{y_t}$ is non-stationary can, however, be viewed as a testable hypothesis by performing unit root tests. Both the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) as well as Phillips-Perron (PP) unit root tests will be applied to each of the time series. The Dickey-Fuller test consists of running a regression of the first difference of the series against the series lagged once of optimally a constant and a time trend which is expressed as:

$$\Delta y_t = a + bt + \alpha y_{t-1} + e_t \quad \text{.....(4.13)}$$

The inclusion of a time trend in models such as equation (4.13) is important because non-stationary time series are sometimes modelled as polynomial trends with covariance-stationary errors. West (1987) argues that the DF tests will be inconsistent if the process under scrutiny is stationary about a trend and the time trend is not included in the regression used to generate the test statistic.

The assumption of unit root can be tested by investigating the significance of y_{t-1} (i.e., α) in equation (4.13) through the ordinary least square estimation of equation (4.13). As discussed in the literature, this testing problem is non-standard and the conventional asymptotic (classical) t-test is inappropriate, even in large samples. Therefore, Monte Carlos methods will be employed in order to obtain the critical values for n(α) which are provided by Fuller (1976).[8] If it is certain that the variable is non-stationary in level then first difference can be taken and the result will be applied to Δy_t rather than y_t itself. The alternative model is then taken by applying first difference operation to equation (4.13) which then becomes;

$$\Delta\Delta y_t = a + bt + \alpha \Delta y_{t-1} + e_t \quad \text{.....(4.14)}$$

One of the drawbacks of the DF test is that it necessarily assumes that the data generating process is an AR(1) process under the null hypothesis. If this assumption does not hold then autocorrelation in residual terms (e_t) will bias the test. In order to overcome

[8] If the t-statistic is less than the critical t-value we reject the null hypothesis of non-stationary

this problem, the "Augmented" Dickey-Fuller (ADF) test can be employed. This is done by generalizing the basic DF framework of equations (4.13) to allow the series of first differences, Δy_t, to be auto-correlated. The ADF test is implemented by the OLS estimation of the following equation;

$$\Delta y_t = a + bt + \alpha y_{t-1} + \sum_{i=1}^{n} c_i \Delta y_{t-i} + e_t \quad \text{.....(4.15)}$$

In the same manner, we applied the test to Δy_t rather than y_t if the result indicates that the variable is non-stationary in level. We then applied first difference operator to equation (4.15) as follows;

$$\Delta\Delta y_t = a + bt + \alpha \Delta y_{t-1} + \sum_{i=1}^{n} c_i \Delta\Delta y_{t-i} + e_t \quad \text{.....(4.16)}$$

Equations (4.15) and (4.16) above follow West's argument. However, the inclusion of a time trend does not guarantee that ADF tests for unit roots will be powerful in every application. Perron (1989) shows that such tests cannot reject the unit root hypothesis when the true data process is a stationary error about a trend function with a one-time break.

The Phillips-Perron (PP) test, on the other hand, is based on the standard DF test but the test consists of running a regression of the first difference of the series against the series lagged more than once of optimally a constant and/or a time trend which is expressed as:

$$\Delta y_t = a + bt + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + ... + \alpha_n y_{t-n} + e_t \quad \text{.....(4.17)}$$

In the event of non-stationary of the series, we conduct tests of cointegration. Granger (1981) hypothesized that economic variables may individually be non-stationary but are not mutually independent, rather, there seems to be a mechanism that prevents wide

divergence. For instance, it may be that the variables y_t and x_t are non-stationary but the variable $z_t = y_t - \varphi x_t$ is stationary (where z_t is the linear combination of the two variables). If this is the case, we say that y_t and x_t are cointegrated and we call φ the cointegrating parameter or vector if y_t and x_t are vectors of variables (Engle and Granger, 1987).

For cointegration test, we apply both the DF and ADF and PP tests to the residuals of the static cointegrating (long run) regressions. The intuition behind this definition is that even if each time series is non-stationary, there might exist linear combinations of such time series that are stationary. In that case, multiple time series are cointegrated and share some common stochastic trends. Indeed, if there is a long run relationship between two or more non-stationary variables, then the idea of the general concept of cointegration is that deviations from this long run path are stationary. If this is the case, the variables in question are said to be cointegrated. However, time series can only be cointegrated if they are integrated of the same order. Also, the fact that variables are cointegrated implies that there is some adjustment process, which prevent the errors in the long run relationship becoming larger and larger. Engle and Granger (1987) have shown that any cointegrated series have an error correction (ECM) presentation.

4.4 Error Correction Modelling Techniques:

The main thrust of ECM is that people act to compensate for their past errors. Simply put, it is a model designed to integrate economic theory in characterizing a long

term equilibrium with an observed disequilibrium by building a model that explicitly incorporates behaviour that would restore the equilibrium (i.e., a method of dynamic modelling that attempts to compensate for part of investors' past error). The starting point of ECM is a test against the null hypothesis that the residual of the long run (static) model as given in equation (4.11) is non-stationary. This, as already discussed, can be done in two ways: first, a DF and second, ADF test can be performed on the residuals of the model. Alternatively, one can simply look at the Durbin-Watson statistic given from such model. A very low statistic indicates non-stationarity of the residuals. The evidence of stationarity of the residuals indicates that the variables in the model are indeed cointegrated.

Our next move is to switch to a short run model with an error correction mechanism. Adopting the Engle-Granger representation, we employ an error correction dynamic specification of the form:

$$\Delta PI_t = \alpha_0 + \alpha_1 M_t + \alpha_2 (PI - M)_{t-1} + e_t \quad \text{.....(4.18)}$$

where **M** is the vector of variables that cointegrate with private investment. Alternatively, equation (4.18) can be written as:

$$\Delta PI_t = \alpha_0 + \alpha_1 L(\Delta M_t) + \alpha_2 ECM_{t-1} + e_t \quad \text{.....(4.19)}$$

where L is a general lag operator and ECM is the time series of residuals from the cointegrating vector.

Equation (4.19) incorporates a corrective mechanism by which previous

disequilibria in the relationship between the level of private investment and the level of one or more of its determinants are permitted to affect the current change in private investment. In this way, an allowance is made for any short run divergence in actual investment from the long run target of private investment. Equation (4.19) will then be reduced to a parsimonious equation through the elimination of insignificant terms and the imposition of constraints that hold a reasonable approximation. The result of re-parameterisation of this equation is then used in further analysis.

4.5 Sources of Data:

Annual and quarterly time series are employed in this study and data are gathered mainly from Central Bank of Nigeria publication notably; Statistical Bulletin and Annual Report and Statements of Accounts for various years. This is complemented by IMF publications notably International Financial Statistic Yearbook (1999) and World Bank publications. Given the difficulty of getting quarterly data series on most of the variables identified, the quarterly interpolation of these variables are carried out by employing robust non-parametric method as suggested by Asogu (1996).

CHAPTER FIVE

PRIVATE INVESTMENT TREND IN NIGERIA

5.1 Introduction:

This chapter investigates investment behaviour in Nigeria by analysing investment trend and identify the possible factors responsible for the observed trend patterns. The trend analysis considers international and inter-temporal comparisons as well as comparisons between private and public investment. The investment trend analysis covers a period of thirty-two years from 1970 to 2001. Descriptive analytical methods are employed for the investment trend analysis. The chapter also considers the response of private sector to macroeconomic policies in Nigeria.

5.2 Investment Behaviour in Nigeria:

Gross nominal investment growth rate as indicated in Table 6 shows an upward trend during the first half of 1970-80 decade. Table 6 clearly show that the growth rate of nominal investment increased from 18.5 per cent in 1970 to 61.9 per cent in 1973 and rose again to 69.8 per cent in 1975. In 1970, real investment-GDP ratio stood at 13.2 per cent, which rose to 24.5 per cent in 1973 and increased again to 31.9 per cent in 1975. The investment trend pattern of 1970-75 period arose from the dramatic rise in international oil prices from 1971 and the sudden accretion of oil revenue to government which strengthened the primacy of the Nigerian public sector. Invariably, the private indigenous group assumed an inevitable subordinate sector. Flush with more money,

Table 6: Investment Growth Rates and Investment-GDP ratios[9]

Year	NINV%	NINV as % of GDP	RINV%	RINV as % of GDP
1970	18.5	14.8	20.0	13.2
1971	59.5	18.7	37.8	15.0
1972	23.8	21.1	20.0	17.0
1973	61.9	22.4	53.5	24.5
1974	26.4	17.0	11.6	24.5
1975	69.8	25.2	26.3	31.9
1976	59.0	31.5	28.6	36.9
1977	6.2	28.3	-8.1	31.4
1978	6.5	27.5	-8.6	30.9
1979	-2.4	22.1	-12.5	26.4
1980	14.0	21.3	3.8	26.0
1981	11.2	23.3	-8.1	32.6
1982	-12.3	20.0	-18.6	26.6
1983	-19.2	14.7	-34.3	18.5
1984	-28.2	9.5	-48.6	10.0
1985	7.3	9.0	1.7	9.3
1986	68.4	15.0	59.8	14.4
1987	58.1	16.0	43.5	20.8
1988	50.2	18.0	-3.8	18.2
1989	53.3	17.7	1.9	17.3
1990	-3.7	14.7	-10.5	14.3
1991	97.7	23.4	75.2	23.9
1992	58.3	21.8	9.5	25.3
1993	35.8	23.3	-13.6	21.3
1994	10.8	19.6	-29.4	14.9
1995	76.8	16.1	2.2	14.9
1996	11.1	15.0	-15.0	12.3
1997	24.2	15.3	15.1	13.7
1998	17.1	17.5	3.6	13.9
1999	6.3	18.1	-1.8	13.2
2000	15.3	20.1	6.5	13.7
2001	10.2	18.9	-8.8	12.1

Source: Computed by the author from the CBN, IMF and IFC data on investment.

[9] NINV and RINV are nominal and real investment respectively

government undertook and pursued magnanimous policy incentives as well as huge infrastructural investment to, among other things, create opportunities for Nigerian indigenous enterprises to develop.

During the second half of 1970-80, aggregate investment growth rates witnessed drastic fall. From its 1975 level, nominal investment growth rate fell sharply to 6.2 per cent in 1977 with negative growth rate record of -2.4 per cent in 1979. During the same period, the real investment growth rates were negative with record of -8.1 per cent and -12.5 per cent for 1977 and 1979 respectively. During the first half of the 1980-1990 decade, the downward trend of nominal investment growth rate continued unabated. The records were -12.3 per cent, -19.2 per cent, and -28.2 per cent for 1982, 1983 and 1984 respectively. This trend later turned around to positive during the second half of the decade with an annual growth rate moving so close to what obtained during the first half of the previous decade. It was 68.4 per cent in 1986 and 50.2 per cent in 1988. It was only in 1990 when a negative growth rate of -3.7 per cent was again recorded.

The reason for this trend is not far-fetched. The historic event of the 1980s as engendered by the volatility and eventual collapse of earnings from oil export as well as the subsequent emergence of debt crisis, reveal the fragility of the developments in the Nigerian economy (Bogunjoko, 1998). Firstly, it shows that most of the projects conceptualized and pursued during the oil boom were doubtful in utility and viability; constituting a deadweight loss in terms of net benefits to the economy (Oyejide and Raheem, 1993). Second, it indicates that the involvement of government in economic

activities had clearly outstripped "decent" limits.

The positive trend and high nominal investment growth rate that was witnessed in the last half of 1980-1990 decade also persisted during the first half of the 1990-2000 decade. Indeed, in 1991, investment growth rate was as high as 97.7 per cent and 76.8 per cent in 1995. This trend was, however, short-lived as the growth rate fell sharply during the second half of the decade with the record of 24.2 per cent in 1997 and 15.3 per cent in 2000. For the 2001, investment growth rate record was 10.2 per cent.

As regards real investment in Table 6, growth rates were negative for most years under investigation, except for the first half of 1970-80 decade, which witnessed positive growth rates. For instance, the real investment growth rate of -8.1 per cent was recorded in 1977, -48.6 per cent in 1984, -10.5 per cent in 1990, -29.4 per cent in 1994 and -33.5 per cent in 2002. Positive real investment growth rates of 3.8 per cent, 1.7 per cent, 2.2 per cent and 6.5 per cent were, however, experienced in 1980, 1985, 1995 and 2000 respectively. The trend of real investment could, however, be attributed to the inflationary trend in the Nigerian economy, which plays a key role in the conversion of nominal investment to real figures.

The investment-growth literature emphasizes the key role of investment in economic development. The sluggish and negative growth rate of investment in Nigeria, therefore, has a lot of implications. Indeed, Nigeria's low investment record has been identified as a major impediment to its economic growth. Figure 2 indicates that the

early and mid 1970-80 decade held much promise for prospects of investment-led growth and development in Nigeria with resources coming mainly from oil boom. During this decade, investment-GDP rate got to its peak of about 32.0 per cent and 37.0 per cent for nominal and real investment respectively. In 1970, nominal investment-GDP rate was 14.8 per cent, 25.2 per cent in 1975 and 21.3 per cent in 1980 representing an annual average growth rate of 23.0 per cent. This upward trend could partly be explained by the discovery of oil in the 1970s.

For its real counterpart, the rates were respectively 13.2 per cent, 31.9 per cent and 26.0 per cent for 1970, 1975 and 1980. It is also observed during the 1970-80 decade that the growth rate never fall below 20.0 per cent and 10.0 per cent for nominal and real investment-GDP respectively. As a result of recession of early 1980s arising from fall in the international oil market, real growth rate of GDP became negative while the nominal investment-growth rate fell drastically to a level as low as 9.0 per cent and 9.3 per cent for its real counterpart during 1980-85 period. Evidence clearly shows that the fall in real GDP as well as the decline in the level of economic development in Nigeria is found in the collapse of investment. As depicted in Figure 2, investment-GDP ratio fell precipitously in the early 1980s thus resulting in the negative growth of the economy.

With the advent of Structural Adjustment Programme (SAP) in 1986, the expectation was a quick return to earlier decade of relatively high growth rate through liberalized-induced investment climate. Although investment rate increased tremendously in the 1990-

2000 decade, the rate never returned to its previous high level. Indeed, the nominal investment-GDP rate stood at 14.7 per cent in 1990, 16.1 per cent in 1995, 20.1 per cent in 2000 and 18.9 per cent in 2001. The real investment-GDP rate was 14.3 per cent in 1990, 14.9 per cent in 1995, 13.7 per cent in 2000 and 12.1 per cent in 2001. The investment-GDP rates after reform indicate a short-lived optimism, as the Nigeria's investment-GDP rate failed to return to any level close to those obtained in the 1970-80 decade. The overall aggregate investment data presented in Table 6 and Figure 2, thus, indicate a little recovery from the sharp cutback following the decline in oil prices in early 1980s.

The important message derived from this investment trend analysis above is that the investment behaviour of the Nigerian economy is highly unpredictable. A critical look at investment growth rates reported in Table 6 confirms that both the nominal and real investments are highly volatile and unpredictable during the period under investigation. It is, however, more unstable in real than its nominal counterpart. What then could have been responsible for this unpredictable nature of the investment behaviour in Nigeria? In an attempt to provide meaningful answer to this question and other relevant issues, we disaggregate investment into its main components; private and public, and then try to examine the trend of private investment vis-à-vis public investment.

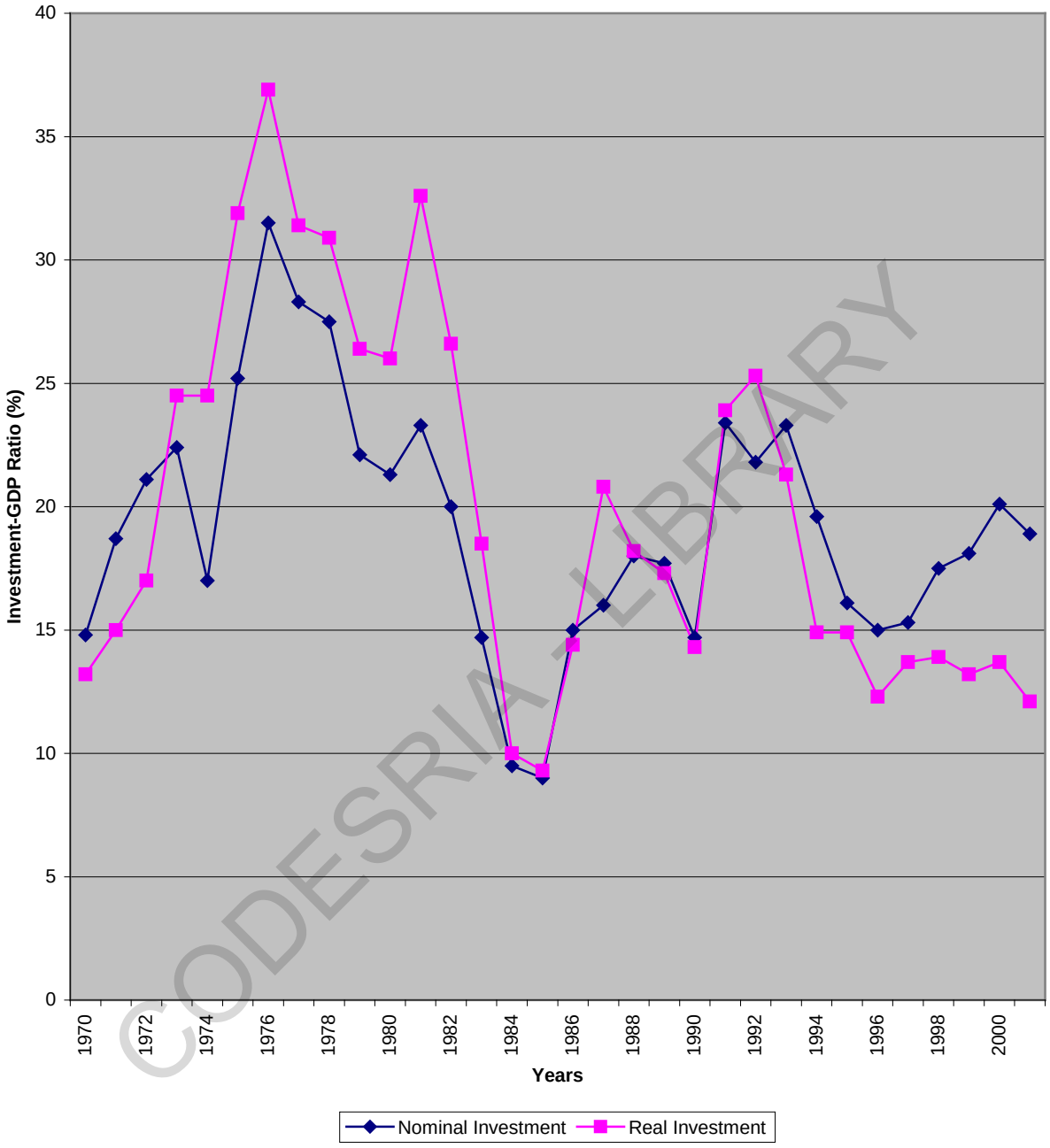

Fig. 2: Gross Investment as Percent of GDP

Data on international comparisons presented in Table 7 suggest that the problem of low investment is central to the explanation of low growth witnessed in sub-Saharan Africa and Nigeria in particular (Hernandez-Cata, 2000). Table 7 indicates that all through 1990s, the ratio of investment to GDP for sub-Saharan Africa fluctuated around 17.0 per cent, which is far below 35.0 per cent attained in East Asia, 22.0 per cent in South Asia and Middle East, 24.0 per cent in Europe, 24.7 per cent in North Africa and 20.3 per cent in Latin America. In most developing countries, public investment (or public capital formation) is often the dominant component of gross investment spending while private investment is the dominant component in Asia, Europe, USA and Latin America. The Nigeria's investment-GDP ratio of 16.8 per cent in the 1990s is one of the lowest records among the African countries. North Africa recorded 24.7 per cent while Kenya, Mauritius and South Africa recorded investment-GDP ratio of 18.3 per cent, 28.0 per cent and 18.1 per cent respectively. However, as indicated in Table 7, public investment-GDP ratio is still very high when compared with the other countries in the African region.

The ratio of private investment to GDP for Nigeria as shown in Table 7 fluctuated around 5.0 per cent which is far below 14.7 per cent attained in Latin America, 18.0 per cent for Europe, 26.1 per cent for East Asia, 13.2 per cent for South Asia, 12.3 per cent for Middle East, 12.8 per cent for North Africa and 9.5 per cent for sub-Saharan Africa. In comparisons with other African countries, the Nigeria's private investment-GDP ratio of 4.7 per cent for 1990s is also far short of 10.1 per cent for Kenya, 5.4 per cent for

Table 7: Investment as a Share of GDP (in percentages)

Region	Simple Average			Weighted Average		
	1970-79	1980-89	1990-99	1970-79	1980-89	1990-99
East Asia						
private/GDP	17.8	18.7	23.3	18.0	19.5	26.1
public/GDP	7.0	8.1	8.0	6.6	8.2	8.8
South Asia						
private/GDP	7.0	8.5	10.2	9.1	10.0	13.2
public/GDP	7.2	8.5	8.0	7.5	9.7	8.7
Europe						
private/GDP	12.3	12.9	17.8			
public/GDP	10.0	8.9	6.2			
Middle East						
private/GDP	12.4	12.1	12.3			
public/GDP	14.7	10.9	9.9			
North Africa						
private/GDP	10.5	13.6	12.8			
public/GDP	14.3	13.9	11.9			
Latin America						
private/GDP	12.5	12.3	13.3	13.1	14.2	14.7
public/GDP	6.8	6.4	5.5	7.4	6.5	5.6
Sub-Saharan Africa						
private/GDP	12.9	9.5	9.5	13.8	13.2	11.5
public/GDP	11.5	8.8	7.5	12.9	9.8	5.3
1. Kenya						
private/GDP	12.7	11.6	10.1			
public/GDP	8.8	8.3	8.2			
2. Malawi						
private/GDP	8.7	5.4	5.4			
public/GDP	15.1	9.6	8.4			
3. Mauritius						
private/GDP	18.8	14.0	19.0			
public/GDP	8.7	7.5	9.0			
4. Nigeria						
private/GDP	8.1	5.5	4.7			
public/GDP	17.1	13.9	12.1			
5. South Africa						
private/GDP	13.9	13.7	12.0			
public/GDP	13.0	9.8	6.1			
Global						
private/GDP	12.5	12.5	13.2	12.8	14.0	16.6
public/GDP	7.9	8.1	7.3	7.9	8.2	6.7

Source: International Financial Statistics Yearbook (various years)

Malawi, 19.0 per cent for Mauritius, and 12.0 per cent for South Africa. The evidence in

Table 7 clearly supports the view that the private investment in Nigeria is not satisfactory enough to meet the required growth rate. The private investment-GDP ratio of 4.7 per cent in recent Nigeria's time fall short of average of 16.6 per cent, 11.5 per cent and 12.8 per cent for the global, sub-African and North African ratios respectively. This trend poses a serious threat to the developmental effort of the Nigerian government and, therefore, calls for proper investigation of the determinants of private investment.

The fall in aggregate investment during 1970-2001 was broad-based as it emanated from both private and public components of investment. The cross examination of nominal data in Table 8 indicates that private investment in Nigeria remained virtually low throughout the period under investigation. Indeed, both Table 8 and Figure 3 clearly show that throughout the period under investigation, private investment was everywhere overwhelmed by public investment. This is an indication that public investment in Nigeria crowd-outs private investment. Private investment was, however, growing but at a relatively low level. For instance, Table 8 indicates a sluggish growth rate in private investment in Nigeria. In 1970, the nominal private investment stood at N,=165.6m compared to public investment of N,=604.7m. The value increased to N,=1462.9m in 1975 compared to public investment of N,=3818.3m representing 43.8 per cent annual growth rate. Private investment later increased to N,=3256.1m in 1980 compared to public investment of N,= 7315.6m. The first half of 1980-90 decade, however, saw private and public investment declining rapidly as a result of recession in world oil market arising

Table 8: Nigeria's Nominal Values and Growth Rates of Private and Public Investment (1970-

2001)

Year	npinv (N,=m)	Nginv (N,=m)	npinv/Tinv (%)	nginv/Tinv (%)	npinv/GDP (%)	nginv/GDP (%)
1970	165.6	604.7	21.5	78.5	3.2	11.6
1971	317.0	911.6	25.8	74.2	4.8	13.9
1972	476.1	1044.9	31.3	68.7	6.6	14.5
1973	864.1	1597.8	35.1	64.9	7.9	14.5
1974	1284.7	1826.0	41.3	58.7	7.0	10.0
1975	1462.9	3818.3	27.7	72.3	7.0	18.2
1976	1897.7	6499.1	22.6	77.4	7.1	24.4
1977	3113.2	5807.1	34.9	65.1	9.9	18.4
1978	3723.4	5775.1	39.2	60.8	10.8	16.7
1979	3355.9	5914.5	36.2	63.8	8.0	14.1
1980	3256.1	7315.6	30.8	69.2	6.6	14.7
1981	3291.8	8464.6	28.0	72.0	6.5	16.8
1982	3166.4	7147.6	30.7	69.3	6.1	13.9
1983	2409.2	5927.1	28.9	71.1	4.2	10.5
1984	1442.5	4543.1	24.1	75.9	2.3	7.2
1985	1432.4	4990.8	22.3	77.7	2.0	7.0
1986	2466.8	8352.4	22.8	77.2	3.4	11.6
1987	4891.0	12210.3	28.6	71.4	4.6	11.4
1988	7678.9	18003.1	29.9	70.1	5.4	12.6
1989	12206.2	27168.7	31.0	69.0	5.5	12.2
1990	15883.2	22024.2	41.9	58.1	6.2	8.5
1991	27502.2	47435.7	36.7	63.3	8.6	14.8
1992	32276.6	86387.5	27.2	72.8	5.9	15.9
1993	30617.1	130525.7	19.0	81.0	4.4	18.9
1994	34999.7	143570.1	19.6	80.4	3.8	15.8
1995	76392.4	239278.7	24.2	75.8	3.9	12.2
1996	89448.6	261330.3	25.5	74.5	3.8	11.2
1997	113702.8	321940.0	26.1	73.9	4.0	11.3
1998	143888.5	366354.4	28.2	71.8	4.9	12.6
1999	166009.2	376504.5	30.6	69.4	5.5	12.6
2000	220124.4	405229.0	35.2	64.8	7.1	13.0
2001	231742.3	373329.0	38.3	61.7	7.2	11.7

Sources: CBN: Statistical Bulletin (2001)

IFC:Trend in Private Investment in Developing Countries, 2002

IMF: International Financial Statistics 2002

World Bank: African Development Indicators, 2002

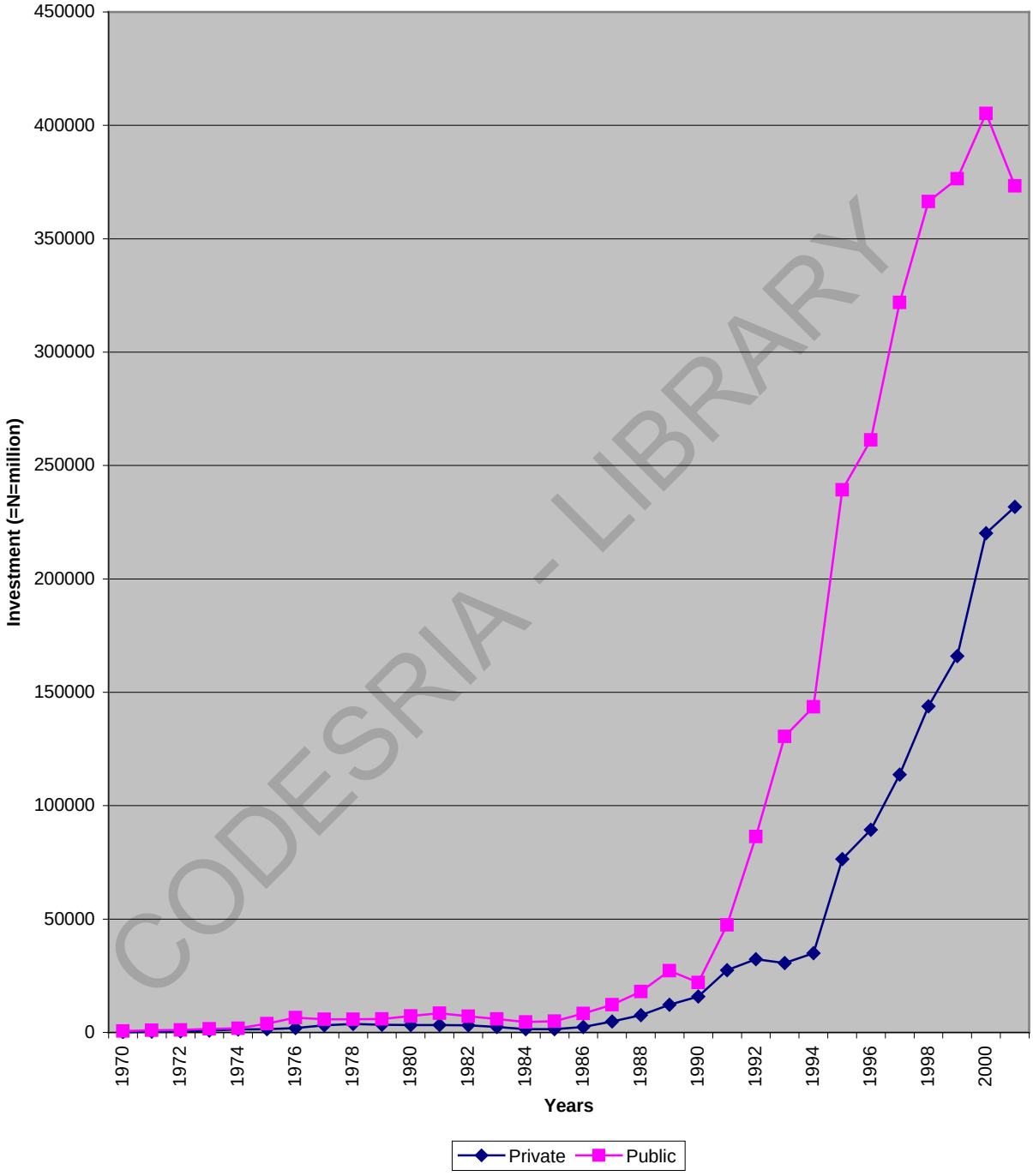

Fig. 3: Nominal Private and Public Investment in Nigeria

from drastic fall in the oil prices. With the introduction of Structural Adjustment Programme (SAP) in 1986, private investment was raised once again with a record of N,= 2466.8m in 1986, N,=15883.2m in 1990, N,=76392.4m in 1995, N,=220124.4m in 2000 and N,=231742.3m in 2001. The figures for 1980-90 and 1990-2000 decades indicate that public investment still dominated the Nigeria's investment climate.

Also, taking 1985 as the base year, Table 9 and Figure 4 show the real investment behaviour in Nigeria. Figure 4 clearly indicates that real private investment was generally volatile during 1970-2001 period. The trend of real private and public investment as shown in Table 9 and Figure 4 has a serious implication on the privatization policy of the Nigerian economy. For instance, real private investment in 1970 was N,=1533.6m compared to public investment of N,=5599.3m and later rose to N,=7067.1m compared to N,= 18445.8m for public investment in 1975 representing average growth rate of 40.7 per cent and 27.5 per cent respectively. In 1978, real private investment highest value of N,= 10792.5m was attained and fell drastically to N,=7697.6m compared to N,=17294.6m for public investment in 1980 representing annual growth rate of 2.7 per cent and 3.5 per cent for private and public investment respectively. There after, real private investment value dropped to N,=1432.4m compared to N,=4990.8m for public investment in 1985 representing negative growth rate of 25.6 per cent and 19.9 per cent respectively.

Table 9:Nigeria's Real Values and Growth Rates of Private and Public Investment (1970-2001)

Year	rpinv (N,=m)	rginv (N,=m)	rpinv (%)	rginv (%)	rpinv/Tinv (%)	rginv/Tinv (%)	rpinv/GDP (%)	rginv/GDP (%)
1970	1533.6	5599.3	45.2	21.3	21.5	78.5	2.8	10.3
1971	2535.8	7293.0	65.4	30.2	25.8	74.2	3.9	11.1
1972	3690.4	8099.9	45.5	11.1	31.3	68.7	5.3	11.7
1973	6353.9	11748.4	72.2	45.0	35.1	64.9	8.6	15.9
1974	8342.4	11857.1	31.3	0.9	41.3	58.7	10.1	14.4
1975	7067.1	18445.8	-15.3	55.6	27.7	72.3	8.8	23.1
1976	7412.7	25387.0	4.9	37.6	22.6	77.4	8.3	28.6
1977	10517.5	19618.5	41.9	-22.7	34.9	65.1	10.9	20.4
1978	10792.5	16739.4	2.6	-14.7	39.2	60.8	12.1	18.8
1979	8716.6	15362.4	-19.2	-8.2	36.2	63.8	9.6	16.8
1980	7697.6	17294.6	-11.7	12.6	30.8	69.2	8.0	18.0
1981	6429.3	16532.4	-16.5	-4.4	28.0	72.0	9.1	23.5
1982	5736.3	12948.6	-10.8	-21.7	30.7	69.3	8.2	18.5
1983	3548.2	8729.2	-38.1	-32.6	28.9	71.1	5.3	13.1
1984	1521.7	4792.3	-57.1	-45.1	24.1	75.9	2.4	7.6
1985	1432.4	4990.8	-5.9	4.1	22.3	77.7	2.1	7.2
1986	2340.4	7924.5	63.4	58.8	22.8	77.2	3.3	11.1
1987	4212.7	10517.1	80.0	32.7	28.6	71.4	6.0	14.9
1988	4237.8	9935.5	0.6	-5.5	29.9	70.1	5.4	12.8
1989	4476.1	9962.9	5.6	0.3	31.0	69.0	5.4	11.9
1990	5417.2	7511.7	21.0	-24.6	41.9	58.1	6.0	8.3
1991	8311.3	14335.3	53.4	90.8	36.7	63.3	8.8	15.2
1992	6746.8	18057.6	-18.8	26.0	27.2	72.8	6.9	18.4
1993	4072.0	17359.4	-39.6	-3.9	19.0	81.0	4.0	17.3
1994	2964.3	12159.7	-27.2	-30.0	19.6	80.4	2.9	12.0
1995	3742.2	11721.3	26.2	-3.6	24.2	75.8	3.6	11.3
1996	3351.6	9792.1	-10.4	-16.5	25.5	74.5	3.1	9.2
1997	3950.2	11184.7	17.9	14.2	26.1	73.9	3.6	10.1
1998	4419.9	11253.4	11.9	0.6	28.2	71.8	3.9	10.0
1999	4709.5	10681.0	6.6	-5.1	30.6	69.4	4.0	9.2
2000	5766.9	10616.4	22.5	-0.6	35.2	64.8	4.8	8.8
2001	5722.0	9218.0	-0.8	-13.2	38.3	61.7	4.6	7.5

Sources: CBN: Statistical Bulletin (2001)
IFC:Trend in Private Investment in Developing Countries, 2002 and; IMF: International Financial Statistics 2002

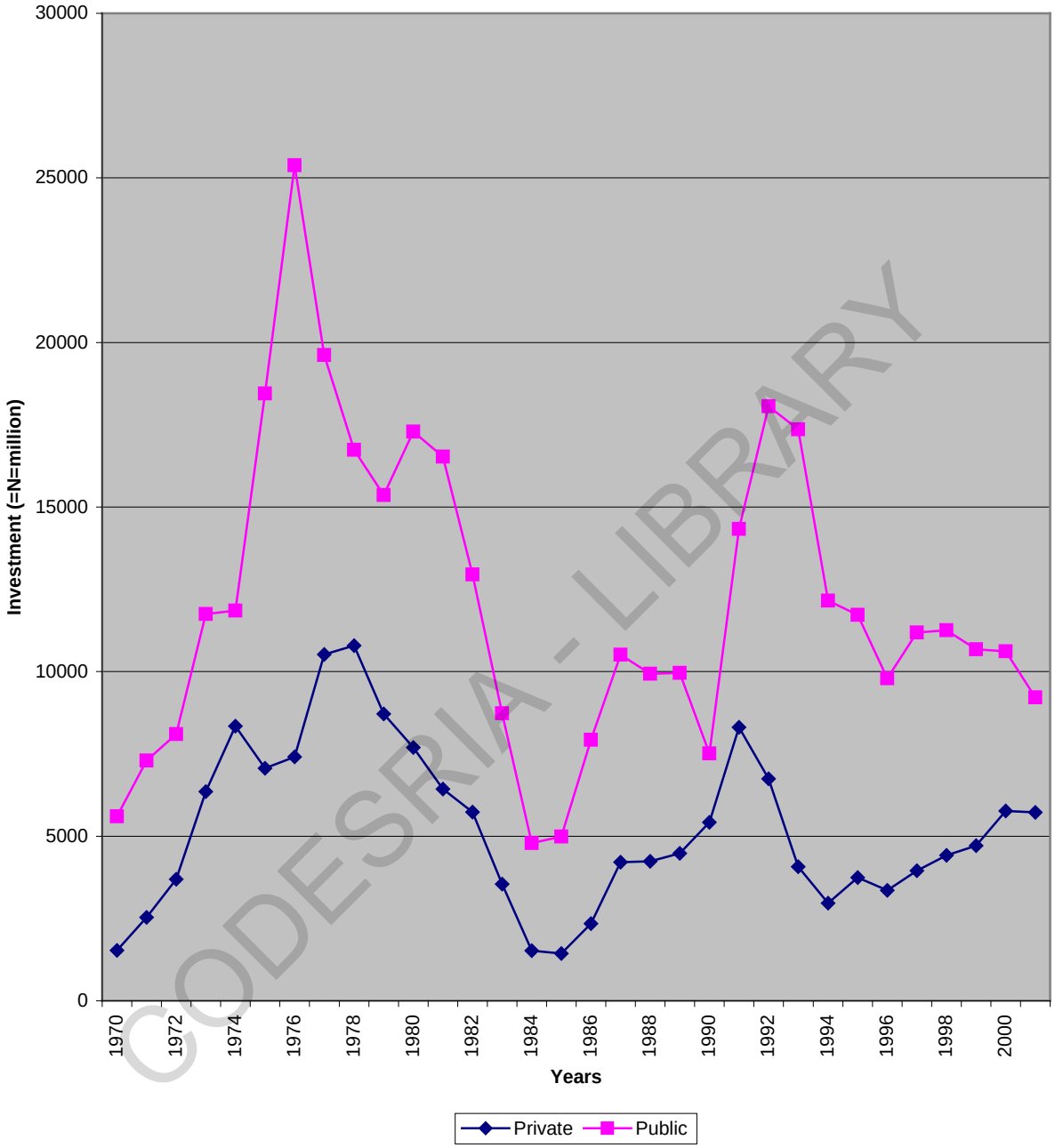

Fig. 4: Real Private and Public Investment in Nigeria

In 1990, real private investment value rose again to N,=5417.2m compared to N,= 7511.7m for public investment representing annual growth rate of 26.8 per cent and 12.34 per cent respectively. This marginal increase was, however, shortlived as real private investment fell again to N,=3742.2m compared to N,=11721.3m for public investment in 1995 representing negative growth rate of 4.8 per cent and 2.4 per cent respectively. Real private investment value fell again between 2000 and 2001 from N,=5766.9m to N,= 5722.0m compared to N,=10616.4m and N,=9218.0m respectively for public investment.

The economic literature is replete with evidence that private investment is more directly related to economic growth than public investment (Khan and Reinhart, 1990). It is, therefore, widely acknowledged that the expansion of private investment should be the main impetus for economic growth in developing countries (Chhibber and Dialami, 1990). Figure 5 shows that private investment as per cent of total investment increased from 21.5 per cent in 1970 to 41.3 per cent in 1974 which later declined to 27.7 per cent in 1975 and increased again to 30.8 per cent in 1980. The 41.3 per cent level attained in 1974 was however difficult to attain since the inception of SAP. It was only in 1990 when private investment as a percentage of total reached 42.0 per cent. Indeed, private investment as a percentage of total investment fell drastically from 30.7 per cent in 1982 to 22.3 per cent in 1985 and 19.6 per cent in 1994. With the implementation of privatization policy, the private investment as a percentage of total has been on the increase though at a very marginal rate. In fact, private investment as a percentage of total was 24.2 per cent in 1995, 35.2 per cent in 2000 and 38.3 per cent in 2001.

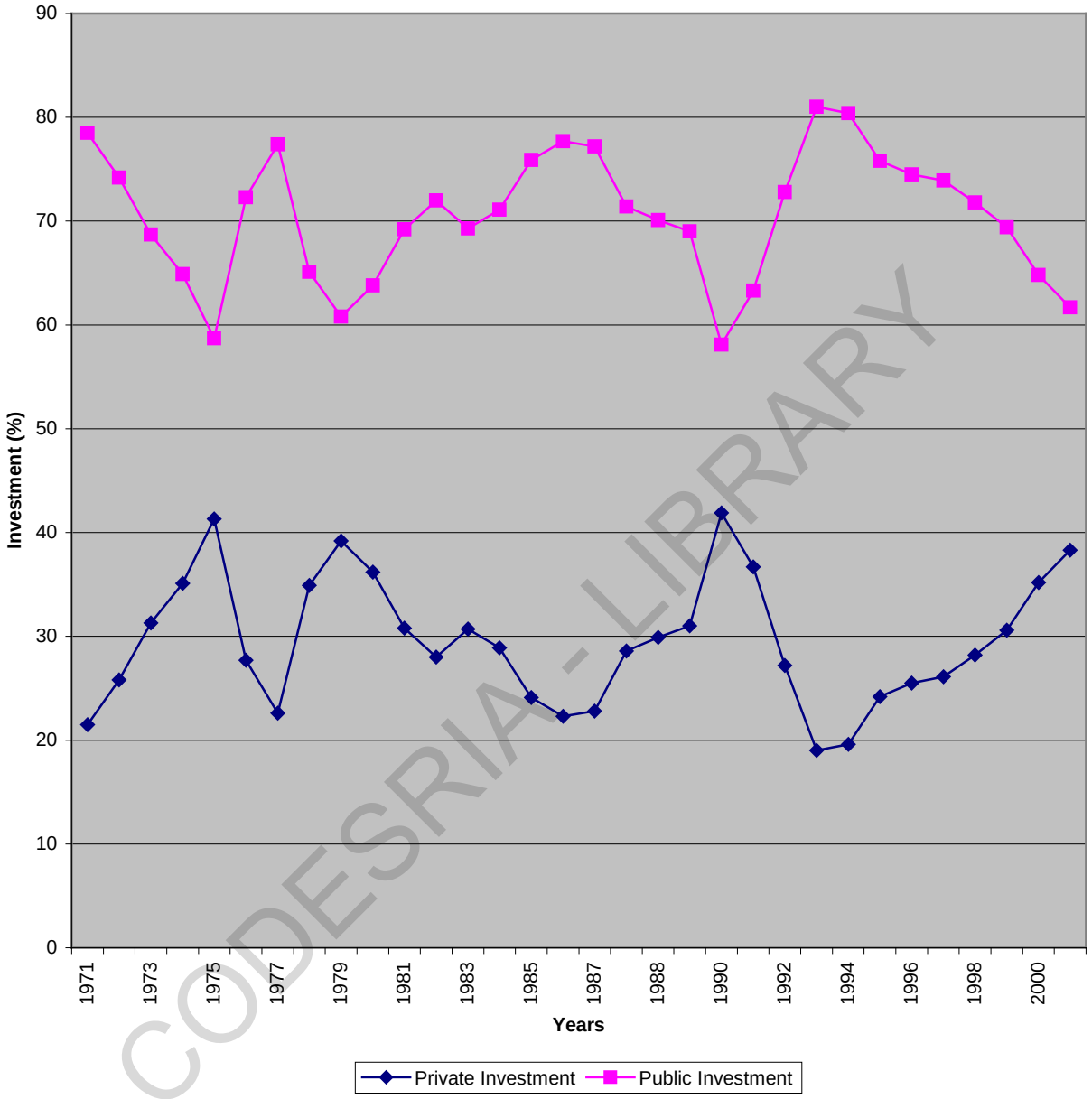

Fig. 5: Private and Public Investment as Percent of Total Investment

In line with the recent privatization policy, the latest years' data show that private investment continued to rise and public investment declined on the average. Although private investment as a percentage of total investment has been on the increase in recent times, Figure 4 shows that public investment as a percentage of total is every where above private investment in Nigeria. This, therefore, calls for proper investigation of why private sector response to adjustment programmes has been slow.

Examining the ratio of private and public investment to GDP as presented in Table nd Table 9, it is obvious that private investment as a percentage of GDP has been on increase since the introduction of SAP in 1986, except for the 1993-1996 period while public investment as a percentage of GDP has been declining. This implies that SAP has induced more beneficial effect on private than public investment. However, the major observation in investment behaviour in Nigeria during the 1970-2001 period is that private sector investment is highly unpredictable. What then could have been responsible for this unpredictable nature of the investment behaviour in Nigeria from the private sector? Evidence about Nigeria suggests that at least 30.0 per cent annual growth rate of private investment is required for 6.0 per cent growth of the economy (Chhibber and Pahwa, 1994). The recovery in private investment since the introduction of privatization policy has been very slow. Today, the 15.0 per cent annual growth rate of private investment is far short of the required rate. What is necessary to get private investment rate returned back to the required level? These issues are examined in section 5.3.

With regards to private investment, Figure 6 clearly indicates that private investment had fluctuated considerably between 1970 and 2001. Before oil boom era, the private investment-growth ratio was at an impressive level. Indeed, nominal private investment-GDP ratio increased from 3.2 per cent in 1970 to 7.0 per cent in 1975 and increased further to 10.8 per cent in 1978. Throughout 1980-2001 period, private investment-GDP ratio never exceeded 10.0 per cent. Following trend similar to that of private investment, nominal public investment-GDP ratio increased from 11.6 per cent in 1970 to its peak of 24.4 per cent in 1976 and thereafter declined continuously to its lowest level of 0.8 per cent in 1985. Since then, there has been a gradual increase with this ratio reaching 8.5 per cent in 1990, 12.2 per cent in 1995, 13.0 per cent in 2000 and declined again to 11.7 per cent in 2001. Similar trends were also observed in real private and public investment-GDP ratios. Figure 6 clearly indicates that the behaviour of private sector investment in Nigeria is slow and the public investment-GDP ratio was every where above its private investment counterpart.

During 1970-80 period, the growth rate of private investment ranged between 21.5 per cent and 30.8 per cent representing annual growth rate of 31.5 per cent averagely. The rate dwindled from 8.6 per cent during the 1973-80 period to 4.2 per cent in the 1980-2000 period. In Nigeria, domestic investment as a ratio of GDP declined from an average of 24.4 per cent during the 1973-81 period to 13.57 per cent during the 1982-96 period. The average investment rate during the 1982-96 period implied that the country barely replaced its depreciating capital.

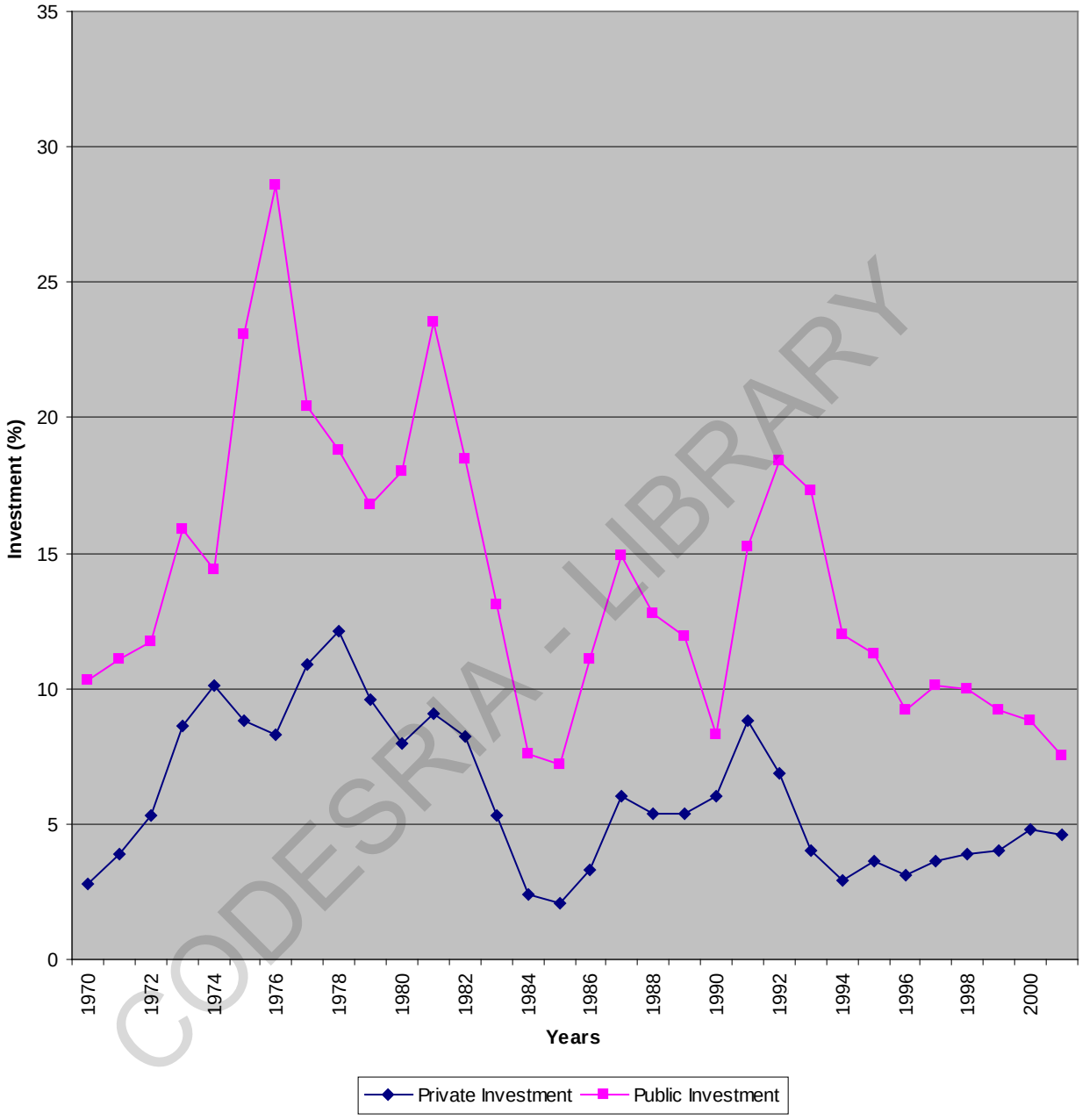

Fig. 6: Private Investment and Public Investment as Percent of GDP

For instance, Table 8 and Table 9 show that private investment rate increased only marginally from 4.2 per cent during 1980-85 period to 5.2 per cent during the 1986-95 period. This trend clearly shows that aggregate investment is highly dominated by the public investment in Nigeria. This is shown in the Figure 6 where public investment-GDP ratio is everywhere above the private investment figure throughout the period. This is an indication that public investment has been substituted for private investment rather than complementing it.

Figure 6 shows that the investment-GDP ratio declined significantly during the period under investigation. The decelerated growth witnessed in Nigeria could therefore be partly associated with sharp reduction in private investment whose share of GDP, relative to public investment, has declined steadily since 1970. At this juncture, a pertinent question that comes to mind is what accounts for the private investment trend patterns observed. Yet in other words, what variables determine the private investment decisions in Nigeria. Answers to these questions will go along way in putting an end to the unpredictable nature of private investment spendings.

5.3 Private Sector Investment Response to Macroeconomic Reforms in Nigeria:

Nigeria, like most developing countries, witnessed unprecedented and severe economic crisis in the late 1970s and early 1980s. The sluggish performance of the affected economies, according to Greene and Villanueva (1991) is attributable to decline in investment rates. The Nigerian economy was highly dependent on oil revenue and market

interest rates were highly regulated below equilibrium rates. The fall in oil price between 1980 and 1985 perhaps, led to the tardy growth of the economy as the whole. As a result of oil crisis, a lot of imbalances manifested ranging from high rate of inflation, widening saving-investment gap, chronic balance of payments, huge budget deficits and hosts of other macroeconomic imbalances. With further collapse of oil prices in 1986, the Nigerian government adopted a far-reaching economic reforms aimed at revitalizing the non-oil sector with policy to encourage private sector investment.

For several years, Nigeria's economic climate has not been conducive to both domestic and foreign investors. Nigeria economy has great potentials for investment opportunities which abound in all sectors. These include oil and gas, agriculture and mining, manufacturing, commerce and others. However, the investment climate has been unattractive and characterized by both macroeconomic and political instability. Slow growth (including negative growth in early 1980s), unsatisfactory institutional and regulatory framework become the order of the day. The relatively weak growth of the Nigerian economy is not surprising given the low investment profile discussed in the previous section. Often, government policies, regulations and procedures are identified as posing serious threat to accomplishing national economic growth objectives.

Although, real economic growth rate, as shown in Table 10, averaged 7.8 per cent during the 1970-80 period, its performances in the early 1980s and 1990s had been daunting. Growth rates were actually negative in the early 1980s as a result of the collapse of oil prices in the international market. The nominal GDP growth rate followed similar pattern of

dismal performance as exhibited by trends in real income. With the level of growth rate attained during the period under investigation, Nigeria is classified among the twenty poorest countries in the world.

Table 10 indicates that the key relative prices have shown signs of serious volatility while macroeconomic policy environment has also changed drastically. Negative real income and private investment growth rates witnessed during 1990-95 period corroborated with the period when inflation rates were high in Nigeria. Indeed, Inflation rates accelerated rapidly and real interest rates declined to negative rates. For instance, Table 10 indicates that inflation rate in Nigeria was as high as 13.7 per cent in 1970 and 33.9 per cent in 1975. The rate fell to 9.9 per cent in 1980, 5.5 per cent in 1985 and increased to 38.3 per cent in 1988 and later fell back to 7.5 per cent in 1990. In 1995, the rate reached its peak of 72.8 per cent and fell drastically to 6.9 per cent in 2000 and rose again to 18.9 per cent in 2001.

Also low rate of private investment witnessed in Nigeria resulting from high lending rates were source of concern for the monetary authority. For instance, during 1986 and 1990, the prevailing lending rates ranged between 24.6 and 30.0 per cent. Realizing the negative implications of the existing interest rates profile for investment in 1990, the monetary authority regulated (pegged) interest rates at maximum of 21.0 per cent in 1991. There were indications that lending rates for investment purposes were out of line with the prevailing rates of returns on investment in the real sector, hence the actual investment fell short of the required investment. Indeed the actual lending rates

Table 10: Nigeria's Relative Prices and Macroeconomic Indicators (1970-2001)

Year	Nominal GDP (%)	Real GDP (%)	Fiscal Deficit (% of GDP)	Inflation Rate (%)	Parallel Exchange Rate (N,=/$)
1970	18.6	25.0	-8.7	13.8	0.7143
1971	26.2	21.3	2.6	15.6	0.6955
1972	9.7	5.5	-0.8	3.2	0.6579
1973	52.5	6.4	1.5	5.4	0.6579
1974	66.5	11.7	9.8	13.4	0.6299
1975	14.5	-3.0	-2.0	33.9	0.6159
1976	27.2	11.1	-4.0	21.2	0.6265
1977	18.2	8.2	-2.4	15.4	0.6466
1978	9.6	-7.4	-7.8	16.6	0.6060
1979	21.4	2.4	3.4	11.8	0.5957
1980	18.3	5.5	3.9	9.9	0.5464
1981	1.7	-26.8	-7.7	20.9	0.6100
1982	2.2	-0.3	-11.8	7.7	0.6729
1983	10.0	-5.4	-5.9	23.2	0.7241
1984	11.1	-5.1	-4.2	39.6	0.7649
1985	13.3	9.4	-4.2	5.5	0.8938
1986	1.1	3.1	-11.3	5.4	3.7606
1987	48.2	-0.5	-5.4	10.2	4.0879
1988	33.5	9.9	-8.4	38.3	4.5967
1989	55.9	7.3	-6.7	40.9	7.3916
1990	15.9	8.2	-8.5	7.5	8.0378
1991	24.2	4.7	-11.0	13.0	9.9095
1992	70.0	3.6	-7.2	44.5	17.4584
1993	27.1	2.6	-15.5	57.2	22.4168
1994	31.7	0.8	-7.7	57.0	23.0000
1995	115.2	2.2	0.1	72.8	81.0000
1996	18.9	3.2	1.4	29.3	81.2000
1997	22.1	3.3	-0.2	8.5	81.6000
1998	2.4	2.4	-4.9	10.0	85.6000
1999	2.8	3.0	-9.5	6.6	92.5000
2000	3.8	3.1	-3.3	6.9	99.2000
2001	2.9	2.9	-4.5	18.9	111.6000

Source: Central Bank of Nigeria Statistical Bulletin (2002)

were still far above 30.0 per cent which then discouraged the mobilization of investment from private sector of the Nigerian economy, thus the dominance of public investment.

Apart from the weak savings, investment and overall growth performance, rapid population and macroeconomic policies such as massive devaluation of the Nigerian currency also accounted for the observed low and declining level of GDP and private investment. For instance, naira appreciated by 23.5 per cent against US dollar during 1970-80 decade, depreciated by 63.6 per cent between 1980 and 1985, depreciated by 113.1 per cent between 1986 and 1990 and further depreciated by 1282.2 per cent during 1990-2000 decade. Due to the overvaluation of the national currency, export incentives were ineffective and this in turn depressed private sector activity. Ineffective import controls were detrimental to private sector by denying machinery, spare parts and raw materials to vital productive and export sectors. Indeed, substantial arrears on outstanding debts and uncertainty about government macroeconomic policies were other factors inhibiting private sector investment in Nigeria.

The Nigerian macroeconomic policy cannot be said to be stable over the 1970-2001 period. The trends of most relative prices such as real interest rate and real exchange rate indicated high volatility. The pre-SAP regime witnessed highly regulated macroeconomic policy environment while SAP-period is characterized by switching between regulation and deregulation and even to re-regulation of some key sectors of the economy. For instance, with the advent of SAP in 1986, domestic interest rates were deregulated. These rates were,

however, subject to CBN's moral suasion control and were later re-regulated in 1991 in the face of high real interest rates. It was discovered that the domestic real interest rates do not adequately represent the true cost of capital in the economy as they were arbitrarily fixed above the true cost of capital. This, perhaps might have led to the slow growth of the Nigerian economy as uncertainty surrounded virtually all the sectors of the economy. Indeed, before SAP, private investment has fallen to 2.0 per cent of GDP while it slightly increased to 7.2 per cent in 2001.

Given the present investment climate in Nigeria, private investment is still been poor. There existed lack of trust between public and private sector as regards macroeconomic policy implementation. Amidst turbulent economic and social conditions, the political logjams arising from June 12, 1993 imbroglio further worsened the confidence of private sector. Liberated from decades of military dictatorship, Nigeria ushered in a new administration in May 1999. The immediate attention of the new administration was the creation of a new economic and social order that would promote sustainable growth which is expected to come primarily from the private sector of the economy. The domination of the public sector was to be reversed, hence the privatization of the all sector of the Nigeria economy. The core of the economic reform policy has therefore been centred on the creation of conducive environment for private initiative to drive the growth process. The expectation of the new democratic government ushered in Nigeria is therefore the boom of the private sector investment, resulting from the liberalized environment.

The overwhelming of public investment from 1970 to 1985 can be attributed to government efforts to provide basic infrastructural facilities for rapid development of the Nigerian economy. However, the behaviour of private investment from 1986 which one would have expected to outweigh public investment shows a worrisome behaviour as it remained below public investment throughout the review period. Overall, the speed and strength of private sector response to reforms in Nigeria have not been satisfactory. Almost two decades of economic adjustment, all relevant macroeconomic indicators suggest that the recovery of private investment in Nigeria has been very weak and slow. Certainly, macroeconomic policies namely; monetary, fiscal and exchange rate, have bearing on the investment behaviour in Nigeria but the impact of these policies on private investment behaviour is still largely unclear. Furthermore, the investment climate in Nigeria has been discouraging, given the political instability imposed upon the country by incessant coup d'etat. This has made foreign investors to be less interested in investing in the Nigerian economy. The deregulation policy and privatization programme to motivate private sector carry out investment spendings could not easily encourage them as private investor operators are not sure of the next policy that will emanate in the wake of emergence of a new administration.

In general, response of the private sector have been weak over years. A number of factors may be responsible for this ugly situation. Among them is the weak state of the

Nigerian economy, measured by the level of income. Most economists are of the view that private investment and economic growth are entwined and mutually reinforcing. The causal relationship indicated by the correlation result shows a strong positive correlation of 0.98 exists between private investment and the level of income in the economy. This perhaps, explains why the level of low investment achieved during the adjustment period was rationalized on the blur growth prospect. Also, the uncertainty that surrounds most government policies requires more time to rebuild the confidence of private sector in the sustainability of the economic reforms. The irreversible nature of most investment projects could have accounted for slow response of the private sector. Private sector needs adequate information as regards investment projects so as not to commit themselves into unprofitable venture.

Among the auxiliary determinants is the public investment which has been recognized to be potentially important in private investment decision. On one hand, public investment may facilitate private investment if public and private investments are complementary. Also, in a direct relationship, public investment acts as a stimulant of private investment in Nigeria. Public investment as a proportion of GDP declined sharply during 1970-2001. Similarly, private investment share of GDP declined.

Also, availability of credits to the private sector has been identified in the economic literature as having positive impact on investment decision. The causal relationship indicated by the correlation result shows that strong positive correlation of 0.95 exists

between private investment and the level of credit available to private sector. However, credit ceilings usually being imposed on financial institutions' loan portfolios, made credits to the private sector very scarce. Today, the credit markets have been liberalized but high interest rates on government financial papers (treasury bills), which is usually used to mop up excess liquidity from the financial system, have crowded-out finance to private sector. Also, the negative real interest rate witnessed during the study period could have discouraged savings thus, limited available credit for investment activity and, consequently for private investment activity.

This, coupled with the rudimentary nature of the capital market partly explains why private investment in Nigeria has remained very poor despite abundant market reforms. In addition to these aforementioned issues is the distortion in the tax treatment of capital and investment income, particularly high capital gains tax and the withholding tax on dividends, acted as disincentive to new investment and may have retarded the necessary restructuring of many private enterprises.

Finally, many macroeconomic uncertainty factors have also combined to discourage investment in the economy. These include inflation, exchange rates, interest rates, growth rates, fiscal deficits, money supply and policy inconsistencies. For instance, inflation rates, fiscal deficits and interest rate have been high and volatile in the country. Also, the trend in foreign exchange values of Naira reveals a systematic depreciation in the value over the years. More remarkable is the highly volatile behaviour of this trend which is largely attributed to policy instability. Interest rates management has also been marked with policy

instability. This, therefore calls for the discussion on how macroeconomic policy uncertainty and aggregate private investment behaved in Nigeria during the period under investigation. This issue is examined extensively in chapter six.

5.4 Conclusion:

The important finding derived from both the nominal and real private investment trend analyses is that private investment behaviour of the Nigerian economy was highly unpredictable during the 1970-2001 period. It is, however, more unstable in real private investment than its nominal counterpart. Generally, lack of confidence in the sustainability of the government economic reforms and policy uncertainty were identified for this ugly investment performance of the private sector in Nigeria. Above all, macroeconomic policy environment has changed drastically and the issue of those factors responsible for sluggish response of private sector to reforms requires re-specification of the private investment model for Nigeria and see how irreversibility and macroeconomic uncertainty had contributed to the poor performance private investment. These issues will be addressed by the results of the econometric analysis presented in chapter six.

CHAPTER SIX

ANALYSIS OF AGGREGATE PRIVATE INVESTMENT IN NIGERIA

6.1 Introduction:

This chapter reports the econometric results of the effects of irreversibility, macroeconomic uncertainty and other identified investment determinants on aggregate private investment spendings in Nigeria. The private investment equation (4.11) of chapter four was estimated using logarithmic and growth rate values for both the nominal and real specifications. As regards the uncertainty measures, the study employed the conditional variance of ARCH process as specified in equation (4.12a - 4.12c) of chapter four. The ARCH process was applied to six macroeconomic policy variables which were inflation rates, exchange rates, interest rates, fiscal balance, money supply and income growth series. Both annual and quarterly series were also employed in the estimation process for the period between 1970-2001. The unit root test results are presented in section 6.2 while cointegration results are reported in section 6.3. Section 6.4 presents the Error Correction Modelling results of aggregate private investment spendings in Nigeria while section 6.5 interprets the results of the estimated aggregate private investment models.

6.2 Analysis of Unit Root Test Results:

Following the steps suggested in section 4.3, the time series property of all variables which appear in the private investment model were investigated. The Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were employed to all the variables of interest. The unit root tests performed considered both the null hypothesis of a random walk with a constant drift and a random walk with a constant drift and trend term. As regards ADF tests, the optimal lag length was chosen by using the Final Predictive Errors (FPE) statistic. As for quarterly series, four lags were sufficient to make error term in the ADF test to be white noise while a single lag was employed for annual series. The results of the unit root tests are reported in Table 11 and Table 12.

All measures of macroeconomic uncertainty, real interest rates and irreversibility series were found to be stationary at levels. They were, indeed, I(0) series. Also, results obtained for nominal and real growth rates of all variables in Table 11 clearly confirmed that the variables are, indeed, I(0) series. For instance, growth rates of private investment, public investment and GDP series achieved stationarity at 5 per cent significant level for DF, ADF and PP tests while growth rates of credit to private sector, debt and debt service achieved stationarity at 1 per cent significant level for all tests performed. In fact, the results reported in Table 11 show that the reported t-statistics of all the six macroeconomic uncertainty proxies (inflation rates, exchange rates interest **Table 11: Unit Root Test Results for Annual Series in Levels.**[10]

[10] Except for the growth rate, all series are measured in logarithmic form. Definitions of series are as defined in Appendix A.

Series	DF		ADF		Phillips-Perron	
Nominal	Untrended	Trended	Untrended	Trended	Untrended	Trended
npinv	-0.8496	-1.5028	-0.5233	-2.2787	-0.8873	-1.9658
nginv	-0.7925	-1.4242	-0.6644	-1.8238	-0.8057	-1.7725
ngdp	-0.4778	-1.2755	-0.5317	-1.6696	-0.4985	-1.6899
nint	-1.2208	-2.3309	-1.0312	-1.9965	-1.1217	-2.3977
cp	-0.7279	-1.5695	-0.4743	-1.8119	-0.6620	-1.8991
db	-0.3402	-1.8462	-0.5212	-1.6898	-0.3056	-1.9009
irr	-2.9350	-3.3377	-2.8074	-3.4397	-2.9546	-3.2397
npinv%	-2.7769	-3.3619	-4.1046	-4.3299	-2.8322	-3.3995
nginv%	-2.7769	-3.3619	-4.1046	-4.3299	-2.8322	-3.3995
ngdp%	-4.4345	-4.3451	-2.9648	-3.8819	-4.5162	-4.4335
cp%	-4.2193	-4.1671	-2.7690	-3.2208	-4.2976	-4.2540
db%	-5.8825	-5.7769	-4.5982	-4.4863	-6.0037	-5.8751
ds%	-5.8049	-5.7963	-3.9762	-3.9586	-5.8077	-5.7976
Real						
rpinv	-2.4797	-2.5986	-3.2676	-3.3377	-2.7366	-2.7801
rginv	-2.4123	-2.4452	-2.9148	-3.2709	-2.5844	-2.5506
rgdp	-1.5803	-1.8612	-0.8402	-1.4574	-1.7503	-2.2044
rint	-3.6540	-3.6432	-4.3998	-4.3657	-3.5341	-3.5156
rpinv%	-3.2740	-3.2760	-3.9223	-3.8765	-3.0749	-3.8861
rginv%	-4.2507	-4.3227	-3.7187	-3.7737	-4.1497	-4.2225
rgdp%	-4.8926	-4.7505	-4.1572	-3.9151	-4.8935	-4.7515

Uncertainty						
Uinf	-6.0204	-6.3025	-3.0268	-3.6432	-6.0111	-6.2633
Uexr	-5.4878	-5.6736	-3.7814	-4.0274	-5.4873	-5.7018
ULm2	-3.4402	-3.6088	-4.1730	-4.5401	-3.3168	-3.4276
ULm2%	-4.5158	-4.8231	-3.1378	-3.5703	-4.5179	-4.7847
Ufb	-2.6513	-3.2147	-3.3662	-4.2264	-2.7089	-3.2438
Ufb%	-5.7934	-6.4767	-2.6486	-3.4366	-5.8472	-6.4043
Ungdp%	-4.7834	-4.8902	-3.8672	-4.3499	-4.7719	-4.8587
Urdgp%	-5.4940	-5.8566	-3.7914	-4.3218	-5.4967	-5.9118
Unint	-54.3994	-57.6562	-2.8960	-3.4304	-35.5196	-39.5604
Urint	-5.9750	-6.1678	-3.0597	-3.2930	-5.9607	-6.1465
Level of significance	MacKinnon critical t-values for rejection of hypothesis of a unit root					
1%	-3.6576	-4.2826	-3.6661	-4.2949	-3.6576	-4.2826
5%	-2.9591	-3.5614	-2.9627	-3.5670	-2.9591	-3.5614
10%	-2.6181	-3.2138	-2.6200	-3.2169	-2.6181	-3.2138
n	31	31	30	30	31	31

Source: Estimates from PC-GIVE Econometric Package

Table 12: Unit Root Test Results for Annual Series at First Difference.

Series	DF		ADF		Phillips-Perron	
Nominal	Untrended	Trended	Untrended	Trended	Untrended	Trended
∆npinv	-3.2243	-3.2583	-3.0469	-3.3280	-3.1403	-3.3308
∆nginv	-4.0779	-4.0097	-2.8751	-3.2879	-4.0878	-4.3230
∆ngdp	-4.0290	-3.9572	-2.6886	-3.5146	-4.1198	-4.0557
∆nint	-6.3961	-6.2796	-5.2354	-5.1332	-6.4529	-6.3314
∆cp	-4.0709	-4.0046	-2.9675	-3.6610	-4.1811	-4.1190
∆db	-5.4977	-5.3891	-4.0835	-3.9947	-5.5237	-5.4065
Real						
∆rpinv	-3.3649	-3.2741	-3.9901	-3.9096	-3.1949	-3.2809
∆rginv	-4.0737	-4.0646	-3.6274	-3.6512	-3.9604	-3.9461
∆rgdp	-5.4958	-5.3690	-3.3613	-3.8010	-5.4828	-5.3673
Level of significance	MacKinnon critical values for rejection of hypothesis of a unit root					
1%	-3.6661	-4.2949	-3.6752	-4.3082	-3.6661	-4.2946
5%	-2.9627	-3.5670	-2.9665	-3.5731	-2.9627	-3.5670
10%	-2.6200	-3.2169	-2.6220	-3.2203	-2.6200	-3.2169
n	30	30	29	29	30	30

Source: Estimates from PC-GIVE Econometric Package

rates, GDP growth rate, money supply growth rate and budget deficit uncertainty), real interest rates, irreversibility series and growth rates of all variables are smaller than the 5 per cent MacKinnon critical t-values of -2.9591 and -3.5614 for DF and PP tests and -2.9627 and -3.5670 for ADF test of the untrended and trended series respectively. The implication of I(0) results is that the levels, rather than first difference values, of the series should be employed in modelling private investment. Hence, spurious inferences can be avoided with the use of OLS techniques for estimating private investment model using growth rates of variables identified.

Using DF test, all nominal and real variables (measured in natural logarithmic form) reported in Table 11 were regarded as non-stationary at their levels since each reported t-statistic was not smaller than the 10 per cent MacKinnon critical t-values of -2.6181 and -3.2138 for the untrended and trended series respectively. Again, using ADF for both untrended and trended, the null hypothesis of non-stationary is accepted for the same set of variables identified as non-stationary under DF test. The ADF critical t-values were respectively -2.6200 and -3.2169 for the untrended and trended series at 10 per cent significant level. The non-stationarity of these variables were also confirmed by the PP test results in Table 11 as the 10 per cent MacKinnon critical t-statistics of -2.6181 and -3.2138 respectively for untrended and trended series were lower than the reported t-values of the series in levels. In general, the results of unit root tests as shown in Table 11 are consistent with the presence of a unit root in all the variables of interest (measured in logged form)

indicating that they are non-stationary at levels[11]. These variables are, therefore, not regarded as I(0) series and they include both the nominal and real private investment, public investment, income, nominal interest rates, credit to private sector, debt and debt service series. The inclusion of the levels of these variables in private investment regression may, therefore, yield spurious results.

This result of non-stationarity of series in levels was followed by testing whether first differences would make the series stationary. In other words, the null hypothesis that the variables are I(1) was tested and the results of these tests were reported in Table 12. The results, however, confirm that differencing only once was all that was required to make these series achieve stationarity. Indeed, all series were confirmed to be stationary at first difference given the DF, ADF and PP tests results in Table 12. Specifically, both real and nominal private investment, public investment, income, credit to private sector, debt as well as nominal interest rates series achieved stationarity at first difference. The MacKinnon critical t-statistics showed that they were stationary at 1 per cent for DF and PP tests with -3.6661 and -4.2949 for untrended and trended respectively while stationary could only be achieved at 5 per cent significant level for ADF test with -2.9665 and -3.5731 for untrended and trended respectively. Thus, the variables are regarded as I(1) series implying that adequate and reliable results can only be achieved if first differencing, rather than levels, of these variables are employed in aggregate private investment modelling.

6.3 Analysis of Cointegration Test Results:

[11] Similar results were also confirmed by the unit root tests for the quarterly series. (See Appendix

Following the findings in section 6.2 that most variables of interest are of I(1) series, except for uncertainty and real interest rates series, Engle and Granger two-step approach was then employed in order to search for any possible cointegration among these variables. This was conducted by the estimation of the long run relation of private investment spendings by Ordinary Least Square (OLS) techniques and tested for stationarity of the residuals. The basic idea here is that the equality in the long run relationship between private investment and its determinants gives a stationary error. Again, DF, ADF and PP tests were employed to test for cointegrated variables. The results of bivariate cointegration tests for DF and ADF only are, however, reported in Table 13.

Given the bivariate Cointegration Regression t-statistics for DF and ADF, all the bivariate series reported in Table 13 were said to be cointegrated. Indeed, all the bivariate series were cointegrated given the 1 per cent DF critical t-value of -2.6395. Also, all these bivariate series were cointegrated given the 5 per cent ADF critical t-value of -2.6423. The results indicate that there existed a long run relationship between private investment series and each of the identified determinants namely; public investment, income, real interest rate, private sector credit and debt series. The implication of this cointegration result is that the deviations from the long run path are stationary. The

Table 13: Cointegration Test Results for Annual Bivariate Series.[12]

B1 and B2)

[12] ":" implies that cointegration is symmetric so that if y is cointegrated with x, then x will be

Nominal Variables	DF	ADF	Real Variables	DF	ADF
npinv↔nginv	-3.2609	-4.3144	rpinv↔rginv	-3.5825	-4.5815
npinv↔ngdp	-3.1048	-3.8857	rpinv↔rgdp	-3.5086	-4.5685
npinv↔rint	-3.1982	-2.9988	rpinv↔rint	-2.9293	-3.2002
npinv↔cp	-3.0338	-2.7161	rpinv↔cp	-3.1374	-3.8274
npinv↔db	-3.2017	-3.2128	rpinv↔db	-3.1115	-3.7085
npinv↔ds	-3.2188	-3.3325	npinv↔ds	-3.0695	-3.9866
npinv↔irr	-3.2426	-3.0229	rpinv↔irr	-3.4341	-4.5985
npinv↔uinf	-3.4722	-3.3484	rpinv↔uinf	-3.1771	-3.4497
npinv↔uexr	-3.1754	-3.0964	rpinv↔uexr	-3.0237	-4.0391
npinv↔unint	-2.8222	-3.0698	rpinv↔urint	-3.2346	-3.8847
npinv↔ugdp%	-3.2301	-3.2114	rpinv↔urgdp%	-3.3017	-3.6777
npinv↔ums%	-3.2789	-3.0911	rpinv↔ums%	-3.1219	-3.8419
npinv↔ufb%	-3.1356	-3.0838	rpinv↔ufb%	-3.1073	-3.8076
Level of significance	MacKinnon critical t-values for rejection of hypothesis of a unit root				
1%	-2.6395	-4.5465		-2.6395	-4.5465
5%	-1.9521	-2.6423		-1.9521	-2.6423
10%	-1.6241	-1.6216		-1.6241	-1.6216
N	30	29		30	29

cointegrated with y.

results in Table 13 also confirm cointegration between private investment and all uncertainty indicators at 5 per cent Mackinnon critical t-value for DF and ADF[13].

In the case of private investment function, the model is multivariate and there may exist multiple cointegrating vectors linking private investment and some or all of its explanatory variables. The null hypothesis tested is that there was no cointegrating vector. As the hypothesis was rejected, additional cointegrating vector was then sequentially tested for. The results of the multivariate cointegration regression tests are reported in Table 14. However, Table 14 only presents results of regressing natural log of nominal and real private investment on public investment, income, real cost of capital, credit to private sector, debt service, irreversibility and macroeconomic uncertainty indicators.

The results of applying the formal DF and ADF tests for detecting a unit root in the residuals series are shown in the lower part of Table 14. Only models that include all series in which DF and ADF tests confirmed stationarity of the residuals are taken to be cointegrated and, therefore, reported in Table 14. When irreversibility and uncertainty measures were included, the unit root test results indicate evidence of cointegrating vector. The DF and ADF critical t-values for detecting a unit root in the residual series of private investment regressions are shown in the last two rows respectively while the coefficient of determinations (R5) are reported in the 3rd row to the last. Given the 5 per Table 14: Cointegration Test Results for Annual Multivariate Series.

[13] Phillips-Perron critical t-values are the same with DF t-statistics.

	Nominal private investment			Real private investment		
VAR	pinv (1)	pinv (2)	pinv (3)	pinv (4)	pinv (5)	pinv (6)
con	-1.5427	-1.3722	-0.9983	-9.5726	-9.0049	-8.5573
ginv	0.9527	0.9087	0.9378	0.9528	0.9695	0.9521
gdp	0.1138	0.1801	0.0951	0.8415	0.8073	0.8856
rint	0.0079	0.0079	0.0082	0.0076	0.0077	0.0075
cp	0.1600	0.1525	0.1096	-0.1663	0.0042	-0.1807
ds	-0.0702	-0.0515	0.0581	0.0691	0.0741	0.0771
irr	0.2412	0.2553	0.2796	0.1447	0.1464	0.1504
uinf	-0.0009					
uexr				0.0029		
uint					0.0001	
ugdp		-0.0002				
ums						-0.0189
ufb			-0.0150			
R5	0.98	0.97	0.98	0.82	0.83	0.84
DF	-4.8012**	-4.9253**	-4.8800**	-5.0349***	-5.2104***	-4.9836**
ADF	-4.5465**	-4.3913**	-5.0494***	-6.2499***	-6.0522***	-5.7526***

*** indicates significance at 1% level

** indicates significance at 5% level

* indicates significance at 10% level

cent critical t-values of -4.5213 and -4.3012 for DF and ADF respectively, the results in Table 14 indicate that private investment indeed cointegrates with all the series and therefore there existed a linear combination between private investment and all the time series employed. Hence, private investment cointegrates with public investment, income, real cost of capital, credit to private sector, debt service, irreversibility and macroeconomic uncertainty indicators.

6.4 Analysis of Error Correction Modelling Results:

In order to have a first indication of the magnitude of the effects of irreversibility and macroeconomic uncertainty variables on private investment, an approach similar to Pindyck and Salimano (1993) was applied to Nigerian annual time series. The results of private investment and uncertainty relationships, as well as the correlation matrix, are presented in Table 15 and Table 16 for nominal and real models respectively. The results of the estimated ECM model with full annual sample are reported in Table 17 for nominal private investment model while Table 18 reports results of its real counterpart. For the quarterly series, the results are similar to that of its annual counterpart which are, however, reported in Appendix C1 and C2. The results for growth rates of series were not reported as they produced estimates that were not supported by theory as regards magnitudes and signs of explanatory variables.

The results in the upper parts of Table 15 and Table 16 clearly show that all uncertainty variables bear the negative signs. The only exception are the interest rates and money supply growth rates uncertainties, whose current values bear positive signs but both are statistically insignificant at 10 per cent level. The correlation matrix results at the lower part of Table 15 and Table 16 also indicate a negative association between private investment and most uncertainty proxies with the exception of fiscal balance uncertainty which bears positive correlation with real private investment series. In general, the econometric results reported in Table 15 and Table 16 reveal a significant negative effect of measures of macroeconomic uncertainty on private investment without other standard investment determinants. Indeed, given the 5 per cent level of significance, inflation and exchange rates uncertainties are significant at their current levels for both the nominal and real models. Interest rates uncertainty is only significant at lagged levels while GDP growth rates uncertainty is only significant at 5 per cent for real model. Inflation rates uncertainty is, however, significant at both the current and lagged levels for real model. The correlations between the private investment and each measure of uncertainty series is not high in both the nominal and real models. There is no indication of autocorrelation among the uncertainty series as shown in the correlation matrices in Table 15 and Table 16. This result, therefore, indicates that each uncertainty proxy measures different dimension of uncertainty as all the six uncertainty effects could be disentangled from one another as shown by the small correlation values between them.

Table 15: Modelling Nominal Private Investment Growth Rate (NPINV%) by OLS

The Sample is 1970 to 2001 less 0 Forecasts

VARIABLE		COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
NPINV%	1	.6952064***	.18962	.21364	3.66629	.4898
CONSTANT		1363.0141212**	655.49632	389.83174	2.07936	.2360
uinf		-.3667919**	.16903	.20070	-2.17001	.2517
uinf	1	-.0504530	.13302	.11951	-.37930	.0102
uexr		-7.3912001**	3.45142	2.26899	-2.14149	.2467
uexr	1	-.6024919	1.40916	1.07566	-.42755	.0129
ulms		-2.2582309	13.23558	10.13078	-.17062	.0021
ulms	1	-7.8137028	13.60681	14.06429	-.57425	.0230
uint		6.0945990*	2.06386	1.13449	1.55301	.2838
uint	1	-10.2416497**	5.12952	3.49705	-1.99661	.3216
ugdp		-.0980765	.07418	.06210	-1.32217	.1110
ugdp	1	-.0350994	.07573	.07196	-.46347	.0151
lufb		-1.3398414	20.80113	9.49499	-.06441	.0003
lufb	1	-14.6210279	21.21458	10.34208	-.68920	.0328
irr		-16.3087457	20.06293	17.98323	-.81288	.0451
irr	1	24.4616498	16.86574	15.61057	1.45038	.1306

R^2 = .6869874 σ = 29.4068035 F(15, 14) = 2.05 [.0941] DW = 1.523
RSS = 12106.6412734250 for 16 Variables and 30 Observations
Information Criteria: SC = 7.81; HQ = 7.31; FPE = 1325.97
R^2 Relative to DIFFERENCE+SEASONALS = .73954

*** indicates significance at 1% level
** indicates significance at 5% level
* indicates significance at 10% level

CORRELATION MATRIX

	NPINV%	uinf	uexr	ulms	uint	ugdp	ufb	irr
NPINV%	1.0000							
uinf	-.2192	1.0000						
uexr	-.1850	.1665	1.0000					
ulms	-.2023	-.0354	.1766	1.0000				
uint	-.2221	-.0326	-.0453	-.1235	1.0000			
ugdp	-.1254	-.2665	.1930	-.0193	-.0434	1.0000		
ufb	-.0320	-.1366	.0739	.0392	.0821	.0627	1.0000	
irr	.2847	.3177	.2602	.2656	-.1971	-.0902	.0620	1.0000

Table 16: Modelling Real Private Investment Growth Rate (RPINV%) by OLS

The Sample is 1971 to 2001 less 0 Forecasts

VARIABLE		COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
RPINV%	1	.7056948***	.19218	.23397	3.67208	.4734
CONSTANT		1752.8050837**	689.17716	534.52376	2.54333	.3013
uinf		-.4420852**	.17688	.23132	-2.49930	.2940
uinf	1	-.2063689*	.13445	.10610	-1.63489	.1357
uexr		-7.7219772**	3.60893	3.76501	-2.13968	.2338
uexr	1	-2.2035587*	1.45351	1.15992	-1.51602	.1329
ulms		1.4261541	13.72905	9.75531	.10388	.0007
ulms	1	-10.6141234	14.04421	15.23792	-.75576	.0367
uint		3.9376835	2.15565	2.12811	1.42668	.1220
uint	1	-8.4336836*	5.31323	5.99017	-1.68730	.1938
ugdp		-.1533796**	.07533	.08048	-2.03603	.2165
ugdp	1	-.1140030	.07782	.06444	-1.46491	.1252
lufb		-2.8339307	21.46951	8.70987	-.13200	.0012
lufb	1	-14.7822193	21.85007	10.28331	-.67653	.0296
irr		-4.5638476	20.05985	18.70815	-.22751	.0034
irr	1	23.7533193	17.24938	15.69931	1.37705	.1122

R^2 = .6079995 σ = 30.4532795 F(15, 15) = 1.55 [.2025] DW = 1.671
RSS = 13911.0334932303 for 16 Variables and 31 Observations
Information Criteria: SC = 7.88; HQ = 7.38; FPE = 1406.06
R^2 Relative to DIFFERENCE+SEASONALS = .62196

*** indicates significance at 1% level
** indicates significance at 5% level
* indicates significance at 10% level

CORRELATION MATRIX

	RPINV%	uinf	uexr	ulms	uint	ugdp	Lufb	irr
RPINV%	1.0000							
uinf	-.0751	1.0000						
uexr	-.0537	.1665	1.0000					
ulms	-.0755	-.0354	.1766	1.0000				
uint	-.0246	-.0326	-.0453	-.1235	1.0000			
ugdp	-.1698	-.2665	.1930	-.0193	-.0434	1.0000		
ufb	.0309	-.1292	.0798	.0806	.0761	.0655	1.0000	
irr	.1312	.3177	.2602	.2656	-.1971	-.0902	.0897	1.0000

The results of ECM models reported in Table 17 and Table 18 clearly show a well-defined error correction term (ECM) which indicates a feedback of unity of the past level's disequilibrium from the long run elasticity of private investment. The implication of this is that income, user cost of capital, public investment, credit to private sector, debt and uncertainty variables maintain private investment equilibrium through time. The effect of these "disequilibrium" error corrections are not only large but also have a negative sign as expected. The strong significance of the coefficient of lagged-ECM supports the earlier assertion that private investment variables and all the standard private investment determinants are indeed cointegrated. The coefficient of determination (R5) is as high as 0.86 for nominal model while it is as high as 0.90 for real model. F-statistics for the models also show that the private investment series and its determinants are linearly related. Indeed, the overall explanatory powers of the models are high. The Durbin-Watson (DW) statistics also show no evidence of autocorrelation. Thus, the conclusions drawn from the analysis are expected to be reliable.

A look at the results in Table 17 indicate that the current level of public investment ($GINV_t$) has a significant positive coefficient while its lagged value ($GINV_{t-1}$) bears a significant negative coefficient in all nominal models. The positive effect of the current value, however, outweighs the negative effect of its lagged value. Similar results are also reported in Table 18, except that only the coefficients of current public investment are positive and significant while its lagged value bears insignificant negative effect on private investment. In the reported results, current and lagged public investment

Table 17: Modelling Nominal Private Investment (△NPINV) by OLS

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
$\Delta PINV_{t-1}$	1.01 (4.97)***	0.80 (4.89)***	0.97 (4.67)***	1.06 (4.36)***	1.02 (4.99)***	0.98 (4.56)***
CONSTANT	0.49 (0.65)	-0.68 (1.05)	0.05 (0.20)	0.24 (0.90)	0.49 (1.35)	0.09 (0.32)
$\Delta GINV_t$	0.75 (3.72)***	0.54 (3.57)***	0.56 (4.01)***	0.50 (3.40)***	0.53 (3.59)***	0.49 (3.19)***
$\Delta GINV_{t-1}$	-0.42 (2.14)**	-0.36 (2.01)**	-0.09 (0.49)	-0.25 (1.28)	-0.31 (1.87)*	-0.33 (1.86)*
ΔGDP_t	-0.30 (1.18)	0.24 (0.82)	-0.28 (0.89)	0.37 (1.28)	0.32 (1.17)	-0.45 (1.68)*
ΔGDP_{t-1}	0.92 (2.72)**	0.96 (2.64)**	0.58 (1.78)*	0.95 (2.55)**	0.55 (1.29)	0.97 (2.68)**
$RINT_t$	0.006 (2.34)**	0.008 (3.06)***	0.009 (3.12)***	0.007 (2.65)**	0.008 (3.05)***	0.008 (2.10)**
$RINT_{t-1}$	-0.009 (2.93)***	-0.011 (3.10)***	-0.010 (3.53)***	-0.008 (2.97)***	-0.009 (3.09)***	-0.009 (2.62)**
ΔCP_t	-0.03 (0.09)	0.04 (0.12)	-0.39 (1.03)	0.04 (0.12)	-0.13 (0.39)	-0.05 (0.15)
ΔCP_{t-1}	0.31 (1.94)*	0.25 (1.80)*	-0.12 (0.31)	0.21 (0.64)	0.29 (1.96)*	0.12 (0.38)
$\Delta DEBT_t$	0.10 (0.84)	-0.07 (0.57)	0.05 (0.43)	-0.005 (0.05)	-0.009 (0.08)	0.02 (0.21)
$\Delta DEBT_{t-1}$	-0.08 (1.89)*	-0.14 (1.66)*	-0.08 (1.97)*	-0.11 (1.69)*	-0.10 (1.98)*	-0.18 (1.80)*
IRR_t	-0.06 (0.60)	-0.09 (0.80)	-0.008 (0.06)	-0.10 (0.92)	-0.06 (0.59)	-0.04 (0.40)
IRR_{t-1}	-0.05 (0.53)	-0.06 (0.62)	0.02 (0.21)	-0.12 (0.14)	-0.05 (0.51)	-0.05 (0.46)
$UINF_t$	0.0001 (0.15)					
$UINF_{t-1}$	-0.0015 (1.67)*					
$UEXR_t$		0.29 (1.15)				
$UEXR_{t-1}$		-0.31 (1.76)*				
$UINT_t$			0.002 (1.01)			
$UINT_{t-1}$			-0.015 (2.01)**			
$UMS\%_t$				0.06 (0.57)		
$UMS\%_{t-1}$				-0.07 (1.76)*		

$UGDP\%_t$					-0.0005 (1.68)*	
$UGDP\%_{t-1}$					0.0001 (0.19)	
UFB_t						0.00002 (0.53)
UFB_{t-1}						-0.00005 (1.75)*
ECM_{t-1}	-0.99 (3.71)***	-0.95 (3.78)***	-0.97 (3.45)***	-0.94 (3.62)***	-0.89 (3.64)***	-0.86 (3.53)***
R^2	0.84	0.84	0.86	0.83	0.85	0.83
F-Ratio	4.41(0.047)	4.25(0.006)	5.10(0.003)	4.04(0.007)	4.54(0.004)	4.04(0.007)
σ	0.1683	0.1718	0.1589	0.1754	0.1671	0.1754
DW	1.89	1.91	2.05	2.20	1.86	1.95

Absolute t-values are in parentheses below each coefficient

*** indicates significance at 1% level

** indicates significance at 5% level

* indicates significance at 10% level

Table 18: Modelling Real Private Investment (ΔRPINV) by OLS

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
$\Delta PINV_{t-1}$	0.83 (3.70)***	0.67 (3.14)***	0.78 (3.27)***	0.76 (2.67)**	0.61 (2.52)**	0.68 (3.11)***
CONSTANT	0.57 (1.18)	-0.56 (0.72)	-0.34 (1.26)	-0.03 (0.09)	0.45 (1.03)	0.08 (0.24)
$\Delta GINV_t$	0.55 (3.19)***	0.43 (2.47)**	0.32 (2.45)**	0.53 (2.63)**	0.41 (2.32)**	0.44 (2.52)**
$\Delta GINV_{t-1}$	-0.51 (2.41)**	-0.34 (1.56)	0.02 (0.13)	-0.29 (1.17)	-0.30 (1.41)	-0.31 (1.47)
ΔGDP_t	-0.01 (0.01)	0.21 (0.34)	-0.26 (0.55)	0.32 (0.47)	0.24 (0.38)	0.26 (0.42)
ΔGDP_{t-1}	0.14 (0.25)	0.31 (0.48)	0.87 (1.86)*	0.46 (0.65)	0.86 (1.71)*	0.44 (0.72)
$RINT_t$	0.003 (1.17)	0.007 (2.26)**	0.008 (3.09)***	0.006 (1.98)**	0.006 (1.99)**	0.006 (1.93)**
$RINT_{t-1}$	-0.005 (1.69)*	-0.008 (2.41)**	-0.012 (5.63)***	-0.007 (2.06)**	-0.007 (2.39)**	-0.007 (2.20)**
ΔCP_t	-0.20 (1.60)	-0.14 (0.37)	-0.38 (0.97)	-0.15 (0.33)	-0.27 (0.70)	-0.25 (0.64)
ΔCP_{t-1}	0.30 (1.69)*	-0.20 (0.52)	0.82 (2.36)**	0.08 (0.19)	0.14 (0.38)	0.02 (0.06)

$\Delta DEBT_t$	0.024 (0.58)	0.09 (0.62)	0.07 (0.54)	0.17 (1.35)	0.02 (0.16)	0.15 (1.27)
$\Delta DEBT_{t-1}$	-0.29 (2.18)**	-0.10 (0.72)	-0.25 (2.23)**	-0.04 (0.36)	-0.10 (0.89)	-0.09 (0.78)
IRR_t	-0.007 (0.07)	-0.040 (0.34)	0.01 (1.06)	-0.02 (0.17)	-0.086 (0.78)	-0.004 (0.03)
IRR_{t-1}	0.17 (1.32)	0.004 (0.03)	0.12 (1.12)	0.07 (0.46)	-0.014 (0.12)	0.036 (0.28)
$UINF_t$	-0.003 (0.29)					
$UINF_{t-1}$	-0.0024 (2.15)**					
$UEXR_t$		0.15 (0.92)				
$UEXR_{t-1}$		-0.24 (1.69)*				
$UINT_t$			0.007 (1.07)			
$UINT_{t-1}$			-0.03 (4.35)***			
$UMS\%_t$				-0.04 (0.32)		
$UMS\%_{t-1}$				-0.009 (0.08)		
$UGDP\%_t$					-0.0005 (1.80)*	
$UGDP\%_{t-1}$					0.0001 (0.36)	
UFB_t						0.00005 (0.17)
UFB_{t-1}						-0.00002 (0.94)
ECM_{t-1}	-0.98 (4.00)***	-0.92 (3.78)***	-0.96 (3.52)***	-0.90 (3.01)***	-0.86 (2.94)**	-0.88 (3.04)***
R^2	0.86	0.89	0.90	0.88	0.85	0.86
F-ratio	4.99(0.003)	3.56(0.013)	7.69(0.0003)	2.95(0.028)	4.48(0.005)	3.67(0.011)
σ	0.1814	0.2090	0.1420	0.2253	0.1899	0.2065
DW	2.10	1.96	1.97	2.12	2.02	2.10

Absolute t-values are in parentheses below each coefficient

*** indicates significance at 1% level

** indicates significance at 5% level

* indicates significance at 10% level

variables ($GINV_t$ and $GINV_{t-1}$) are significant at 1 per cent and 5 per cent in the nominal private investment equations respectively but only significant at 5 per for current value ($GINV_t$) in the real models. This implies that public sector concentrated on investment projects that are complementary to that of private investment.

Also, notable is the cost of capital variable as provided by Jorgenson which the results of this study have found its coefficient to be significant. The measure of user cost of capital, proxied by real interest rate (RINT), has the expected negative sign for its lagged level ($RINT_{t-1}$) while it possesses positive sign on its current level ($RINT_t$). The negative lagged effect marginally outweighs the positive current effect for nominal models. The positive effect of current level, on the other hand, outweighs the negative lagged effect in the real private investment models. Both positive and negative effects are significant at 1 per cent level for the real models while both effects are significant at 5 per cent for its nominal counterparts. It follows, therefore, that lower real costs of capital stimulate private investment while higher costs discourage private investors.

The coefficient of income variable indicates that lagged income (GDP_{t-1}) variable bears the right positive sign and statistically significant at 5 per cent and 10 per cent level for nominal and real models respectively. The coefficient of the current income variable (GDP_t) bears insignificantly negative sign in some nominal and real models. The results, therefore, confirm the significance of income variable as one of the determinants of investment in Nigeria. Also, lagged private investment ($PINV_{t-1}$) was found to be positive and highly

significant in both real and nominal models. Thus, the investment climate, measured by past investments, constitutes a good indicator for current private investment decision in Nigeria. The coefficient of the lagged private investment ($PINV_{t-1}$) is statistically significant at 1 per cent level and the coefficient values lies between 1.0 and 1.2 for nominal models while it lies between 0.6 and 0.9 for real models.

The effect of private sector (CP) credit is mixed. For instance, the coefficient of lagged credit to the private sector (CP_{t-1}) bears a positive sign which is significant at 10 per cent in some nominal models and insignificant in some others. For its real counterpart, the sign is also mixed. While most lagged values (CP_{t-1}) possess positive signs, the coefficients of the current levels are negative but insignificant in all the nominal and real models while its lagged levels (CP_{t-1}) are significant in some nominal models. This implies that it takes some times before the availability of credit to private sector impact positively on private investment spendings. The result in general strongly support the claim that the problem of getting credit by private sector is a major hindrance to private investment in Nigeria. The Nigerian monetary sector should encourage investment for economic growth. Evidence shows that financial savings must be strongly stimulated in order to enhance availability of credits which would translate to higher levels of investment. It is the ability of the financial system to effectively and efficiently mobilize resources as well as create adequate credit facilities that encourage investment from private sector.

As regards the effect of debt on private investment, the lagged value of debt variable

($DEBT_{t-1}$) has the correct negative sign which is significant at 10 per cent level. The coefficient of its current level ($DEBT_t$) is positively signed but insignificant in all real and some of the nominal models. The positive sign of the coefficient of current debt variable ($DEBT_t$) in real model is contrary to the results obtained for most research studies on African countries. However, the results of most real models indicate that the current value of debt variable ($DEBT_t$) is insignificant at all. The lagged level of debt variable ($DEBT_{t-1}$) was negatively related to private investment but also insignificant.

The results in Table 17 and Table 18 indicate that macroeconomic policy uncertainty is a major obstacle to investment. However, for some individual components of the overall measure of uncertainty, inflation rates uncertainty (UINF) and interest rates uncertainty (UINT) have negative sign and both are significant at the 10 per cent level for both the nominal and real models. The significance of these uncertainty measures come only at the lagged levels ($UINF_{t-1}$ and $UINT_{t-1}$). Quite remarkable is the effect of inflation rate uncertainty (UINF) on private investment. For the results in Table 17, larger inflation rate uncertainty results in lower private investments in Nigeria. While fiscal balance uncertainty (UFB) and money supply uncertainty (UMS%) have mixed signs, both are not significant in both the nominal and real models. The income growth rate uncertainty (UGDP) is only significant at 10 per cent in nominal models while it is insignificant in all real models. The volatility of money supply growth series (UMS%) bears the least influence on private investment while inflation and income growth rates uncertainties (UINF and UGDP) bear the most significant negative effect on the nominal and real private investment. The

volatility of the nominal interest rates (UINT) has a significant negative effect on private investment which is in line with the most existing results. The results are, however, mixed with short-term rates indicating a negative effect and long-term rates indicating the opposite effect.

The coefficient of lagged exchange rates volatility ($UEXR_{t-1}$) has a negative sign and significant in both nominal and real models. The coefficient of current exchange rates volatility ($UEXR_t$) is, however, insignificant in both nominal and real models. The significance of the coefficient of lagged exchange rate volatility ($UEXR_{t-1}$) is the most serious type of uncertainty. This may, however, be due to the fact that in the past the exchange rates were currently depreciating at an alarming rate and therefore causing a lot of concern for private investors.

The result indicates that, no matter how uncertainty is defined, uncertainty matters a lot and it is a serious obstacle to private investment decisions. Indeed, it may matter so much as to render insignificant some of the traditional determinants of investment, such as the user cost, interest rate, debt level and profitability. It is, however observed that individual measure of macroeconomic uncertainty may (not) be powerful investment obstacle but, private investment is dampened by overall macroeconomic uncertainty.

The assessment of the impact of irreversibility (IRR) or, more generally, non-convex adjustments costs indicated its role in determining the current level of private investment expenditures. The irreversibility measure is the difference between the discounted yield and

the risk-adjusted market interest rate and enters the aggregate private investment model. The results obtained show that irreversibility has affected private investment decisions negatively and thus irreversibility lowered private investment spendings in Nigeria. That is, the results clearly indicate that there is reluctance on the part of private sector as regards investment spendings. The reluctance to invest is characterized by a difference between the discount rate guiding investment decisions and the Jorgenson user cost of capital. The negative sign of irreversibility measure (IRR), even though not significant, indicates that a combination of factors such as low growth and high uncertainty (which implies occasional large negative shocks) usually tend to push private sector toward the zone of inaction. The result implies that irreversibility may affect the timing of private sector investment decisions thereby reducing private investment spending in the short run.

6.5 Interpretation of Results:

It was found that private investment, public investment, income, credit to private sector and debt series were non-stationary and they were in fact, I(1) series while real interest rates and uncertainty indicators were all I(0) series. The results also showed that public investment, income, real interest rates, credit to private sector, debt and uncertainty series cointegrated with private investment series. This indicated that public investment, income, real interest rates, credit to private sector, debt and uncertainty series maintained the private investment equilibrium through time.

It was also confirmed in Table 19 that a 1 per cent increase in income (GDP) would lead to about 0.5 per cent increase in private investment (PINV) while a 1 per cent increase in debt series (DEBT) would lead to 0.1 decrease in private investment. A 1 per cent increase in credit to private sector (CP) would cause 0.02 per cent increase in private investment while a 1 per cent increase in cost of capital (RINT) would lead to 0.01 per cent decline in private investment. The result also indicated a crowd-in effect of public investment with 1 per cent increase in public investment leading to 0.6 per cent increase in private investment.

Table 19:Modelling Private Investment (LPINV) With All Uncertainty Indicators By OLS

The Sample is 1971 to 2001 less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
LPINV 1	.4315290***	.12042	.11588	3.58339	.4164
CONSTANT	-44.6794975	18.44912	15.81767	-2.42177	.2458
LGINV	.6068286***	.16603	.18034	3.65485	.4260
LGDP	.4791078**	.27143	.24037	2.39670	.0978
RINT	-.0069330**	.00283	.00310	-2.45378	.2507
LCP	.0183846*	.13868	.12598	1.77754	.3879
LDEBT	-.0633009*	.04226	.05649	-1.59798	.1108
UINF	-.0066267*	.00078	.00101	-1.80271	.0346
UEXR	-.3957973**	.16521	.14158	-2.39569	.2418
UMS%	-.0174549	.08402	.06943	-.20774	.0024
UNINT	-.0007786*	.00829	.00795	-1.59396	.0005
UGDP%	-.0003064	.00022	.00017	-1.40477	.0988
UFB	-.0026004*	.00004	.00001	-1.62625	.0553

R^2 = .9047497 σ = .1800425 F(12, 18) = 284.20 [.0000] DW = 1.764
RSS = .5834755228 for 13 Variables and 31 Observations
Information Criteria: SC = -2.532681; HQ = -2.938005; FPE = .046009
R^2 Relative to DIFFERENCE+SEASONALS = .75592

*** indicates significance at 1% level
** indicates significance at 5% level
* indicates significance at 10% level

The results of the estimated private investment models identified macroeconomic uncertainty as a determinant of private investment. Overall, it was also found that macroeconomic uncertainty indicators (inflation rates, exchange rates, interest rates, growth rates, money supply and fiscal deficits growth rates uncertainties) are negatively related with aggregate private investment in Nigeria. Although, few individual effects of the components of macroeconomic uncertainty were found to be insignificant, the overall measure of macroeconomic uncertainty has been a major hindrance to private investment recovery in Nigeria. For instance, Table 19 reveals that a 1 per cent increase in inflation rates uncertainty (UINF) led to 0.01 per cent decline in private investment while a 1 per cent increase in fiscal deficits uncertainty (UFB) caused private investment to fall by 0.003 per cent. Also a 1 per cent increase in money supply growth uncertainty (UMS%) forced private investment to reduce by 0.02 per cent while a 1 per cent rise in exchange rate uncertainty (UEXR) reduced private investment by 0.4 per cent. The result also indicates that a 1 per cent increase in interest rates uncertainty (UINT) reduced private investment by 0.001 per cent while a 1 per cent increase in income growth uncertainty (UGDP%) caused 0.02 percent decline in private investment in Nigeria.

The assessment of the effect of irreversibility indicated that it negatively affect the current level of private investment expenditures. The results implied lower investment spendings from private sector in the face of irreversible investment decisions. More uncertainty in the returns to capital increases the user cost for private investors with

irreversible investment, without affecting the user cost for investors with reversible investment. The general econometric result indicated reluctance on the part of private investors regarding investment spendings only in the short run.

6.6 Conclusion:

The chapter presented an econometric analysis of the determinants of private investment in Nigeria using Error Correction Modelling (ECM) techniques. It also considered the effects of irreversibility and six dimensions of macroeconomic uncertainty, measured by means of an ARCH methodology on private investment over 1970-2001 period. The findings shed light on private sector's investment decisions in the face of uncertainty and a number of indicators proved significant. The chapter is concluded with the quantitative effects of the significant variables and uncertainty indicators on private investment rates. The econometric results clearly revealed that uncertainty discouraged private investment in Nigeria. Indeed, four out of the six macroeconomic uncertainty measures negatively affected private investment rates significantly. Thus, increased uncertainty, to a very large extent, has explained the depressed level of private investment in the Nigerian economy between 1970 and 2001. The negative effects which irreversibility and macroeconomic uncertainty have, had indeed, helped in explaining why actual investment behaviour of private sector of the Nigerian economy differed from predictions of the conventional investment models. It is, therefore, concluded that irreversibility and

uncertainty make private investors less eager to invest.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary:

The impact of uncertainty on investment has attracted considerable attention in the analytical and empirical macroeconomic literature. On theoretical grounds, however, uncertainty can affect investment through different channels, some of which operate in mutually opposing directions. Thus, the sign of its overall effect is therefore ambiguous, and can only be assessed empirically. The study, therefore, investigated the determinants of aggregate private investment in Nigeria, focusing on the effects of six different dimensions of macroeconomic uncertainty. It also examined whether irreversibility exists and if it does, what effect does it portend on aggregate private in Nigeria? The trend of Nigeria's private investment spendings pattern was also analyzed.

It is evident in the investment literature that the most appropriate variable for capturing the effect of uncertainty on private investment decision is the threshold value for the marginal profitability of capital. The most obvious way to get information on this threshold value is to obtain information on the level of an individual firm or investment project. However, for an aggregate investment function which is suitable for economic policy recommendations at national level, there is no straightforward way to introduce this threshold value. Rather than sample variability or standard variations, the study relied on approximating indicators for uncertainty as determined by the conditional variance from

univariate ARCH procedure for six macroeconomic variables, namely; inflation rates, exchange rates, interest rates, GDP growth rates, money supply growth rates and fiscal balance.

Annual and quarterly time series analyses were employed. Analysis covered the period of 1970 to 2001. The data used for analysis were sourced from various sources. These sources are Statistical Bulletin of the Central Bank Nigeria, the Federal Office Statistics (FOS), World Bank publications and International Financial Statistics (IFS) Yearbooks of International Monetary Fund (IMF). Descriptive analytical methods were employed in trend analysis while Error Correction Modelling (ECM) techniques were adopted in the estimation of the specified private investment models. Both nominal and real private investment models were examined using the logarithmic and growth rate formulations.

In line with Error Correction Modelling (ECM) techniques adopted, time series properties of variables in private investment equation specified were first examined by using Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The optimal lag length of the ADF was chosen by using the Final Predictive Errors (FPE) statistics. The results revealed that private investment behaviour of the Nigerian economy was highly unpredictable during the period under investigation. It was, however, more unstable in real than its nominal counterpart. It was found that private investment, public investment, income, credit to private sector and debt series were non-stationary and they

were in fact, I(1) series while real interest rates and uncertainty indicators were all I(0) series. The results also showed that public investment, income, real interest rates, credit to private sector, debt and uncertainty series cointegrated with private investment series. This indicated that all these variables maintained the private investment equilibrium through time.

The general result indicated consistency of the identified determinants of the private investment as regards signs. For instance, private investment was found to be negatively affected by the real interest rates and debt variables, while it was positively affected by the income and public investment variables. Also, the level credit to the private sector has a positive and statistically significant effect on private investment. Indeed, it was shown that a 1 per cent increase in cost of capital had led to 0.01 per cent decline in private investment while 1 per cent increase in income caused 0.5 per cent increase in private investment. Also, while a 1 per cent increase in debt series led to 0.1 decrease in private investment, a 1 per cent increase in credit to private sector had caused 0.02 per cent increase in private investment. The result also indicated a crowd-in effect of public investment with 1 per cent increase in public investment leading to 0.6 per increase in private investment. Although the level of credit to private sector was highly significant in explaining private investment, its effect was, however, small. Also, private investment and public investment were found to be complementary and thus there is a great need for the Nigerian government to continue to develop the infrastructural base of the economy to boost investment spendings of the private sector.

It was found that the reluctance to invest occurred as a result of positive difference between the value and cost of waiting. The inter-temporal trade-off between the value of waiting (benefits) and costs of changing the private capital stock was employed in estimating this difference which was then labelled as irreversibility measure. The result revealed that the Nigerian private investors were reluctant to invest and this was as a result of irreversibility of most investment decisions. However, the reluctance to invest was influenced by the discount rate guiding investment decisions and the user cost of capital. The results provided a readily interpretable measure of the importance of irreversibility constraints and revealed that the irreversibility indicator, though not statistically significant, bear a negative relationship with private investment. The result generally indicated that structural bottlenecks were most of the time more important in private investment decisions in Nigeria.

The measure of macroeconomic uncertainty has a negative sign and statistically significant in most of the estimated equations. All macroeconomic uncertainty indicators displayed a strong negative association with the aggregate private investment variable in Nigeria. We found, most especially, that uncertainty about inflation rates, exchange rates, interest rates and fiscal balance were negatively related with aggregate private investment. This finding indicated that measures of uncertainty were found to be major impediments to private investment decisions in Nigeria. In fact, uncertainty about macroeconomic policy

negatively affects private investors' expectation. For instance, the inflation rates as well as interest rates volatility experienced during 1970-2001 could be interpreted to mean a high degree of uncertainty for private sector with regards to profitability and the cost of investment. Indeed, erratic swings in the level of real private investment were found inflation and interest rates uncertainties.

The effect of exchange rate volatility was significantly negative. This suggests that a depreciation of the exchange rate has a negative influence on private investment. Thus, all other things being equal, the exchange rate policy of Naira devaluation against other currencies of the world had contributed negatively to the recovery of private investment. However, the effects of fluctuations in the money supply and income growth rates were less pronounced.

7.2 Conclusions:

The last two decades of 1970-2001 period appeared to be a time of exceptional uncertainty in Nigeria. During these decades, the Nigeria's economic activity slowed down substantially. Virtually all markets showed considerable volatility and, indeed, the consumers price index and Naira currency exhibited significant fluctuations. Real output shrunk markedly while private investment also declined considerably. Government continued making room for extra budgetary allocation for actions that were not directly related to investment purposes hence, high deficits were incurred . Both the private and

financial sectors were subjected to turmoil that led to severe economic crises during the period. Investment from private sector in Nigeria was, therefore, sluggish and almost at a standstill. The study concluded that private investment during the period under investigation was highly volatile and unpredictable.

From the examination of aggregate private investment spending behaviour in Nigeria, the study concluded that significant macroeconomic variables that affected private investment include income, public investment, real interest rates, credit to private sector and debt variables. In addition, availability of credit to private sector of the Nigerian economy has not only been a major obstacle to private investment. Also, private investment and public investment were found to be complementary. However, high debt value and accumulation of high level of external debt constituted a strong deterrent to the recovery of private investment in Nigeria. These macroeconomic factors were, however, not sufficient enough to explain private investment trend witnessed during 1970-2001 period.

The irreversibility of aggregate private investment expenditures provides a simple reason for the private investment trend witnessed in Nigeria during the period under investigation. In addition, private investors in Nigeria are risk averse and not risk neutral, and so uncertainty has an independent, adverse effect on investment decisions. The major conclusion is that uncertainty, measured by the conditional variance from ARCH process of macroeconomic variables, is an additional determinant of the aggregate private investment level. Uncertainty negatively affected investment expectations of the private sector. The

greatest uncertainty, however, concerns fluctuations of inflation rates, exchange rates, interest rates and fiscal balance had strong negative effect on private investment decisions in Nigeria. Frequent changes and inconsistencies in macroeconomic policies created real and imaginary fears in the mind of private investors. The overall state of mistrust and uncertainty in the country strongly deter investment condition and climate. The overall effect of uncertainty on private investment was, therefore, negative. The effect and magnitude of uncertainty, however, largely depend on the way in which indicators of uncertainty are defined.

The study concludes that macroeconomic uncertainty measures and private investment are negatively related with more significant effects coming from inflation rates, exchange rates, interest rates and fiscal deficits of uncertainty indicators. Thus, higher uncertainty will usually lead to lower private investment. Public sector would only promote growth by providing a lead as well as creating conducive environment for private investors to come forward and invest. However, uncertainty could not help private investment process. Such an environment cannot be conducive to investment and sustained growth. The key to future recovery in investment from private sector and growth, to a larger extent, lies in the reduction of macroeconomic uncertainty.

7.3 Recommendations:

The Nigeria's economy urgently needs an investment crusade from private sector for

its revival. While Nigeria has the pre-requisite of a populous market, private investment has been slow. Private sector investment is one of the major ways left to lift the Nigerian economy out of low growth phenomenon. It then becomes important to reassess how far and strongly these matters can be pursued. Although, the results confirmed a crowding-in effect of public investment, the dominance of public investment had in the past posed serious constraint to private investment. Over the years, investors were constrained by political and policy instability and worsening macroeconomic environment. Certain measures may be undertaken by the Nigerian government in collaboration and consultation with the private sector. It is therefore suggested that:

1. The key to future recovery of private investment lies in reducing uncertainty. Policies that would bring about a significant reduction of overall macroeconomic uncertainty should be the major concern of the policy makers. The public sector should focus on creating a new economic order that would promote sustainable economic development and reduce uncertainty. For the Nigerian economy to achieve a 20 per cent increase in private investment, the overall level of uncertainty must be reduced by at least 5 per cent. Thus, macroeconomic policies aimed at reducing aggregate uncertainty would go a long way in stimulating private investment spendings in Nigeria. For instance, the rate of inflation should not be above 5 per cent annually.

2. The reduction in inflation rates and exchange rates uncertainties should be the core of

the reform process which together with reinvigorated economic policies is expected to create enabling environment for private initiative to drive the growth process. It is, therefore, suggested that the key prices in the Nigerian economy should be relatively stable. Increase in the general price level should be curtailed and should not exceed 3 per cent annually.

3. The effect of fluctuations in exchange rate calls for review of the current liberalization to a moderate level. Further devaluation of naira against foreign currencies should be discouraged. In Nigerian context, the policy consequences are that the reduction of uncertainty of macroeconomic variables will have a large impact on private investment. If, however, this reduction requires frequent adjustments of the interest rates and devaluation of exchange rates, the final effect on investment might be negative.

4. Public sector should intensify its effort in the development of infrastructural base of the economy to boost private sector. That is, government should continue to increase its investment drive in the area of infrastructural projects. Public investment should increase by 5 per cent so as to have about 10 per cent increase in private investment. Public sector should, therefore, inspire confidence in private investors through imaginative and innovation approach and policies. Also, a reduction of about 25 per cent in debt stock is also suggested for private investment recovery in Nigeria.

5. It is correct that the private investors cannot be forced to invest but the government

can induce, attract, guide and even request them to make investment and provide them environment which is investment friendly to the extent possible within the resource, law and order and political constraints. Consistency in economic policies is major requirement for sustained private investment flow. Government should provide firm assurances on the subject because of the less intensity or pressure for observing the tough conditions of the lending agencies which have inhibited private investment.

6. In its pursuit to achieve its targets and goals, it is extremely important for the Apex Bank to reassess its monetary policy by implementing policies favourable to prospective investors in particular and the Nigerian investment environment in general. In order to restore private sector confidence, the Central Bank of Nigeria will have to continue monitoring interest rates while the government has to develop a package for fiscal stimulus. For instance, for the Nigerian economy to have a 5 per cent growth in private investment, interest rates should not exceed 10 per cent. Similarly, a reduction in fiscal deficit to a level not higher than 3 per cent of GDP from its previous level of over 10 per cent annually is recommended for adequate recovery in private investment in Nigeria.

7. One of the strongest ways to propel development is through increased private investment. Sufficient funds may, therefore, be placed at the disposal of the private organizations responsible for initiating investment projects. Banks and other

financial institutions should provide adequate credit facilities to the private sector at relatively low interest rates. This will go a long way in ensuring continuing participation of private sector in investment activities. For the Nigerian economy to have a 20 per cent growth in private investment, growth rate of credit to private sector should not be less than 10 per cent.

In conclusion, impediments to private investment recovery would be removed if all the major macroeconomic uncertainties confronting the Nigerian economy such as high inflation and interest rates, exchange rates fluctuations, high fiscal deficits-GDP ratio and low GDP growth are resolved, to a large extent. The results of the study suggest that policies that address only some components of macroeconomic uncertainty may not be enough to revive private investment. Thus, macroeconomic policies aimed at reducing aggregate macroeconomic uncertainty would go a long way in stimulating private investment spendings in Nigeria. Once the macroeconomic uncertainties are reduced, it is expected that private investment crusade will gain momentum and accelerated growth will be achieved. It is, however, extremely difficult to predict how fast a return to a sustainable growth path and recovery of private investment can be achieved.

7.4 Limitations of the Study:

In any time series analysis, it is difficult to capture all factors influencing a particular variable of interest. Given that the study employed time series analysis, it bears the same

defect. Indeed, a number of factors that affect private investment decisions could not be adequately captured in this study. For instance, factors such as political instability, credibility of government policies, official attitude towards investors and some others macroeconomic policy variables such as capacity utilization and foreign interest rates might have affected private investment decisions. These issues were, however, not investigated in this study. Thus, micro survey and cross-sectional analysis are expected to probe further to learn more about the determinants of private investment through the administration of questionnaires to selected projects, firms or industries.

There are numbers of uncertainty policy measures whose effects on private investment decisions were not captured and analyzed in this study. These include wage rate uncertainty, tax rate uncertainty, terms of trade uncertainty, political instability, to mention but few. It is also clear that the results emerging from this aggregate analysis are too unstable to be relied on for use in hard policy advice. This is due to the fact that uncertainty-investment relationship depends strongly on the nature of the firm or industry. It is correct that uncertainty is approximated by the volatility or conditional variance of a number of macroeconomic variables, but it is also clear that several other factors are relevant when using micro or survey study. For this reason, additional analysis using more large-scale, micro-economic data are required.

Perhaps, adopting longer time series and modelling simultaneously all the uncertainty indicators involved might assist in obtaining more robust results. Also, the measures of

macroeconomic uncertainty employed in the study were based on simple forecasting procedures from univariate models. This could be considerably improved upon by the use of multivariate models. Also, the study could not separate reversible from irreversible private investment data used. Finally, the irreversibility measure employed in this study is still doubtful and indeed, may be inappropriate. Hence, there is the need for proper identification of the effect and appropriate indicator of irreversibility at the aggregate investment study.

7.5 Suggested Issues for Further Research Study:

All the limitations identified above and lots more are create gaps to be filled in the investment literature by researchers. The under-listed issues are hereby suggested for future research study:

1. There is the need for firm-level studies and cross-sectional studies of the effect of irreversibility and uncertainty on private investment in Nigeria. In fact, additional analysis using more large-scale, micro-economic data should be undertaken.

2. There is also the need to address the overall empirical measures of irreversibility and macroeconomic uncertainty as well as political and social instability.

3. The issue of irreversibility and uncertainty can also be directed towards

human capital formation.

4. There is the need to search for additional determinants of private investment in Nigeria.

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APPENDIX A: Definitions of Variables

npinv: Nominal private investment

nginv: Nominal public investment

ngdp: Nominal gross domestic product

nint: Nominal interest rates

cp: Credit to the private sector

db: Debt burden indicator

irr: Irreversibility indicator

rpinv: Real private investment

rginv: Real public investment

rgdp: Real gross domestic product

rint Real interest rates

Uinf: Inflation rates uncertainty

Uexr: Exchange rates uncertainty

Unint: Interest rates uncertainty

Ungdp%: Nominal GDP growth rate uncertainty

Urdgp%: Real GDP growth rate uncertainty

Um2%: Money supply (M2) growth rate uncertainty

Ufb%: Fiscal balance growth rate uncertainty

APPENDIX B1: Unit Root Test Results for Quarterly Series in Levels.

	DF		ADF		Phillips-Perron	
Nominal Series	Untrended	Trended	Untrended	Trended	Untrended	Trended
Npinv	-1.6594	-1.2655	-0.9936	-1.7753	-1.2374	-1.7362

Nginv	-1.3456	-0.7751	-0.9551	-1.2098	-1.1008	-1.4571
Ngdp	-1.0986	-0.5639	-1.0325	-0.9462	-0.8790	-1.2594
Nint	-1.1007	-2.0115	-1.0648	-2.0205	-1.2565	-2.3625
Cp	-1.8118	-1.0093	-1.2225	-1.3366	-1.3039	-1.6334
Db	-0.3512	-2.0073	-0.5839	-2.0064	-0.3672	-2.1709
Irr	-2.4176	-2.5851	-2.0117	-2.0914	-2.7846	-3.0381
Real Series						
Rpinv	-2.3991	-2.5797	-2.4876	-2.6953	-2.6129	-2.6839
Rginv	-1.7183	-1.8039	-1.8665	-2.0117	-2.3445	-2.3559
Rgdp	-2.4479	-1.8354	-1.8154	-1.5166	-2.4115	-2.2143
Rint	-2.6694	-3.2013	-3.7632	-3.8046	-3.3551	-3.3831
Uncertainty Series						
Uinf	-10.7666	-10.7297	-7.0909	-7.0944	-4.1215	-3.7165
Uexr	-5.9525	-6.2236	-3.9561	-4.3328	-4.1209	-3.7164
Unint	-11.5274	-11.7413	-2.9596	-3.0554	-4.1212	-3.7158
Ungdp%	-7.0068	-7.3279	-3.5094	-3.9543	-4.1152	-3.7220
Urdgp%	-11.7045	-11.8737	-4.0031	-4.2531	-4.1213	-3.7162
Um2%	-4.0882	-3.7463	-6.1349	-5.7861	-4.1194	-3.7190
Ufb%	-4.2091	-4.3246	-4.9861	-4.9781	-4.0851	-4.2007
Level of Significance	McKinnon Critical Values					
1%	-3.4826	-4.0325	-3.4843	-4.0348	-3.4826	-4.0325
5%	-2.8842	-3.4455	-2.8849	-3.4466	-2.8842	-3.4455
10%	-2.5787	-3.1474	-2.5791	-3.1481	-2.5787	-3.1474
N	127	127	123	123	127	127

APPENDIX B2: Unit Root Test Results for Quarterly Series at First Difference.

Nominal Series	DF		ADF		Phillips-Perron	
	Untrended	Trended	Untrended	Trended	Untrended	Trended
Δ npinv	-3.7685	-3.8274	-2.6750	-3.2920	-3.7551	-3.8358

Δ nginv	-5.0839	-5.1323	-2.7997	-3.2829	-5.0952	-5.1506
Δ ngdp	-4.9535	-4.9882	-2.5857	-3.3620	-4.9614	-4.9942
Δ nint	-9.5663	-9.5277	-5.5975	-5.5719	-9.5784	-9.5402
Δ cp	-3.9237	-4.0449	-2.8656	-3.6231	-3.9250	-4.0619
Δ db	-11.7867	-11.7389	-5.7797	-5.7493	-11.7784	-11.7343
Irr	-9.9556	-9.5114	-6.4844	-6.4915	-9.4975	-9.4605
Real Series						
Δ rpinv	-3.7327	-3.8331	-3.2778	-3.3540	-3.7944	-3.9231
Δ rginv	-4.6963	-4.8455	-3.0448	-3.1969	-4.7211	-4.8918
Δ rgdp	-4.7194	-4.8101	-3.2593	-3.2945	-4.5769	-3.2944
Level of Significance	McKinnon Critical Values					
1%	-3.4831	-4.0331	-3.4847	-4.0355	-3.4831	-4.0331
5%	-2.8844	-3.4458	-2.8851	-3.4469	-2.8844	-3.4458
10%	-2.5788	-3.1476	-2.5792	-3.1482	-2.5788	-3.1476
N	126	126	122	122	126	126

APPENDIX C1: Error Correction Modelling Results for Quarterly Nominal Series of Private Investment Models

EQ(1) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.6505448	.23556	.20780	7.00675	.3925
ΔLNPINV2	-.4513516	.18100	.15692	-2.49360	.0756
ΔLNPINV3	-.2397215	.10729	.07158	-2.23426	.0616
CONSTANT	.0058228	.03123	.03284	.18643	.0005
ΔLNGINV	.2761643	.07468	.10775	3.69787	.1525
ΔLNGINV1	-.4537120	.09559	.08572	-4.74663	.2287
ΔLNGINV2	.1610982	.08600	.04818	1.87321	.0441
ΔLNGINV3	.0571392	.06932	.04179	.82422	.0089
ΔLNGDP	.5200137	.09063	.12634	5.73793	.3023
ΔLNGDP 1	-.9519637	.15588	.13360	-6.10710	.3292
ΔLNGDP 2	.2892160	.14293	.11957	2.02352	.0511
ΔLNGDP 3	.2450060	.11093	.07707	2.20872	.0603
ΔLNGDP 4	-.1573482	.09398	.12548	-1.67433	.0356
RINT	.0010812	.00059	.00089	1.84719	.0430
RINT 1	-.0023215	.00087	.00118	-2.66857	.0857
RINT 2	.0020226	.00084	.00060	2.39956	.0704
RINT 3	-.0008848	.00085	.00051	-1.03508	.0139
RINT 4	-.0000208	.00063	.00043	-.03318	.0000
ΔLCP	.1821960	.12800	.14865	1.42337	.0260
ΔLCP 1	-.2932712	.13539	.12681	-2.16616	.0582
ΔLCP 2	.0965325	.13337	.08431	.72379	.0068
ΔLCP 3	.0457231	.13377	.08584	.34181	.0015
ΔLCP 4	-.0198373	.12924	.15853	-.15349	.0003
ΔLDB	.0007312	.01872	.02231	.03905	.0000
ΔLDB 1	.0184929	.01784	.01614	1.03667	.0139
ΔLDB 2	-.0038115	.01734	.01426	-.21975	.0006
ΔLDB 3	-.0109166	.01733	.01333	-.62986	.0052
ΔLDB 4	.0041253	.01771	.03088	.23298	.0007
IRR	-.0435634	.02300	.03268	-1.89377	.0451
IRR 1	.1474285	.03390	.03970	4.34897	.1993
IRR 2	-.1369307	.04049	.03349	-3.38218	.1308
IRR 3	.0211447	.03511	.02101	.60228	.0048
IRR 4	.0127942	.02486	.01545	.51460	.0035
UINF	-.0001013	.00013	.00014	-1.78320	.0380
UINF 1	.000000962	.00015	.00015	.00646	.0000
UINF 2	-.0000393	.00014	.00014	-.28081	.0010

UINF	3	.0000565	.00015	.00015	.37413	.0018
UINF	4	-.0000370	.00015	.00018	-.23975	.0008
ecm1	1	-1.2685044	.26155	.26625	-4.84996	.2364

R^2 = .8756461 σ = .0385543 F(38, 76) = 14.08 [.0000] DW = 1.948
RSS = .1129690981 for 39 Variables and 115 Observations
Information Criteria: SC = -5.316422; HQ = -5.869469; FPE = .001991
R^2 Relative to DIFFERENCE+SEASONALS = .75952

EQ(2) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.7395078	.20684	.19507	8.40987	.4820
ΔLNPINV2	-.4670227	.16161	.13665	-2.88974	.0990
ΔLNPINV3	-.3006586	.10843	.07142	-2.77285	.0919
CONSTANT	-.0054943	.02784	.02621	-.19732	.0005
ΔLNGINV	.2908347	.05614	.09571	5.18071	.2610
ΔLNGINV1	-.4954293	.08526	.08462	-5.81049	.3076
ΔLNGINV2	.1603492	.07556	.04509	2.12204	.0559
ΔLNGINV3	.0690487	.06128	.03371	1.12685	.0164
ΔLNGDP	.5227240	.08934	.12611	5.85126	.3106
ΔLNGDP 1	-.9497692	.13401	.11277	-7.08712	.3979
ΔLNGDP 2	.3369573	.12885	.10490	2.61501	.0825
ΔLNGDP 3	.2039084	.10580	.06663	1.92736	.0466
ΔLNGDP 4	-.1152183	.09663	.13304	-1.19238	.0184
RINT	.0008423	.00052	.00083	1.61405	.0331
RINT 1	-.0026062	.00080	.00118	-3.26227	.1228
RINT 2	.0026240	.00082	.00063	3.21920	.1200
RINT 3	-.0008884	.00081	.00054	-1.09304	.0155
RINT 4	-.0001246	.00059	.00038	-.21264	.0006
ΔLCP	.1279837	.10736	.14719	1.19214	.0184
ΔLCP 1	-.2931249	.12010	.11582	-2.44075	.0727
ΔLCP 2	.1289026	.11936	.08519	1.07994	.0151
ΔLCP 3	.0218190	.11717	.07635	.18621	.0005
ΔLCP 4	-.0238020	.11611	.15543	-.20499	.0006
ΔLDB	-.0033379	.01683	.02100	-.19838	.0005
ΔLDB 1	.0240321	.01640	.01432	1.46528	.0275
ΔLDB 2	-.0032405	.01577	.01301	-.20555	.0006
ΔLDB 3	-.0085447	.01562	.01266	-.54705	.0039
ΔLDB 4	.0000931	.01565	.02822	.00595	.0000
IRR	-.0360561	.02116	.03189	-1.70434	.0368
IRR 1	.1415208	.03106	.03886	4.55574	.2145

IRR	2	-.1407782	.03635	.03064	-3.87321	.1649
IRR	3	.0198662	.03220	.02200	.61687	.0050
IRR	4	.0189003	.02335	.01614	.80951	.0085
UEXR		-.0009595	.00051	.00038	-1.89484	.0451
UEXR	1	.0010618	.00055	.00038	1.92713	.0466
UEXR	2	-.0003040	.00053	.00047	-.57888	.0044
UEXR	3	.0005154	.00048	.00034	1.06943	.0148
UEXR	4	-.0003080	.00042	.00060	-.73958	.0071
ecm2	1	-1.4186571	.23105	.24246	-6.13995	.3316

R^2 = .8948279 σ = .0354563 F(38, 76) = 17.02 [.0000] DW = 1.982
RSS = .0955434451 for 39 Variables and 115 Observations
Information Criteria: SC = -5.483955; HQ = -6.037002; FPE = .001683
R^2 Relative to DIFFERENCE+SEASONALS = .79661

EQ(3) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.4295675	.20279	.23987	7.04947	.3954
ΔLNPINV2	-.3069755	.16569	.16856	-1.85266	.0432
ΔLNPINV3	-.1844869	.10642	.08556	-1.73355	.0380
CONSTANT	.0054169	.02473	.02338	.21902	.0006
ΔLNGINV	.312579	.06083	.10426	5.13885	.2579
ΔLNGINV1	-.4267179	.08832	.09981	-4.83123	.2350
ΔLNGINV2	.1119288	.08097	.05772	1.38239	.0245
ΔLNGINV3	.0525021	.06667	.04795	.78748	.0081
ΔLNGDP	.5401792	.09069	.11611	5.95663	.3183
ΔLNGDP 1	-.8361684	.13939	.13703	-5.99896	.3214
ΔLNGDP 2	.1879117	.13321	.12264	1.41059	.0255
ΔLNGDP 3	.1688658	.11435	.09298	1.47669	.0279
ΔLNGDP 4	-.0009405	.12718	.18323	-.00740	.0000
RINT	.0013109	.00059	.00087	2.20758	.0603
RINT 1	-.0029407	.00086	.00124	-3.40771	.1325
RINT 2	.0023707	.00085	.00090	2.78468	.0926
RINT 3	-.0006925	.00086	.00061	-.80751	.0085
RINT 4	-.0003175	.00060	.00045	-.52569	.0036
ΔLCP	.1631117	.12018	.18437	1.35728	.0237
ΔLCP 1	-.2507238	.12944	.14424	-1.93699	.0470
ΔLCP 2	.0853849	.12800	.08633	.66705	.0058
ΔLCP 3	.0198092	.12804	.08489	.15471	.0003
ΔLCP 4	.0927029	.12774	.18419	.72569	.0069
ΔLDB	-.0011909	.01862	.02364	-.06396	.0001

ΔLDB	1	.0195822	.01774	.01687	1.10384	.0158
ΔLDB	2	-.0053499	.01740	.01479	-.30742	.0012
ΔLDB	3	-.0119915	.01706	.01230	-.70308	.0065
ΔLDB	4	-.0058477	.01675	.02806	-.34917	.0016
IRR		-.0561618	.02258	.03417	-2.48756	.0753
IRR	1	.1521299	.03334	.04274	4.56319	.2151
IRR	2	-.1238187	.03920	.03687	-3.15899	.1161
IRR	3	.0216910	.03509	.02232	.61811	.0050
IRR	4	-.0002518	.02623	.02024	-.00960	.0000
UNINT		.0029144	.00163	.00258	1.78626	.0403
UNINT	1	-.0028794	.00117	.00128	-2.45203	.0733
UNINT	2	-.0001377	.00115	.00101	-.11932	.0002
UNINT	3	-.0006233	.00116	.00098	-.53763	.0038
UNINT	4	-.0027153	.00132	.00133	-2.05696	.0527
ecm3	1	-1.0541052	.23205	.27801	-4.54253	.2135

R^2 = .8803670 σ = .0378154 F(38, 76) = 14.72 [.0000] DW = 1.904
RSS = .1086803516 for 39 Variables and 115 Observations
Information Criteria: SC = -5.355125; HQ = -5.908172; FPE = .001915
R^2 Relative to DIFFERENCE+SEASONALS = .76865

EQ(4) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.7285714	.21440	.19459	8.06246	.4610
ΔLNPINV2	-.5048345	.17124	.14097	-2.94812	.1026
ΔLNPINV3	-.2596947	.10823	.06910	-2.39945	.0704
CONSTANT	-.0048495	.02129	.02125	-.22783	.0007
ΔLNGINV	.2927775	.05771	.09831	5.07289	.2530
ΔLNGINV1	-.4856825	.09001	.09397	-5.39607	.2770
ΔLNGINV2	.1498980	.08005	.04681	1.87261	.0441
ΔLNGINV3	.0815056	.06583	.03649	1.23808	.0198
ΔLNGDP	.5172590	.08728	.11876	5.92619	.3161
ΔLNGDP 1	-.8987595	.14336	.11473	-6.26930	.3409
ΔLNGDP 2	.2259015	.13672	.10435	1.65234	.0347
ΔLNGDP 3	.2323077	.12677	.07598	1.83249	.0423
ΔLNGDP 4	-.0742972	.11253	.14110	-.66025	.0057
RINT	.0007940	.00053	.00085	1.48838	.0283
RINT	1 -.0022448	.00080	.00119	-2.80815	.0940
RINT	2 .0022296	.00082	.00065	2.72499	.0890
RINT	3 -.0007408	.00083	.00049	-.89738	.0105
RINT	4 -.0001961	.00059	.00036	-.33040	.0014

ΔLCP		.1276567	.11259	.15854	1.13384	.0166
ΔLCP	1	-.2695600	.12531	.13145	-2.15115	.0574
ΔLCP	2	.1154331	.12453	.09397	.92692	.0112
ΔLCP	3	-.0095317	.12371	.08408	-.07705	.0001
ΔLCP	4	.0116949	.12311	.16266	.09499	.0001
ΔLDB		.0017192	.01787	.02132	.09619	.0001
ΔLDB	1	.0204843	.01667	.01515	1.22915	.0195
ΔLDB	2	-.0047354	.01655	.01364	-.28608	.0011
ΔLDB	3	-.0081642	.01646	.01312	-.49592	.0032
ΔLDB	4	.0041626	.01661	.02897	.25062	.0008
IRR		-.0383299	.02169	.03208	-1.76729	.0395
IRR	1	.1496609	.03215	.03999	4.65463	.2218
IRR	2	-.1492503	.03877	.03311	-3.85000	.1632
IRR	3	.0232648	.03400	.02219	.68431	.0061
IRR	4	.0170971	.02548	.01580	.67100	.0059
UNGDP%		-.0000994	.00012	.00009	-.83952	.0092
UNGDP%	1	.0000499	.00013	.00007	.39195	.0020
UNGDP%	2	.0001474	.00013	.00009	1.14906	.0171
UNGDP%	3	-.0002195	.00012	.00011	-1.83898	.0426
UNGDP%	4	.0000989	.00011	.00009	.93299	.0113
ecm4	1	-1.3674343	.23796	.23393	-5.74641	.3029

R^2 = .8884407 σ = .0365171 F(38, 76) = 15.93 [.0000] DW = 1.932
RSS = .1013458948 for 39 Variables and 115 Observations
Information Criteria: SC = -5.424997; HQ = -5.978044; FPE = .001786
R^2 Relative to DIFFERENCE+SEASONALS = .78426

EQ(5) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.6880757	.20265	.16735	8.33006	.4773
ΔLNPINV2	-.4790594	.16124	.13356	-2.97110	.1041
ΔLNPINV3	-.2644510	.10151	.06318	-2.60505	.0820
CONSTANT	-.0067008	.02004	.02066	-.33430	.0015
ΔLNGINV	.2746429	.05853	.08958	4.69207	.2246
ΔLNGINV1	-.4639569	.08431	.07741	-5.50296	.2849
ΔLNGINV2	.1421415	.07599	.04622	1.87047	.0440
ΔLNGINV3	.0742190	.06235	.04772	1.19033	.0183
ΔLNGDP	.6605649	.09301	.11968	7.10181	.3989
ΔLNGDP 1	-1.0499427	.14832	.12601	-7.07880	.3973
ΔLNGDP 2	.2755927	.12667	.11024	2.17573	.0586
ΔLNGDP 3	.2210913	.10310	.07228	2.14450	.0571

ΔLNGDP	4	-.0669676	.09197	.11272	-.72811	.0069
RINT		.0007706	.00055	.00086	1.41002	.0255
RINT	1	-.0018849	.00079	.00111	-2.38346	.0695
RINT	2	.0017968	.00077	.00057	2.32097	.0662
RINT	3	-.0006980	.00079	.00056	-.88552	.0102
RINT	4	-.0000441	.00058	.00039	-.07656	.0001
ΔLCP		.1759238	.12552	.20050	1.40161	.0252
ΔLCP	1	-.3888609	.13614	.13729	-2.85627	.0969
ΔLCP	2	.1324345	.12981	.10381	1.02025	.0135
ΔLCP	3	.0510467	.12601	.09507	.40510	.0022
ΔLCP	4	-.0286584	.11876	.15188	-.24131	.0008
ΔLDB		-.0143331	.01731	.01912	-.82785	.0089
ΔLDB	1	.0278391	.01686	.01744	1.65079	.0346
ΔLDB	2	-.0035329	.01636	.01607	-.21595	.0006
ΔLDB	3	-.0092155	.01621	.01454	-.56856	.0042
ΔLDB	4	-.0051782	.01661	.03226	-.31180	.0013
IRR		-.0388712	.02235	.03122	-1.73952	.0383
IRR	1	.1488727	.03289	.03830	4.52637	.2123
IRR	2	-.1536932	.03854	.02966	-3.98740	.1730
IRR	3	.0273172	.03344	.02118	.81690	.0087
IRR	4	.0198733	.02370	.01470	.83871	.0092
UMS%		.0000851	.00011	.00011	.77609	.0079
UMS%	1	.000004982	.00011	.00008	.04536	.0000
UMS%	2	.000008771	.00011	.00012	.07630	.0001
UMS%	3	.0003920	.00018	.00021	2.15879	.0578
UMS%	4	-.0002472	.00020	.00026	-1.73296	.0369
ecm5	1	-1.3965736	.23608	.21274	-5.91556	.3153

R^2 = .8886418 σ = .0364842 F(38, 76) = 15.96 [.0000] DW = 1.978
RSS = .1011631590 for 39 Variables and 115 Observations
Information Criteria: SC = -5.426802; HQ = -5.979848; FPE = .001783
R^2 Relative to DIFFERENCE+SEASONALS = .78465

EQ(6) Modelling ΔLNPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLNPINV1	1.6201366	.21474	.17942	7.54471	.4282
ΔLNPINV2	-.4364169	.16871	.13458	-2.58683	.0809
ΔLNPINV3	-.2249683	.10164	.06265	-2.21345	.0606
CONSTANT	.0071622	.02092	.02499	.34228	.0015
ΔLNGINV	.2907508	.05885	.09985	4.94096	.2431
ΔLNGINV1	-.4442648	.08674	.08320	-5.12161	.2566

ΔLNGINV2	.1385784	.07639	.04470	1.81405	.0415
ΔLNGINV3	.0640370	.06188	.04289	1.03492	.0139
ΔLNGDP	.4976768	.09490	.12956	5.24430	.2657
ΔLNGDP 1	-.8967998	.14016	.12024	-6.39836	.3501
ΔLNGDP 2	.2614688	.12903	.09959	2.02643	.0513
ΔLNGDP 3	.2300667	.10230	.06854	2.24890	.0624
ΔLNGDP 4	-.1698560	.09073	.12823	-1.87202	.0441
RINT	.0008453	.00054	.00092	1.56202	.0311
RINT 1	-.0019430	.00080	.00124	-2.44162	.0727
RINT 2	.0017019	.00077	.00057	2.22416	.0611
RINT 3	-.0007295	.00078	.00052	-.93529	.0114
RINT 4	-.0001042	.00059	.00043	-.17793	.0004
ΔLCP	.0572097	.11988	.16533	.47723	.0030
ΔLCP 1	-.1623970	.12830	.13628	-1.26577	.0206
ΔLCP 2	.0720729	.12647	.08768	.56990	.0043
ΔLCP 3	.0120529	.12566	.08843	.09592	.0001
ΔLCP 4	-.0337080	.12028	.16728	-.28025	.0010
ΔLDB	-.0030677	.01756	.02263	-.17474	.0004
ΔLDB 1	.0215716	.01676	.01584	1.28742	.0213
ΔLDB 2	-.0049728	.01635	.01478	-.30411	.0012
ΔLDB 3	-.0140107	.01622	.01289	-.86402	.0097
ΔLDB 4	-.0142329	.01827	.02328	-.77904	.0079
IRR	-.0718711	.02188	.03245	-3.28531	.1244
IRR 1	.1929667	.03399	.03860	5.67687	.2978
IRR 2	-.1589169	.04091	.03311	-3.88415	.1656
IRR 3	.0239104	.03479	.02185	.68722	.0062
IRR 4	.0130239	.02454	.01563	.53071	.0037
UFB	.000000015	.000000074	.00069	1.66950	.0354
UFB 1	-.000000032	.000000823	.00026	-3.02229	.1073
UFB 2	.000000004	.000000046	.00042	.80751	.0085
UFB 3	.000000001	.000000025	.00028	.20101	.0005
UFB 4	.000000002	.000000056	.00059	-.43913	.0025
ecm6 1	-1.2535558	.23967	.23030	-5.23037	.2647

R^2 = .8903915 σ = .0361964 F(38, 76) = 16.25 [.0000] DW = 1.916
RSS = .0995736498 for 39 Variables and 115 Observations
Information Criteria: SC = -5.442639; HQ = -5.995685; FPE = .001755
R^2 Relative to DIFFERENCE+SEASONALS = .78803

APPENDIX C2: Error Correction Modelling Results for Quarterly Real Series of Private Investment Models

EQ(7) Modelling ΔLRPINV by OLS

The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	1.4262520	.22737	.23246	6.27269	.3411
ΔLRPINV2	-.3378793	.17238	.14389	-1.96009	.0481
ΔLRPINV3	-.2101426	.10453	.07978	-2.01031	.0505
CONSTANT	-.0197246	.03701	.04185	-.53295	.0037
ΔLRGINV	.4663778	.09372	.14152	4.97626	.2458
ΔLRGINV1	-.6623298	.14443	.13329	-4.58594	.2167
ΔLRGINV2	.1907110	.12417	.08099	1.53589	.0301
ΔLRGINV3	.0847972	.09902	.07407	.85636	.0096
ΔLRGDP	.5270178	.19334	.24125	2.72588	.0891
ΔLRGDP 1	-.6606658	.22140	.15499	-2.98407	.1049
ΔLRGDP 2	.1311766	.21498	.12044	.61018	.0049
ΔLRGDP 3	.1047502	.21688	.18165	.48298	.0031
ΔLRGDP 4	.1499769	.25706	.28389	.58343	.0045
RINT	.0021368	.00074	.00122	2.90276	.0998
RINT 1	-.0050707	.00117	.00161	-4.33318	.1981
RINT 2	.0040633	.00125	.00111	3.25221	.1222
RINT 3	-.0007108	.00112	.00083	-.63255	.0052
RINT 4	-.0006472	.00077	.00054	-.83614	.0091
ΔLCP	-.0525064	.18098	.23846	-.29013	.0011
ΔLCP 1	-.0689640	.17901	.15917	-.38525	.0019
ΔLCP 2	.0346914	.17930	.10792	.19348	.0005
ΔLCP 3	.0346953	.18117	.15057	.19151	.0005
ΔLCP 4	-.0400499	.15691	.29379	-.25524	.0009
ΔLDB	.0121296	.02532	.02702	.47898	.0030
ΔLDB 1	.0186482	.02378	.01794	.78424	.0080
ΔLDB 2	.0080798	.02316	.01394	.34888	.0016
ΔLDB 3	-.0125897	.02297	.01307	-.54801	.0039
ΔLDB 4	-.0069355	.02389	.02812	-.29030	.0011
IRR	-.0185729	.02964	.04996	-.62654	.0051
IRR 1	.0625219	.04483	.06407	1.39461	.0250
IRR 2	-.0552208	.04523	.03640	-1.22093	.0192
IRR 3	.0110191	.04418	.01888	.24941	.0008
IRR 4	.0017420	.03155	.02235	.05521	.0000
UINF	-.0001120	.00017	.00019	-.65942	.0057
UINF 1	.0002733	.00019	.00024	1.43032	.0262
UINF 2	-.0000464	.00019	.00020	-.24369	.0008

UINF	3	.0001020	.00020	.00020	.51255	.0034
UINF	4	.0000753	.00020	.00029	.37633	.0019
ecm1	1	-1.0619363	.25635	.23139	-4.14253	.1842

R^2 = .8142876 σ = .0506620 F(38, 76) = 8.77 [.0000] DW = 1.967
RSS = .1950647641 for 39 Variables and 115 Observations
Information Criteria: SC = -4.770205; HQ = -5.323251; FPE = .003437
R^2 Relative to DIFFERENCE+SEASONALS = .62809

EQ(8) Modelling ΔLRPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	1.4961263	.19321	.22711	7.74339	.4410
ΔLRPINV2	-.2591885	.16023	.13747	-1.61757	.0333
ΔLRPINV3	-.2976605	.11245	.09397	-2.64706	.0844
CONSTANT	-.0043374	.03353	.03123	-.12936	.0002
ΔLRGINV	.4176787	.07251	.09863	5.76018	.3039
ΔLRGINV1	-.6338079	.11580	.12392	-5.47309	.2827
ΔLRGINV2	.1420108	.10212	.06630	1.39059	.0248
ΔLRGINV3	.1065866	.08362	.06100	1.27467	.0209
ΔLRGDP	.3057130	.17508	.26793	1.74610	.0386
ΔLRGDP 1	-.5117556	.18819	.12902	-2.71931	.0887
ΔLRGDP 2	.1597382	.18829	.12495	.84835	.0094
ΔLRGDP 3	.1237008	.19308	.15312	.64068	.0054
ΔLRGDP 4	-.0601950	.23252	.26836	-.25889	.0009
RINT	.0022105	.00065	.00090	3.39187	.1315
RINT 1	-.0064649	.00107	.00146	-6.04883	.3250
RINT 2	.0051150	.00123	.00116	4.15503	.1851
RINT 3	-.0001456	.00114	.00085	-.12750	.0002
RINT 4	-.0010390	.00075	.00048	-1.38967	.0248
ΔLCP	.1199642	.14849	.21407	.80790	.0085
ΔLCP 1	-.1694338	.15621	.14603	-1.08462	.0152
ΔLCP 2	.0490261	.15479	.09825	.31673	.0013
ΔLCP 3	-.0371355	.15478	.12232	-.23992	.0008
ΔLCP 4	.0496494	.13555	.24052	.36629	.0018
ΔLDB	-.0039797	.02191	.02305	-.18162	.0004
ΔLDB 1	.0244131	.02127	.01562	1.14789	.0170
ΔLDB 2	.0040810	.02046	.01194	.19943	.0005
ΔLDB 3	-.0082351	.01993	.01231	-.41313	.0022
ΔLDB 4	-.0006116	.02037	.02349	-.03002	.0000
IRR	-.0236296	.02625	.04617	-.90019	.0105
IRR 1	.0716184	.04007	.05928	1.78713	.0403

IRR	2	-.0536174	.03987	.03531	-1.34483	.0232
IRR	3	.0039284	.03924	.02542	.10011	.0001
IRR	4	.0029576	.02809	.02058	.10528	.0001
UEXR		-.0019943	.00062	.00062	-3.21575	.1198
UEXR	1	.0024493	.00066	.00054	3.69812	.1525
UEXR	2	-.0015552	.00064	.00050	-2.43167	.0722
UEXR	3	.0008856	.00064	.00054	1.38763	.0247
UEXR	4	.0001164	.00053	.00068	.22050	.0006
ecm2	1	-1.1660388	.22170	.23432	-5.25964	.2669

R^2 = .8528204 σ = .0451010 F(38, 76) = 11.59 [.0000] DW = 1.943
RSS = .1545914553 for 39 Variables and 115 Observations
Information Criteria: SC = -5.002751; HQ = -5.555797; FPE = .002724
R^2 Relative to DIFFERENCE+SEASONALS = .70526

EQ(9) Modelling ΔLRPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	.9464734	.15784	.25425	5.99634	.3212
ΔLRPINV2	.0073759	.13861	.16899	.05321	.0000
ΔLRPINV3	-.0944701	.09816	.09809	-.96246	.0120
CONSTANT	.0219265	.02762	.02578	.79396	.0082
ΔLRGINV	.4538560	.06941	.09331	6.53844	.3600
ΔLRGINV1	-.4269056	.10484	.12603	-4.07211	.1791
ΔLRGINV2	.0315619	.09796	.08841	.32219	.0014
ΔLRGINV3	.0556880	.08229	.07162	.67673	.0060
ΔLRGDP	.4050196	.16680	.26302	2.42822	.0720
ΔLRGDP 1	-.3441325	.18062	.15631	-1.90532	.0456
ΔLRGDP 2	.0288793	.18245	.11617	.15829	.0003
ΔLRGDP 3	.1828271	.19144	.15015	.95500	.0119
ΔLRGDP 4	.0738377	.23851	.27181	.30958	.0013
RINT	.0031826	.00066	.00089	4.80862	.2333
RINT 1	-.0059980	.00100	.00157	-5.99657	.3212
RINT 2	.0029742	.00109	.00157	2.73348	.0895
RINT 3	.0002147	.00103	.00074	.20929	.0006
RINT 4	-.0010270	.00069	.00045	-1.49247	.0285
ΔLCP	.1128536	.15058	.22638	.74944	.0073
ΔLCP 1	-.0958283	.14997	.15411	-.63900	.0053
ΔLCP 2	.0303038	.14994	.10471	.20211	.0005
ΔLCP 3	-.0066197	.15047	.12520	-.04400	.0000
ΔLCP 4	.2798864	.14034	.23616	1.99429	.0497
ΔLDB	-.0045367	.02162	.02550	-.20982	.0006

ΔLDB	1	.0132899	.02062	.01937	.64440	.0054
ΔLDB	2	-.0032569	.02033	.01385	-.16023	.0003
ΔLDB	3	-.0177653	.01976	.01232	-.89899	.0105
ΔLDB	4	-.0147850	.01963	.02899	-.75325	.0074
IRR		-.0585048	.02631	.04956	-2.22356	.0611
IRR	1	.1018592	.03921	.06004	2.59803	.0816
IRR	2	-.0478509	.03924	.03388	-1.21933	.0192
IRR	3	.0082668	.03865	.02419	.21388	.0006
IRR	4	-.0243030	.02938	.01932	-.82714	.0089
UNINT		.0066663	.00134	.00153	4.97787	.2459
UNINT	1	-.0046097	.00141	.00118	-3.26489	.1230
UNINT	2	-.0015553	.00136	.00121	-1.14445	.0169
UNINT	3	-.0013913	.00138	.00113	-1.00892	.0132
UNINT	4	-.0063651	.00131	.00121	-4.86692	.2376
ecm3	1	-.5551112	.19451	.26932	-2.85387	.0968

R^2 = .8633198 σ = .0434625 F(38, 76) = 12.63 [.0000] DW = 1.790
RSS = .1435633504 for 39 Variables and 115 Observations
Information Criteria: SC = -5.076760; HQ = -5.629807; FPE = .002530
R^2 Relative to DIFFERENCE+SEASONALS = .72628

EQ(10) Modelling ΔLRPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	1.4949887	.21815	.25229	6.85306	.3819
ΔLRPINV2	-.3850626	.16871	.15007	-2.28241	.0641
ΔLRPINV3	-.2330954	.10305	.07889	-2.26200	.0631
CONSTANT	-.0076642	.02491	.02283	-.30762	.0012
ΔLRGINV	.4098359	.08396	.10718	4.88111	.2387
ΔLRGINV1	-.6739537	.13311	.14609	-5.06331	.2522
ΔLRGINV2	.1932255	.11520	.07687	1.67731	.0357
ΔLRGINV3	.1042771	.09086	.06561	1.14763	.0170
ΔLRGDP	.5807894	.19823	.23035	2.92985	.1015
ΔLRGDP 1	-.7188241	.22306	.15309	-3.22258	.1202
ΔLRGDP 2	.1123043	.21364	.14205	.52567	.0036
ΔLRGDP 3	.0285164	.22397	.21222	.12732	.0002
ΔLRGDP 4	.4945613	.38136	.53199	1.29684	.0216
RINT	.0019187	.00072	.00113	2.68240	.0865
RINT	1 -.0048361	.00112	.00158	-4.31378	.1967
RINT	2 .0041501	.00119	.00114	3.47766	.1373
RINT	3 -.0007027	.00110	.00084	-.63919	.0053
RINT	4 -.0006359	.00077	.00056	-.82954	.0090

ΔLCP		-.0554058	.17225	.23479	-.32167	.0014
ΔLCP	1	-.1355011	.17398	.15982	-.77881	.0079
ΔLCP	2	.0712727	.17296	.10417	.41207	.0022
ΔLCP	3	.0015240	.17218	.12964	.00885	.0000
ΔLCP	4	.0029488	.15113	.27005	.01951	.0000
ΔLDB		.0148611	.02647	.03104	.56148	.0041
ΔLDB	1	.0210130	.02510	.01804	.83714	.0091
ΔLDB	2	.0043155	.02488	.01336	.17347	.0004
ΔLDB	3	-.0121606	.02523	.01424	-.48208	.0030
ΔLDB	4	.0009450	.02547	.02961	.03711	.0000
IRR		-.0118956	.03073	.04796	-.38712	.0020
IRR	1	.0619376	.04644	.06216	1.33357	.0229
IRR	2	-.0625275	.04588	.03715	-1.36285	.0239
IRR	3	.0135449	.04479	.02182	.30239	.0012
IRR	4	.0025897	.03229	.02162	.08021	.0001
URGDP%		.0003407	.00032	.00039	1.06112	.0146
URGDP%	1	.0001296	.00023	.00013	.56265	.0041
URGDP%	2	-.0000213	.00023	.00011	-.09430	.0001
URGDP%	3	.0000411	.00023	.00011	.17887	.0004
URGDP%	4	-.0003239	.00028	.00034	-1.17078	.0177
ecm4	1	-1.1608525	.24885	.24843	-4.66485	.2226

R^2 = .8173874 σ = .0502374 F(38, 76) = 8.95 [.0000] DW = 1.973
RSS = .1918087812 for 39 Variables and 115 Observations
Information Criteria: SC = -4.787038; HQ = -5.340084; FPE = .003380
R^2 Relative to DIFFERENCE+SEASONALS = .63430

EQ(11) Modelling ΔLRPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	1.5713419	.18649	.21946	8.42566	.4830
ΔLRPINV2	-.4237947	.14743	.13245	-2.87458	.0981
ΔLRPINV3	-.2491989	.09644	.08535	-2.58385	.0808
CONSTANT	-.0088665	.02400	.02367	-.36951	.0018
ΔLRGINV	.4071153	.07728	.09699	5.26829	.2675
ΔLRGINV1	-.6985826	.11726	.12500	-5.95780	.3184
ΔLRGINV2	.2020647	.10477	.07636	1.92870	.0467
ΔLRGINV3	.1156530	.08505	.07192	1.35977	.0238
ΔLRGDP	.8739618	.20800	.20480	4.20181	.1885
ΔLRGDP 1	-.9148232	.25475	.18821	-3.59107	.1451
ΔLRGDP 2	.0471647	.23585	.13807	.19997	.0005
ΔLRGDP 3	.1194732	.23420	.17351	.51013	.0034

ΔLRGDP	4	.2283561	.24090	.24332	.94794	.0117
RINT		.0014065	.00068	.00107	2.06568	.0532
RINT	1	-.0040970	.00101	.00137	-4.05694	.1780
RINT	2	.0040067	.00111	.00100	3.60067	.1457
RINT	3	-.0008062	.00105	.00088	-.76738	.0077
RINT	4	-.0005721	.00073	.00057	-.78532	.0080
ΔLCP		-.0071129	.16429	.23740	-.04330	.0000
ΔLCP	1	-.1893976	.16693	.15843	-1.13461	.0167
ΔLCP	2	.1138975	.16518	.11169	.68954	.0062
ΔLCP	3	.0276591	.16219	.14369	.17053	.0004
ΔLCP	4	.0054146	.14488	.26000	.03737	.0000
ΔLDB		-.0079805	.02288	.02617	-.34879	.0016
ΔLDB	1	.0302196	.02220	.01626	1.36142	.0238
ΔLDB	2	.0044930	.02164	.01238	.20763	.0006
ΔLDB	3	-.0079405	.02117	.01218	-.37504	.0018
ΔLDB	4	-.0151950	.02179	.02884	-.69722	.0064
IRR		-.0112187	.02810	.04757	-.39919	.0021
IRR	1	.0598999	.04246	.05971	1.41071	.0255
IRR	2	-.0756423	.04254	.03057	-1.77813	.0399
IRR	3	.0188293	.04181	.02132	.45040	.0027
IRR	4	.0107472	.02990	.01986	.35941	.0017
UMS%		.0001272	.00017	.00013	.74310	.0072
UMS%	1	.0000416	.00017	.00010	.23922	.0008
UMS%	2	.0000421	.00018	.00013	.23301	.0007
UMS%	3	.0004139	.00024	.00021	1.73637	.0382
UMS%	4	-.0003037	.00027	.00021	-1.12574	.0164
ecm5a	1	-1.3311945	.22047	.22890	-6.03798	.3242

R^2 = .8412891 σ = .0468345 F(38, 76) = 10.60 [.0000] DW = 1.964
RSS = .1667035091 for 39 Variables and 115 Observations
Information Criteria: SC = -4.927320; HQ = -5.480366; FPE = .002937
R^2 Relative to DIFFERENCE+SEASONALS = .68217

EQ(12) Modelling ΔLRPINV by OLS
The Sample is 1973(2) to 2001(4) less 0 Forecasts

VARIABLE	COEFFICIENT	STD ERROR	H.C.S.E.	t-VALUE	PARTIAL r^2
ΔLRPINV1	1.5381375	.22175	.28313	6.93633	.3877
ΔLRPINV2	-.4179132	.17261	.17253	-2.42113	.0716
ΔLRPINV3	-.1758526	.10159	.08313	-1.73094	.0379
CONSTANT	.0104084	.06140	.05506	.16951	.0004
ΔLRGINV	.4767303	.07962	.10501	5.98734	.3205
ΔLRGINV1	-.8082755	.14391	.17188	-5.61652	.2933

ΔLRGINV2		.2732324	.12792	.09574	2.13599	.0566
ΔLRGINV3		.0613197	.09719	.07373	.63092	.0052
ΔLRGDP		.2741611	.18622	.21963	2.47228	.0777
ΔLRGDP	1	-.3981942	.19946	.11831	-1.99636	.0498
ΔLRGDP	2	.0742453	.19805	.11502	.37489	.0018
ΔLRGDP	3	.1658762	.20609	.17996	.80488	.0085
ΔLRGDP	4	-.0054175	.23850	.28366	-.02272	.0000
RINT		-.0019795	.00067	.00106	-2.93692	.1019
RINT	1	-.0047976	.00105	.00145	-4.57845	.2162
RINT	2	.0040006	.00113	.00113	3.53984	.1415
RINT	3	-.0008584	.00105	.00082	-.81379	.0086
RINT	4	-.0004583	.00075	.00058	-.61391	.0049
ΔLCP		.2411841	.16331	.22407	1.47681	.0279
ΔLCP	1	-.4012664	.18237	.17714	-2.20026	.0599
ΔLCP	2	.1741725	.17453	.09515	.99797	.0129
ΔLCP	3	-.0511916	.16907	.12578	-.30279	.0012
ΔLCP	4	-.0086601	.14343	.24070	-.06038	.0000
ΔLDB		.0079580	.02270	.02554	.35055	.0016
ΔLDB	1	.0250093	.02174	.01720	1.15016	.0171
ΔLDB	2	-.0011577	.02118	.01242	-.05466	.0000
ΔLDB	3	-.0079177	.02082	.01305	-.38027	.0019
ΔLDB	4	-.0004662	.02135	.02275	-.02184	.0000
IRR		-.0180684	.02757	.04710	-.65539	.0056
IRR	1	.0698473	.04166	.06362	1.67654	.0357
IRR	2	-.0659695	.04247	.03750	-1.55336	.0308
IRR	3	.0209031	.04144	.02094	.50441	.0033
IRR	4	-.0058656	.02950	.02077	-.19886	.0005
UFB%		.000000129	.000000344	.00000	.37588	.0019
UFB%	1	-.000000753	.000000378	.00000	-1.99245	.0496
UFB%	2	-.000001843	.000000415	.00000	-4.44173	.2061
UFB%	3	-.000001216	.000000494	.00000	-2.46324	.0739
UFB%	4	-.000000109	.000000367	.00000	-.29797	.0012
ecm6	1	-1.1764053	.25080	.28705	-4.69070	.2245

R^2 = .8397032 σ = .0470679 F(38, 76) = 10.48 [.0000] DW = 1.945
RSS = .1683692753 for 39 Variables and 115 Observations
Information Criteria: SC = -4.917377; HQ = -5.470423; FPE = .002967
R^2 Relative to DIFFERENCE+SEASONALS = .67899