

Capital Market Imperfections and Corporate Investment Behavior: A Switching Regression Approach Using Panel Data for Nigerian Manufacturing Firms

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Abstract

We investigate the impact of capital market imperfections on corporate investment behavior using panel data for Nigerian manufacturing firms from 1984-2000. We deal with both static and dynamic misspecification problems by using an endogenous switching regression model. We find that financial factors have a significant effect on the investment behavior of Nigerian firms, but the extent and impact of financing constraints are not uniformly distributed. Variables that capture firms' credit worthiness, asymmetric information, agency problems and size increased the probability of a firm being in the high-premium regime. The likelihood of being in either a low or high regime varies over the business cycle in line with general macroeconomic conditions.

Keywords: Capital Market Imperfections; Corporate Investment; cash flow; Tobin's q
JEL Classifications Codes: G15, G31

1. Introduction

The body of empirical research which explores the connection between investment and finance has developed with the theme that financial structure is relevant to a firm's investment decisions when capital markets are imperfect. This is in contrast to Modigliani and Miller's (1958) irrelevance theorem. Modigliani and Miller have argued that in a perfect capital market, a firm's investment decisions are independent of its financing decisions because the financial structure would not affect the costs of investing. Under such assumption, they conclude that a firm's financial structure is irrelevant to its value¹.

However, recent research argues that, in an imperfect capital market, internal and external capital are not perfect substitutes for each other. Investment may consequently depend on such financial factors as availability of internal finance, ease of access to debt or new equity finance, or the functioning of particular credit markets. This may be due to imperfect information about the quality or riskiness of the borrower's investment project. Information asymmetries and costly contract enforceability generate agency costs that result in outside investors demanding a premium on debt or

¹ Retained earnings, debt and equity as sources of investment finance are assumed equivalent to one another. Shares in the securities segment of such a market can be traded without dealing costs. Borrowing and lending rates are equal. All firms have equal access to the market and internal and external funds are perfectly substitutable. There are neither bankruptcy costs nor any form of taxation.

stock issued by the firm and cause external funds to be an imperfect substitute for internal funds (Hu and Schiantarelli, 1998).

Imperfections constrain investment expenditure and mobilization of capital for investment as a result of credit rationing² or effective denial of external financing. Owing to information asymmetries and agency problems, capital market imperfections will create a wedge between the costs of external and internal funds. In such a situation firms prefer to finance investment with internal funds, and therefore, corporate investment will depend on firms' financial factors. External finance, if available, will be more costly than internal finance because of transaction costs, agency problems, asymmetric information or the cost of auditing the borrower.

Imperfect substitution between internal and external funds will result in the excess sensitivity of investment to cash flow because of problems related to the conflict of interest³ between managers and outside shareholders in the firm. The cost of issuing new debt or equity to finance investment projects will depend on a firm's financial structures, other characteristics that proxy for the severity of information and agency problems, and on macroeconomic conditions (Hu and Schiantarelli, 1998).

Financial markets in Sub-Saharan Africa are usually described as imperfect. Central to the major issues in financial regulation and liberalization in Africa are agency problems between creditors and equity-shareholders, between the public and the private sectors, and between managers and capital contributors. The agency problems are accentuated by information asymmetry, search, transaction and contracting costs. In particular, there is a relative absence of legal and regulatory mechanisms, such as bankruptcy courts and laws, to enforce contracts. This has resulted in an abundance of credit rationing and high collateralization, which discourages new growth opportunities, with adverse consequences for the economic growth of Africa (Ncube and Senbet, 1997). This is equally true of Nigeria.

Despite the size and policy relevance of finance and economic literature that has studied the relationship between corporate investment and finance⁴, the empirical evidence has been largely unexplored in Africa generally, including Nigeria. This is a major research gap which this study seeks to fill.

There are a number of reasons why Nigeria is a good case to test the impact of capital market imperfections on corporate investment behavior. First, access to credit has deteriorated in Nigeria over time and it has been ranked as the most critical problem facing the country (The World Bank, 2007). Second, and related, available research evidence indicates that the Nigerian capital market is imperfect (Odedokun, 1995; Olowe, 1998; Oludoyi, 1999; Adelegan, 2003, 2006a & b). Specifically, evidence shows that information is not instantaneously and simultaneously available to all investors. Furthermore, the Nigerian capital market has been classified by International Finance Corporation (IFC) as *emerging* and *undeveloped* as it has exhibited different forms of imperfections. Examples include: barring of foreign investors from entering into the Nigerian capital market, imposition of price caps on share price movement⁵, regulation of interest rates and political instability which resulted in thinness of trading, low market capitalization, low turnover, low and/or negative performance ratios, low betas and/or a high proportion of negative betas, significant abnormal returns and illiquidity of the market (Inanga and Emenuga, 1997; Ogwumike and Omole, 1997, Oludoyi, 1997, Inanga, 1999,

² Keeton (1979) has distinguished between two types of credit rationing. Type 1 credit rationing occurs where amounts needed cannot be borrowed at the existing interest rate. This leads to entire groups of identical loan applicants being either completely or partially excluded from borrowing by banks. This type of credit rationing is sometimes referred to as 'red lining'. In type 2 credit rationing, borrowers from an identical group are able to borrow while others are not.

³ This conflict may be explained by the fact that managers bear the entire cost of activities, but not the 100 percent gain since they hold less than 100 percent equity. They may therefore invest in non-value maximizing perquisites. This action may, however, be mitigated through the mechanism of debt financing. According to Jensen (1986), introducing debt into the financial structure may reduce the amount of free cash available for managers and thereby reduce the problem. Even where managers are tempted to continue the firm's operations in their self-interest despite the firm's poor cash flow, Harris and Raviv (1990) have argued that debt finance can be a tool to threaten the firm's liquidation.

⁴ A thorough review of this line of research can be found in Hubbard (1998) and Lensink, et al (2001)

⁵ Prior to January 1995, foreign investors could not hold more than 40 per cent equity capital in any single company listed on the Nigerian Stock Exchange. Furthermore, before April 1995, the equity share price could not be raised by more than 10 kobo (100 kobo = 1 naira) on any trading day on the Stock Exchange. This was raised to 20 kobo in April 1995 and increased to 5% of a particular firm's share price in May 1996. This is a practice that contributes to market imperfections by preventing share prices from responding freely to market forces of supply and demand based on relevant publicly available information.

Adelegan, 2003a). The above imperfections are revealed in microstructure elements such as high transaction costs.

Other problems include capital rationing and discrimination in the credit market and unequal access of firms to the capital market. Borrowers with low net worth⁶ are regarded as high credit risks by potential savers who then demand high-risk premiums as compensation for parting with their savings. The cost of external finance to such borrowers is often so prohibitive as to compel them to resort to internal and informal finance to fund productive investments (Inanga, 1999). This study will provide a basis for comparison with similar studies from developed countries and provide a benchmark for other developing countries to which Nigeria's experience could serve as a useful lesson. There is also a need for "triangulation" in the research using different settings, methods, data and periods among others. This study provides evidence from emerging markets like Nigeria.

This paper investigates the impact of capital market imperfections on corporate investment behavior in Nigeria. In particular, the paper aims to address the following three questions.

- Do capital market imperfections have differential effects on the investment behavior of firms in Nigeria?
- Do the incidence and severity of information and agency problems vary across firms and over time?
- What are the effects of variables that capture each firm's credit worthiness, asymmetric information, and agency problems on the probability of being in the high- or low-premium regime?

The study contributes to the existing literature by using firm level data from Nigeria, which is a developing country, to analyze how the incidence and severity of information and agency problems vary across firms and over time, and the differential effects on corporate investment behavior, rather than focusing on developed economies as has thus far been done in the literature. The use of a Nigerian data set has the advantage of triangulation in research by providing empirical evidence from Africa. Other developing countries to which Nigeria's experience could serve as a useful lesson will also benefit from the findings of the study. The study deals with both static and dynamic misspecification problems by using an endogenous switching regression model to analyze the impacts of capital market imperfections on investment. The model was estimated using panel data for Nigerian manufacturing firms with 1113 firm year observations from 1984-2000.

We find that financial factors have a significant effect on the investment behavior of Nigerian firms. However, the extent and impact of financing constraints is not uniformly distributed. We also find that variables that capture each firm's credit worthiness, asymmetric information, and agency problems, such as a high level of liquidity and low level of interest-payment-to-profit ratios, increased the probability of a firm being in the high-premium regime. However, the stock of debt does not play an important empirical role. Large firms are more likely to be in the high-premium regime and the likelihood of being in either the low or high regime varies over the business cycle in line with general macroeconomic conditions.

The rest of the study is organized into six sections. Section 2 presents an overview of the Nigerian business environment and capital market. Section 3 presents a review of the relevant literature. In section 4, the research methodology and data sources are described. Section 5 analyzes and interprets the findings. The penultimate section presents the summary and conclusion, while the last section discusses the implications of the findings.

2. The Nigerian Business Environment and Capital Market

Nigeria is a low income country in Sub-Saharan Africa with a gross national income per capita of US\$560 dollars. Table 1 provides economic data on doing business in Nigeria compared with 175

⁶ That is capital employed represented by excess of total assets over current liabilities.

countries of the world. In 2006, Nigeria moved down from number 76 out of 175 in terms of ease of access to credit to number 83. This represents a significant decline in Nigerians' access to credit.

Table 1: Economic Data on Nigerian Business Environment (Total 175 countries rank)

| Ease of: | 2006 rank | 2005 rank | Change in rank |
|-----------------------|-----------|-----------|----------------|
| Getting Credit | 83 | 76 | -7 |
| Paying Taxes | 105 | 99 | -6 |
| Protecting Investors | 46 | 43 | -3 |
| Starting a Business | 118 | 115 | -3 |
| Doing Business | 108 | 109 | +1 |
| Registering property | 170 | 171 | +1 |
| Enforcing contracts | 66 | 105 | +3 |
| Dealing with licenses | 129 | 134 | +5 |

Source: The World Bank (2006):Doing Business

The Nigerian business environment has also moved backwards in terms of investor protection and the ease of starting a business. Nigeria ranked 170, 66 and 108 respectively in terms of ease of registration of property, contract enforcement and doing business in 2006 as compared with 175 nations. These rankings also reflect the degree of imperfections in the economy.

The Nigerian capital market commenced operations in 1961 as the Lagos Stock Exchange. It was redesignated the Nigerian Stock Exchange (NSE) in 1977 with branches established in Lagos, Port Harcourt and Kaduna. The NSE trading floor has now increased to seven locations in Lagos, Kaduna, Port Harcourt, Kano, Ibadan, Onitsha and Abuja.

The Securities and Exchange Commission (SEC) was established to protect investors and promote capital market growth and development in the country. It is the apex regulatory organ of the Nigerian Capital Market. Formerly called the Capital Issue Committee (1961), and later the Capital Issues Commission (Capital Issue Decree No. 14 of 1973), the SEC was established under the SEC Decree No. 71 of 1979 amended in 1988 and 1999.

The total number of listed securities (comprising government stock, industrial loans and equities) increased from 9 in 1961 to 52 in 1971 and 71 in 1978. It also increased from 157 in 1980 to 276 in 1994 but declined to 260 in 2000 and increased to 277 in 2004, with an average annual growth rate of 17% for the entire period (Ariyo and Adelegan, 2005).

The current operational highlights of the Nigerian stock market are presented in Table 2. The value of shares traded was 225.82 billion naira (US\$1.737 billion)⁷, the value of new issues approved was 227.38 billion naira (US\$1.749 billion) in 2004 and market capitalization in 2004 was 2,112 billion naira (US\$16,246 billion).

⁷ The exchange rate is USD\$1=130 naira.

Table 2: Stylized Facts of Operational Statistics of the Nigerian Stock Market

| Statistics | 2004 | 2003 | 2000 | 1999 | 1998 | 1997 | 1996 | AGR |
|---|-----------|-----------|---------|---------|---------|---------|---------|--------------|
| | | | | | | | | (1996-2004)% |
| Market capitalization (billions of naira) | 2,112b | 1,359b | 478.6b | 299.9b | 263.3b | 292.0b | 285.6b | 51 |
| Market capitalization/GDP% | 25.55% | 19.52% | 9.77% | 9.39% | 9.49% | 9.95% | 10.43% | 21 |
| Shares traded (volume) | 19.21b | 13.30b | 5.0b | 3.9b | 2.1b | 1.3b | 0.882b | 72 |
| Value traded (billions of naira) | 225.82b | 120.70b | 28.2b | 14.1b | 13.6b | 11.1b | 7.1b | 100 |
| New issues (billion/millions of naira) | 227.38b | 185.02b | 35.71m | 44.44m | 17.28m | 9.11m | 21.45m | - |
| New issues/GDP | 4% | 3% | 0.09% | 0.12% | 0.06% | 0.03% | 0.08% | 85 (1.05)* |
| Listed securities (number) | 277 | 265 | 261 | 269 | 264 | 264 | 276 | - |
| Price cap | 5% | 5% | 5% | 5% | 5% | 5% | 20 kobo | - |
| NSE All-Share Index(1984=100) | 23,844.45 | 20,128.94 | 8111.01 | 5266.43 | 5672.76 | 6440.51 | 6992.1 | 32 |

Source: Nigerian Stock Exchange: "The Nigerian Stock Exchange Fact book", various issues. NSE, Nigerian Stock Exchange: Annual Reports & Accounts, various issues, NSE, Oludoyi (2000), Central Bank of Nigeria (CBN) Annual Report and Statements of Accounts, 2004.

Note: Exchange rate is \$1 = 130 naira. 1 naira= 100 kobo, N= naira, t=trillion, b=billion, m=million, AGR (1996-2000)=average growth rate from 1996 to 2004 measured in percentages, * = average New issues/GDP.

3. Literature Review

The q theory of investment was introduced by Keynes (1936) and Brainard and Tobin (1968, 1977) and Tobin (1969) and extended to models of investment assuming convex costs of adjusting the capital stock by Hayashi (1982). Their approach emphasizes equity prices and shifts attention away from the bond and money markets towards equity markets. In place of interest rates, equity prices become the channel whereby monetary policy affects investment spending (Blanchard, 1981, Palley, 2001). According to the q theory, 'the rate of investment – the speed at which investors wish to increase the capital stock – should be related, if to anything, to q , the value of capital relative to its replacement cost' (Tobin (1969). The principal way in which financial policies and events affect aggregate demand is by changing the valuations of physical assets relative to their replacement cost.

The q and cash flow model is adopted in this study because it has a number of theoretical advantages over other models. First, unlike most other investment models, it allows output to be endogenously determined and variable. Second, unlike Jorgenson's neoclassical model and the accelerator model, it is forward-looking based on market valuation of the firm's assets rather than based on lags of past variables. Third, it allows for distinct analysis of the effects of temporary versus permanent changes in tax parameters. Finally, it avoids the Lucas critique⁸, since the estimated adjustment parameters should not depend on policy rules (Schaller, 1990).

Most studies of financing constraints and corporate investment since Fazzari et al, 1988 estimate a q and cash flow model of investment. The existing empirical literature analyzing financial factors in investment decisions has produced a number of findings suggesting the significance of financing constraints for firm decisions (Hubbard, 1998).

These studies are organized around the commonly used criteria that have been utilized to identify firms that are more likely to suffer from financing constraints. Most of these criteria emphasize the cross-sectional differences that exist across firms. These include earnings retention and dividend pay-out practice, group affiliations, firm size, age, agency problems and concentration of ownership and structural changes in the financial market and classification based on the switching function between high-premium and low-premium regimes (Fazzari et al, 1988; Fazzari and Peterson, 1993; Bond and Meghir, 1994; Alonso-Borrego, 1994; Hoshi et al, 1991; Schiantarelli and Sembenelli, 1995; Chirinko and Schaller, 1995; Jaramillo et al, 1994; Harris et al, 1994; Hu and Schiantarelli, 1998).

⁸ According to the Lucas critique, predictions based on historical data would be invalid if some policy change alters the relationship between relevant variables. If the policy change alters the relationship between the variables, then the historical relationship between variables would differ from the future relationship. The Lucas critique is a criticism of the use of econometrics in determining economic policy. The argument can be expressed as follows: if a government observes an econometric pattern and decides to exploit that regularity to achieve a policy objective, it will cause the underlying behavior to change and econometric regularity to disappear.

Bigsten et al (1999) analyzed the investment behavior of four African countries⁹ and found a positive effect of profits on investment, but this was confined to smaller firms rather than larger firms. Bond et al (1997) studied firms' investment behavior in Belgium, France, Germany and the UK, and found that financial constraints on investment are more severe in the UK than in the three other countries. Mairesse et al (1999) studied firms' investment behavior in France and the US and found significant changes in the investment behavior of French and US firms over the previous twenty years. Laeven (2001) investigated whether financial liberalization relaxes the financing constraints of thirteen developing countries.¹⁰ He found that small firms are financially constrained before the start of the liberalization process, but this becomes less so after liberalization; however, financing constraints of large firms are low both before and after financial liberalization.

Corporate studies in Nigeria have been concentrated on the estimation of corporate cost of capital (Akintola-Bello and Adedipe, 1983, Inanga, 1987 and Adelegan, 2001), determinants of dividend decisions (Uzoaga and Alozieuwa, 1974; Inanga, 1975, 1978; Soyode, 1975; Oyejide, 1976; Odife, 1977, Ariyo, 1984, Odedokun, 1995, Izedonmi and Eriki, 1996, Adelegan and Inanga, 2001, Adelegan, 2002, 2003a, 2003b, 2006a, 2006b,) and financing decisions (Soyode, 1978, Oyejide, 1987, Soyibo, 1996, Ariyo, 1999, Salami, 2000, Adenikinju, 2002, Adelegan, 2007).

Literature on the link between corporate investment and finance in Nigeria is limited. Akinnifesi (1984) empirically analyzed the determinants of investment behavior of manufacturing industries in Nigeria based on five alternative theories of investment and private foreign investment data for a sample of eight manufacturing industries over the period 1966 to 1976. Odedokun (1995) examined the relationship between dividend policy, investment spending and financing decisions of sixty quoted non-financial firms in Nigeria from 1985 to 1988 and concluded among others that "on the whole, therefore, the existence of mutual interdependence between financing and investment decisions and the dependence of finance and investment decisions on dividend policy is strongly supported by the data." Soyibo, (1996) identified the four major productive investment finance alternatives used by Nigerian firms as bank credit, share capital increase, drawing down on corporate time and saving deposits and debentures, and other capital market debt instruments.

Although studies of corporate investment and financing decisions in Nigeria are few and somewhat inconclusive, they made significant steps forward in the identification of the determinants of investment behavior of firms in Nigeria. Akinnifesi and Odedokun in their studies viewed the firm as a 'black box' that operates to meet the relevant marginal conditions with respect to inputs and outputs, while maximizing profits, or present value. They based their studies on the representative firm assumption by pooling all the firms in their samples together. However, their models are limited because they consider neither firms' heterogeneity by incorporating firm and industry specific characteristics, nor the time dimension in the firms' decision process. Fazzari et al (1988). Subsequent studies such as Hu and Schiantarelli (1998) have dropped the 'black box' approach and have established that firms face different degrees of financing constraints and different premiums on external finance, by partitioning firms into groups based on a priori criteria or by using an interaction approach.

Furthermore, these few studies on firms' investment behavior in Nigeria are limited to the pre- and post-Structural Adjustment Programme (SAP) periods. There have been several economic policy changes after the introduction of SAP.

In view of the above limitations, it is evident that many questions have been left unanswered by previous studies in the Nigerian context. While they provide a good introduction to the subject, they are silent on the questions: What is the link between capital market imperfections and investment expenditure of firms in Nigeria? Given the fact that firms face different degrees of financing constraints, do firm size, industry specific characteristics and different premiums on external finance affect the investment behavior of different types of firms in the high-and low-premium regimes? Do the incidence and severity of information and agency problems vary across firms and over time? Given

⁹ They are Cameroon, Ghana, Kenya and Zimbabwe.

¹⁰ They are Argentina, Brazil, Chile, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Korea, Taiwan and Thailand.

capital market imperfections, what are the factors that drive corporate investment behavior in Nigeria in the light of current policy pronouncements?

This study attempts to provide meaningful answers to these questions and so make a modest contribution to the investigation of demand for corporate investment and financing constraints in Nigeria.

4. Methodology

4.1. Switching q Model of Investment

Most empirical research on capital market imperfections and corporate investment is based on a reduced form q-cash flow investment model. The q theory states that all fluctuations in investment are related to q. In order to examine the effects of capital market imperfections, variables that measure financing constraints are added to the basic reduced form equation of investment. Investments are only sensitive to internal funds if there are financing constraints; it is common to include a measure of internal sources. The standard measure used in the empirical literature is cash flow (CF). The Tobin's q model is used very often with financial variables such as cash flow added to the q model of investment to pick up capital market imperfections.

Using cash flow, gives the relationship shown in equation (1) as:

$$\left(\frac{I}{K}\right)_{it} = a_i + bq_{it} + c\left(\frac{CF}{K}\right)_{it} + \mu_{it} \quad (1)$$

where: I_{it} is gross investment expenditures on plant, machinery and equipment, K_{it} is the beginning of period capital stock, measured as equals net replacement value of plant and equipment, plus the value of investment in shares of other companies, land, buildings and properties, intangibles, plus the value of inventories, q_{it} is the beginning period Tobin's q deflated by capital stock, CF is cash flow which is the income after interest and taxes, plus all non-cash deductions from income (depreciation allowances and amortization) and μ_{it} is an error term.

Moreover, cash flow can be thought of as a proxy for firms' internal net worth. Previous studies have sorted firms in groups based on *a priori* measures such as dividend pay-out, size, group affiliation among others. The more severe the information and agency problems faced by a firm, the higher the cost of external finance, and the greater the sensitivity of the firm's investment to cash flow. Furthermore, using q as a measure of investment opportunities may be a poor proxy because of a breakdown traceable to efficient markets or capital market imperfections. However, cash flow variable, when added to q-model of investment is expected to pick up capital market imperfections.

The division of firms into groups according to an *a priori* time invariant financing constraint has a number of drawbacks. There are potential problems of static and dynamic misspecification encountered where firms are sorted using *a priori* criteria. Similar problems also affect the related technique of estimating a single equation with the interaction terms between cash flow and possibly other regressors and variables that capture the severity of agency costs. In either case, it is either impossible or impracticable to allow contemporaneously for the multiplicity of factors affecting the importance of agency problems, and for their time varying nature. During the sample period it may be the case that a firm that is initially faced with severe financing constraints becomes less financially constrained later. This will especially be the case when the extent of capital market imperfections depends on the general macroeconomic environment. Hence, although it is possible to identify firms that may be financially constrained, it is quite often impossible to identify the years during which a firm is constrained. This makes it almost impossible to differentiate between firm-specific effects on investment and the effects of financing constraints (Kaplan and Zingales, 1997). Finally, the variable used to select firms is probably correlated with the endogenous variable investment. In that case, the analysis suffers from selection bias (Hu and Schiantarelli, 1998).

The switching q model of investment helps to tackle these problems and provide a basis to test the dynamics of the movement of firms across regimes. Hu and Schiantarelli (1998) applied an

endogenous switching model of investment within the framework of q models based on the assumption of convex adjustment costs to overcome these problems. However, the switching regression model has a long history. It was used in an early study by Roy (1951) who considers an example of two occupations, hunting and fishing, and individual self select based on their comparative advantage. The model was extensively discussed by Maddala and Nelson (1975) and Maddala (1983). It has also been applied to the union-nonunion wage model (Lee, 1978), the housing-demand model (Troost, 1977), the disequilibrium market model (Fair and Jaffee, 1972), the labor-supply model (Heckman, 1974; Gronau, 1974). Almost all the models with discrete parameter changes fall in the category of switching models.

Although the q theory of investment is an appealing framework for investment studies, its empirical performance is often disappointing. One of the main reasons why the q model behaves so badly is related to measurement problems (Gomes, 2001). Since the marginal q is unobservable, the average q has often been used as a proxy. However, the average q is only a perfect proxy for marginal q when markets are perfectly competitive and there is a homogeneous production technology. Hence, severe measurement problems are probably introduced. Moreover, the empirical measurement of (average) q requires data on prices and number of shares outstanding, which prevents the inclusion of private and thus smaller firms in the sample (Perfect and Wiles, 1994).

However, the switching q model of investment incorporates cash flow in the study of investment behavior. This makes it appropriate for a developing economy like Nigeria where the capital market imperfections in the form of information and agency problems are pronounced. In the developed economies, institutional factors have reduced the degree of imperfections of the capital market to the barest minimum.

The study attempts to deal with both static and dynamic misspecification problems by using an endogenous switching regression model, with sample separation unknown, to investigate the impact of capital market imperfection on investment. Adopting the switching regression model of investment developed by Hu and Schiantarelli (1998), the study captures the effect of capital market imperfections on investment, within the framework of q -cash flow models based on the assumption of convex adjustment costs.

The investment function can be in either of two regimes: high-premium and low-premium. A high-premium regime applies to firms that have low net worth and therefore face a high premium on external finance. Firms in the high-premium regime are expected to have a higher sensitivity of investment to cash flow than firms in the low-premium regime. Firms in the low-premium regime have high net worth and so face a low premium on external funds. We expect variables that capture firms' future profit prospects (Tobin's q) to matter more in the low-premium regime than in the high-premium regime.

The probability of operating in each regime is determined by a switching function. The switching function is defined as a function of those variables that the theory suggests influence the imperfect substitutability between internal and external sources of finance. It is a function of a firm's financial variables, and other characteristics that proxy for the severity of informational and agency problems, and the overall macro environment. In the model, the probability of whether a firm is facing a high premium on external finance is endogenously determined. Hence this model captures the dynamic effects of a firm's specific variables and the macroeconomic conditions on the firm's investment and financing decisions. Moreover, by estimating the switching regression we can directly test the effect of different factors on the firm's likelihood of facing a high premium.

To achieve the objective, the specifications of the switching q model of investment that we used are stated as equations 2 to 5 below. Firm i at time t operate in the low-premium regime with an investment equation defined by equation (2)

as,

$$\left(\frac{I}{K}\right)_{it} = a_i + X_{it}\beta^{LP} + \varepsilon_{it}$$

if $Z_{it}\gamma + \mu_i < 0$ (2)(3)

or it operates in the high-premium regime with an investment equation (4)

$$\left(\frac{I}{K}\right)_{it} = a_i + X_{it}\beta^{HP} + \varepsilon_{it}$$

if $Z_{it}\gamma + \mu_i > 0$ (4)(5)

where: $(I/K)_{it}$ is as previously defined. In the investment function, X_{it} which is X_{1t} and $X_{2t} = (\mathbf{q}_{it}, (CF/K)_{it}, YD, INDD)$, \mathbf{q}_{it} and CF_{it} are as previously defined. YD is year dummies and INDD is industry dummies

In this study, the switching function, Z_{it} is the vector that includes a set of balance sheet variables that are suggested to be important indicators for the extent to which firms are confronted with financing constraints. They capture each firm's credit worthiness, asymmetric information, and agency problems. They are the lagged values of the debt-to-market value ratio $((D/V)_{i,t-1})$, the interest-to-operating-income ratio $((Int/Y)_{i,t-1})$ and the stock of liquid-financial-assets-to-capital ratio $((Liq/K)_{i,t-1})$ and SIZE which is defined as the logarithm of the real total capital stock $(LK_{i,t-1})$. The industry dummies and the year dummies are also included in the switching function. The balance sheet variables and industry dummies capture the dynamic effects of firm's specific characteristics, while the year dummies capture the macro conditions on the corporate firms' investment behavior and financing decisions.

This approach allows us to endogenously determine the premium on external finance (that is the wedge) by a switching function. X and Z are overlapping sets of explanatory variables. β^{LP} , β^{HP} and γ are sets of parameters to be estimated. ε_1 , ε_2 and μ_{it} are residuals that are only contemporaneously correlated. It is normally assumed that $(\varepsilon_1, \varepsilon_2, \mu_{it})$ are jointly normally distributed with mean vector 0, and covariance matrix

$$\Sigma = \begin{pmatrix} \mu_1^2 & \mu_{12} & \mu_{1v} \\ \mu_2 & \mu_2^2 & \mu_{2v} \\ \mu_{1v} & \mu_{2v} & 1 \end{pmatrix}$$

Var (v) = 1 because, by nature of the conditions (2-3) and (4-5), μ is estimable only up to a scale factor.

The dependent variable is corporate investment (I/K) and the independent variables in the investment function are the X_{it} vector, which is X_{1t} for low premium regime and X_{2t} for high premium regime. The X_{it} vector includes Tobin's q_{it} , (q/K) , cash flow (CF/K) and its lag $((CF/K)_{t-1})$, industry dummies (IND) and the year dummies (YD). q (q/K) is defined as the end of the year market value of the firm (market value of equity plus book value of debt) deflated by K. In calculating the denominator of q , we summed fixed assets with inventory. Cash flow (CF/K) defined as income after tax and extraordinary items plus adjustment for items that does not involve the movement of cash especially depreciation and its lag $((CF/K)_{t-1})$. There are 14 industries in the sample used in this study¹¹. IND1 represents agriculture, IND2 represents automobile and tyres, IND3 represents breweries, IND4 represents building materials, IND5 represents chemical and paints, IND6 represents computer and office equipments, IND7 represents conglomerates, IND8 represents food, beverages and tobacco, IND9 represents footwear, IND10 represents healthcare, IND11 represents industrial and domestic products, IND12 represents packaging, IND13 represents printing and publishing and IND14

¹¹ We used Nigerian Stock Exchange sectoral classifications.

represents textile. Year dummies for 1988 to 2000 were introduced. Observations of other years were dropped due to lags.

4.2. Estimation Procedure

The models presented above are estimated and analyzed for the entire study period. We estimate equations 2 to 5 with the Z_{it} vector to obtain the maximum likelihood estimates of the switching regression model. The switching regression model can be estimated one equation at a time, either by two step least squares or by maximum likelihood. In this setting, both approaches ignore some information. The two step estimator is inefficient but, the single equation maximum likelihood estimators each reestimate α , and hence ignore the fact that α is being estimated twice, differently. We use the full information maximum likelihood estimator. By maximizing a log-likelihood function, we jointly estimate the parameters β^{LP} , β^{HP} and γ . The results expected from the above estimation procedures are summarized in section 4.

4.3. Data

The study sample comprises 85 out of the 102 manufacturing companies quoted on the Nigerian Stock Exchange (NSE) between 1984 and 2000. This accounts for 83 percent of the relevant population of firms according to NSE's classification¹². The choice of firms was informed by availability of relevant information in the financial statements of each firm in the sample. Data used in this study are mainly from secondary sources, which include the Nigerian Stock Exchange fact books, annual reports of companies; Nigerian Stock Exchange daily official lists for the first and the last day of trading in each of the years covered in the study. The Nigerian Stock Exchange is a reliable source of data of quoted companies because the companies are mandatorily required to submit their financial reports to the Nigerian Stock Exchange quarterly and biannually. Company annual reports are also reliable because they are statutorily required to be audited by recognized auditing firms before publication.

1984 was chosen as the base year because it was the year in which stock market indexing was first introduced in Nigeria. The period covered, 1984 to 2000, also witnessed some significant economic policy changes in Nigeria's corporate history. This resulted in a panel data set with 1200 firm year observations in all. The study deleted any firms that have missing or inconsistent data to obtain a clean sample and that resulted in 1113 observations. Introduction of lag values and dropping of outliers resulted in a usable sample size of 800 firm-years. The firms in the data base are typically large, and their stock is publicly traded.

The data set has a few distinctive advantages. First, there is a breakdown of investment expenditure between several asset types, which makes it possible for the study to carry out an explicit aggregation of capital goods. Second, unlike most western countries, mergers and acquisitions were infrequent in Nigeria during the sample period, so there is very little attrition in our data set. Third, the virtual lack of mergers and acquisitions also means that almost all the firms remain in the sample at the same margin – through accumulation, not through acquisitions.

5. Data Analysis and Results

Summary statistics of the firm year observations in the sample that are used for the empirical analysis of the link between financing constraints and investment behavior are presented in Table 3. From Table 3, the average investment-to-capital ratio (I/K) is 6 percent; some firms have an investment-to-capital ratio that is as high as 47 percent. The average cash flow-to-capital ratio (CF/K) is 17 percent while its maximum in the sample is 89 percent. The average Tobin's q (q/K) is 1.14. Tobin's q signifies market

¹² They are automobile and tyre, breweries, building materials, chemical and paints, conglomerates, computer and office equipment, engineering technology, food, beverage and tobacco, footwear, healthcare, industrial/domestic products, packaging, publishing and textiles, excluding companies in banking, commercial services, construction, insurance, investment companies, machinery (marketing) and petroleum (marketing) which are not involved in manufacturing and therefore have limited investment in plant and machinery and productive equipments.

evaluation of future profit prospects and the benchmark is 1. It also shows that on average the market value of the firms exceeds the value of their capital stock. The stock of debt measured as debt-to-market value of the firm ratio $((D/V)_{t-1})$ is about 9 percent on the average. The flow measure of debt which is the interest expenses ratio $((INT/Y)_{t-1})$ is about 24 percent.

Table 3: Descriptive Statistics of 800 Firm-year Observations from 1984-2000

| Variable | Mean | Minimum. | Maximum | Std.Dev. |
|----------------------------|--------|----------|---------|----------|
| I/K | 0.06 | 0.02 | 0.47 | 0.07 |
| q/K | 1.14 | 0.05 | 7.31 | 0.99 |
| CF/K | 0.17 | 0.02 | 0.89 | 0.15 |
| $(LIQ/K)_{t-1}$ | 0.13 | 0.01 | 1.66 | 0.18 |
| $(D/V)_{t-1}$ | 0.09 | 0.00 | 0.90 | 0.15 |
| $(INT/Y)_{t-1}$ | 0.24 | 0.00 | 0.32 | 2.25 |
| $SIZE(LK)_{t-1}$ | 5.40 | 3.72 | 7.50 | 0.77 |
| CAP. Stock (billions of ₦) | 1039.6 | 1.5 | 39271.7 | 2898.6 |

Source: Author's computations based on samples
Computed using STATA Version 8.0.

Table 4 presents the results of the analysis of the effects of variables that capture each firm's credit worthiness, asymmetric information, and agency problems on the probability of being in the high- or low-premium regime. We also discussed the impact of macroeconomic conditions (captured by the year dummies in the switching function) on the firms' investment behavior and financing decisions.

We investigate the differences in investment behavior between firms in the high-premium regime and those in the low-premium regime. The switching function determines whether or not a firm faces a high (HP) or low (LP) premium on external finance endogenously. The switching function categorizes corporate investment in either of the two regimes. Each regime is characterized by different values of the coefficients of cash flow and q.

We estimated equations (2-5) using the switching regression model to provide research evidence for the objective. This model gives us the maximum likelihood estimates and provides research evidence about the relationship between the financing constraints and investment behavior given capital market imperfections. We also investigated the effects of the balance sheet variables (in the switching functions) on the probability of being in the high- or low-premium regime.

Table 4 presents the results for a basic version of the switching regression model. The dependent variable is corporate investment (I/K) and the independent variables in the investment equation are q (q/K) and cash flow (CF/K), industry dummies (IND) and year dummies (YD)

Table 4: Effect of q and Cash flow on Investment Behaviour: Switching Regression Model

| Dependent variable: $(I/K)_{it}$. Log-Likelihood=661.92. No of observations: 794 | | | | |
|---|-----------------------|----------------------|----------------------|----------------------|
| Investment function | $(q/K)_{it}$ | CF/K | Sigma | |
| LP regime | 0.158 (11.766)*** | 0.076 (2.173)** | 0.076 (23.169)*** | |
| HP regime | -0.032 (-6.743)*** | 0.037 (1.197) | 0.092 (19.012)*** | |
| Switching function | $(D/V)_{it-1}$ | $(Int/Y)_{it-1}$ | $(Liq/K)_{it-1}$ | LK_{it-1} |
| | -0.16 (-1.405) | -0.049 (-1.954)** | 0.473 (4.94)*** | 0.0672 (5.317)*** |

Source: Computed using LIMDEP Version 7.0, 1997

T-ratios are in parentheses. All equations include industry and year dummy variables
***, **, * represent significance at 1%, 5% and 10% levels respectively.

The financial variables in the switching function are the lagged values of the debt-to-market value ratio $((D/V)_{i,t-1})$, the interest-to-operating-income ratio $((Int/Y)_{i,t-1})$ and the stock of liquid-financial-assets-to-capital ratio $((Liq/K)_{i,t-1})$ and SIZE (which is the logarithm of the real total capital

stock (LK_{it-1})). The industry dummies and the year dummies are also included in the switching function. The industry dummies measure the industry specific characteristics, while the year dummies capture the macroeconomic conditions. The model was estimated for the unbalanced¹³ panel for the 1984-2000. The initial years are lost for estimation as a result of lags in the equations.

From Table 4, the performance of q is mixed. The coefficient of q (q/K) is positive and highly significant in the low-premium regime (LP regime) at 1 per cent level of significance. However, the coefficient of q (q/K) is negative and statistically significant in the high-premium regime (HP regime) at 1 per cent level of significance. This indicates that the investments of firms in the low-premium regime (LP regime) are sensitive to market evaluation of their future growth prospects captured by q . Thus, an increase in q (q/K) leads to an increase in corporate investment of firms in the LP regime. For firms in the HP regime, a decrease in q (q/K) results in an increase in corporate investment. This implies that firms in the HP regime will increase their investment when the market evaluation of their future prospects (q) is low. They will increase their corporate investment in the current period; this will in turn lead to an increase in their future q (q/K). The coefficient of q (q/K) for firms in the low-premium regime is 0.158, while it is -0.032 for firms in the high-premium regime. The coefficient of q for the LP regime is larger than that of the HP regime. These different estimates provide support for the difference in investment behavior between the two regimes.

From Table 4, we discover that the coefficients of cash flow (CF/K) are statistically significant in the LP regime, but not in the HP regime. This is contrary to expectations. These results can be explained within the context of the Nigerian economy. Cash flow reflects firms' liquidity position. Market value of the firm (numerator of q) is a measure of market fundamentals while cash flow is also a proxy for market fundamentals and financing constraints and managers and entrepreneurs may respond to market fundamentals. The joint significance of q and cash flow for firms with a strong balance sheet position in the LP regime shows that their investment behavior responds to market fundamentals and liquidity positions. The significance of cash flow in the investment function for LP firms is also due to the fact that cash flow contains information not captured by the beginning of period q .

The investment behavior of firms in the HP regime is not sensitive to current cash flow because corporate investment is a capital stock, which is planned in advance. Corporate investment of firms in the HP regime does not respond to current cash flow, which is a flow measure of liquidity, but responds to market fundamentals as reflected by q . When q is low, firms in the HP regime increase their investment. This will ultimately increase their future q values.

The coefficient of cash flow (CF/K) has the expected positive sign in both regimes. The cash flow coefficient is 0.076 for the LP regime and 0.037 for the HP regime. Cash flow coefficient (CF/K) is higher in the LP regime than in the HP regime. This result is contrary to findings in Fazzari et al (1988) and Hu and Schiantarelli (1998) on United States data. This is because cash flow measures liquidity and firms with high net worth in the LP regime are more liquid than firms in the HP regime. Our result reveals the differential effects of imperfections on the corporate investment behavior of firms in the low and high regimes.

This indicates that the investments of firms in the low-premium regime are more sensitive to their future profit prospects captured by q and availability of internal funds measured by current cash flow, than firms in the high-premium regime. The estimates for the switching function reported in Table 4 supports the identification of the two investment regimes. The coefficient of leverage variable, which is the stock of debt measured by debt-to-market value of firm ratio $(D/V)_{it-1}$, is negative but not statistically significant. This implies that the stock of debt does not play an important empirical role.

The coefficient of the flow of debt measured as interest expense-to-profit ratio $((Int/Y)_{it-1})$ is negative and statistically significant at the 5 per cent level of significance. This indicates that when interest expense-to-profit ratio $(Int/Y)_{it-1}$ declines, the firm is likely to face a high premium. We expect the coefficients of the interest expense-to-profit ratio $((Int/Y)_{it-1})$ and debt-to-market value of firm ratio

¹³ The number of years of observation differs for each firm. The longest is 17 years firm observations, while the shortest is 9 years of firm observations.

((D/V)_{it-1}) to be positive. Contrary to expectations, both coefficients are negative. The negative coefficients of the interest expense-to-profit ratio ((Int/Y)_{it-1}) and debt-to-market value of firm ratio ((D/V)_{it-1}) may have to do with the nature and peculiarities of the sample. Publicly quoted companies in Nigeria are generally lowly geared. This accounts for a low debt-to-capital structure ratio of about 15 per cent on average (Adelegan, 2005). Thus, as the ratio increases the firm is less likely to face a high premium because it is still within the acceptable gearing level.

The coefficient of stock measure of liquidity, which is liquid-financial-assets-to-capital ratio ((Liq/K)_{it-1}), is positive and statistically significant at the 1 per cent level of significance. The positive and significant coefficients of liquid-financial-assets-to-capital ratio ((Liq/K)_{it-1}) indicate that the higher this ratio, the more likely it is for the firm to pay a high premium on external finance.

In the switching function, the sign of the coefficients of size which is the log of capital stock (LK_{it-1}) is positive and statistically significant at the 1 per cent level of significance. The positive coefficient of size means that the larger the firm, the higher the probability of being in the high-premium regime. This reflects the fact that large firms have a more diverse ownership structure, which tends to increase agency costs. This confirms the findings in Devereux and Schiantarelli (1989) and Hu and Schiantarelli (1998) that large firms have a more diverse ownership structure¹⁴, that tends to increase agency costs. The ownership of small firms may be more concentrated, with managers holding significant blocks of stock, which may mitigate agency problems. The result of the investment equation and switching function (the significant coefficients of liquid financial assets, size and interest expense ratio) signifies that the incidence and severity of agency problems vary across regimes and over time.

The industry dummies show that all sectors have firm year observations falling in either of the two regimes. For firms in the LP regime, the coefficients of IND1, IND2, IND4, IND6, IND7, IND8, IND10, IND11 and IND12 are positive and statistically significant. This signifies that industry specific characteristics influence the corporate investment behavior of low-premium firms in agriculture, automobile and tires, building materials, computer and office equipment, conglomerates, food, beverages and tobacco, healthcare, industrial and domestic products, and packaging.

The coefficients of IND1, IND2, IND4, IND5, IND6, IND7, IND10, IND11 and IND12 are negative and statistically significant for firms in the HP regime. This signifies that industry specific characteristics negatively influence the corporate investment behavior of high-premium firms in agriculture, automobile and tires, building materials, chemicals and paints, computer and office equipment, conglomerates, healthcare, industrial and domestic products, and packaging.

In the switching function, the coefficients of IND1, IND6, IND7, IND8, IND10 and IND12 are positive and statistically significant. This implies that firms in agriculture, computer and office equipment, conglomerates, food, beverages and tobacco and healthcare industries are likely to be in the HP regime.

The coefficients of the year dummies are negative and statistically significant from 1988 to 1996 in the LP regime. The coefficients of the year dummies are positive and statistically significant in the HP regime from 1988 to 1997. These results imply that macro conditions affected corporate investment behavior from 1988 to 1997. The inclusion of year dummies in the switching function captures changes in general macroeconomic conditions that affect all firms in the same way and are not accounted for by changes in firm-specific variables. In any year characterized by recession, we expect a larger value of the coefficient of the year dummy, since firms are more likely to face a high premium.

The coefficients of year dummies in the switching function are negative and statistically significant for 1988 to 1997. This means that general macroeconomic conditions have an effect on the probability of being in one or the other regime through the balance sheet variables¹⁵ and the year

¹⁴ The firms in the sample are publicly quoted companies, hence they have many shareholders. Some are quoted on the first tier securities market while others are quoted on the second tier securities market. The second tier securities market was established to accommodate small firms that cannot meet the stringent listing requirements expected of big firms operating in the first tier securities market. In Nigeria, publicly quoted companies are expected to have at least 500 shareholders to be quoted on the first tier securities market. The requirement is not less than 100 shareholders to be quoted on the second tier securities market.

¹⁵ The balance sheet variables in the switching function are variables that are suggested to be important indicators for the extent to which firms are confronted with financial constraints. They capture each firm's credit worthiness, asymmetric information, and agency problems. They are the lagged

dummies included in the switching function. These years are characterized by recession, which resulted in a deterioration in macroeconomic conditions. This is reflected in impositions of price caps on stock market prices that adversely affect the denominator in the leverage variable (debt-to-market value ratio $((D/V)_{i,t-1})$). Furthermore, this reduces cash flow that is available to cover payment of interest obligations $((int/Y)_{i,t-1})$.

Macro shocks affect the market value of firms, while monetary policy will also affect firms' access to long-term credit. The deregulation of interest rates in 1987 led to an increase in interest rates, which increased the cost of external finance and decreased access to it in subsequent years. Also, in an attempt to sanitize the banking system, the withdrawal of government money from commercial banks to the central bank in 1989 reduced the liquidity of banks. This further reduced the ability of commercial banks to provide credit to firms for long-term use. The attendant effect is the reduction of liquidity of firms and a worsening of their balance sheet positions.

In June 1993, the Central Bank of Nigeria introduced Open Market Operations (OMO) which involved direct selling of government securities to mop up excess liquidity in the economy. This reduces the liquidity of banks, increases interest rates and reduces access of firms to credit. Since stringent monetary policy leads to a decrease in bank liquidity, this will also cause a reduction in investment by those firms that for informational reasons are dependent on banks.

One of the implications of the significant coefficients of the year dummies is that the severity of agency problems varies with general macroeconomic conditions due to an environment of financing constraints. This implies that firms are likely to be in the HP regime during these years. This suggests that the recession caused a severe financing problem for firms in Nigeria during these periods.

The model we have estimated above from equations 2-5 includes current cash flow as a regressor or independent variable (all the other variables in the investment function are either end of period or beginning of period values)¹⁶. This may create endogeneity problems. To account for this possibility, we re-estimated equations 2-5 using a lagged value of cash flow to replace current value of cash flow. These results are presented in Table 5.

Table 5: Effect of q and Lag of Cash flow: Switching Regression Model

| Dependent variable: $(I/K)_{it}$. Log-Likelihood=664.69. No of observations: 794 | | | | |
|---|-----------------------|----------------------|----------------------|--------------------|
| Investment function | $(q/K)_{it}$ | $(CF/K)_{it-1}$ | Sigma | |
| LP regime | 0.156 (11.593)*** | 0.069 (2.608)*** | 0.008 (23.111)*** | |
| HP regime | -0.034 (-7.501)*** | 0.083 (2.406)** | 0.091 (19.305)*** | |
| Switching function | $(D/V)_{it-1}$ | $(Int/Y)_{it-1}$ | $(Liq/K)_{it-1}$ | LK_{it-1} |
| | -0.502 (-1.326) | -0.018 (-2.221)** | 1.214 (4.059)*** | -0.007 (-0.161) |

Source: Computed using LIMDEP Version 7.0, 1997

T-ratios are in parentheses. All equations include industry and year dummy variables

***, **, * represent significance at 1%, 5% and 10% levels respectively.

From Table 5, the coefficient of q (q/K) is positive and statistically significant at the 1 per cent level of significance in the LP regime. The coefficient of q (q/K) for firms in the HP regime is negative but also statistically significant at the 1 per cent level of significance. This means that an increase in the market's evaluation of the firm's investment opportunity measured by q will lead to an increase in the corporate investment of firms in the LP regime. A decrease in q will lead to an increase in the corporate investment of firms in the HP regime.

values of the debt-to-market value ratio $((D/V)_{i,t-1})$, the interest-to-operating-income ratio $((Int/Y)_{i,t-1})$ and the stock of liquid-financial-assets-to-capital ratio $((Liq/K)_{i,t-1})$ and SIZE which is defined as the logarithm of the real total capital stock $(LK_{i,t-1})$.

¹⁶ Cash flow is a flow variable, while corporate investment, market value of equity, debt and capital stocks are stock variables. Stock variables are more permanent and change less frequently than flow variables. For corporate investment, market value of equity and book value of debt that goes into the calculation of q, we use end of period values, for capital stock we use beginning of period value.

Cash flow differs across regimes in the magnitude of its impact on investment. The coefficient of lag of cash flow $((CF/K)_{it-1})$ is positive and statistically significant for firms in the LP regime. This implies that the higher the preceding year's cash flow, the higher the level of corporate investment of firms in the LP regime. The coefficient of lag of cash flow $(CF/K)_{it-1}$ for firms in the HP regime is also positive and statistically significant. This implies that an increase in the preceding year's cash flow will result in an increase in corporate investment for firms in the HP regime.

The cash flow coefficients of the low- and high-premium regimes can be explained by the fact that corporate investment is a stock and is usually planned over time, while cash flow is a flow. Therefore, the cash flow of the previous year is important in determining the current expenditure on corporate investment for firms in the HP regime.

As previously discussed, the corporate investment behavior of firms in the LP regime has positive relationships with both current cash flow and the preceding year's cash flow. This is because the corporate investment of firms in the LP regime responds to market fundamentals and liquidity position (current and preceding year's cash flow). An increase in the current and preceding year's cash flow will lead to an increase in corporate investment.

Corporate investment behavior for firms in the HP regime is positive and sensitive to the preceding year's cash flow. This is because corporate investment is a stock and is usually planned over a period of one year in advance by the HP regime, and therefore the liquidity of the previous year (preceding year's cash flow) matters for its investment.

The results of the investment function in Table 5 show that the coefficient of q (q/K) is larger and the coefficient of the lag of cash flow $((CF/K)_{it-1})$ is smaller in the LP regime than in the HP regime. This is what we expect, for LP regime firms tend to be more sensitive to changes in market evaluation of their future profit prospects, summarized by q , than firms in the HP regime. On the other hand, the coefficient of lag of cash flow $((CF/K)_{t-1})$ is higher and the coefficient of q (q/K) is smaller in the HP regime than in the LP regime. This further reveals the presence and importance of financing constraints measured by cash flow-investment sensitivity.

The coefficient of q for firms in the LP regime is 0.156, while the coefficient of q for firms in the HP regime is -0.034 . The coefficient of lag of cash flow for firms in the HP regime is 0.083, while the coefficient of lag of cash flow of the LP regime is 0.069. This further supports the importance of capital market imperfections for corporate investment behavior.

HP regime firms have a high and positive sensitivity of their investment to internal funds measured by the preceding year's cash flow, while firms in the LP regime have a higher and more positive sensitivity of corporate investment to q , which is the market's evaluation of the firms' investment opportunities and a measure of future profit prospects and current and lag of cash flow.

In the switching function, the coefficient of stock of debt measured as debt-to-market value of firm $((D/V)_{it-1})$, is negative but not statistically significant. This implies that the stock of debt does not play an important empirical role. The coefficient of the flow of debt measured as interest expense-to-profit ratio $((Int/Y)_{it-1})$ in the switching function is negative and statistically significant at the 5 per cent level of significance. This indicates that when interest expense-to-profit ratio $(Int/Y)_{it-1}$ declines, the firm is likely to be in a high-premium regime. As earlier explained, the negative coefficients of the interest expense-to-profit ratio $((Int/Y)_{it-1})$ and debt-to-market value of firm ratio $((D/V)_{it-1})$ may have to do with the nature and peculiarities of the Nigerian sample where publicly quoted companies are generally lowly geared.

The coefficient of liquid-financial-assets-to-capital ratio $((Liq/K)_{it-1})$ is positive and statistically significant at the 1 per cent level of significance. This indicates that the stock measure of liquidity plays an important empirical role. The higher this ratio, the more likely it is for the firm to pay a high premium on external finance. The coefficient of size is not statistically significant. This implies that size does not play an important empirical role in the switching function for the investment equation that includes lag of cash flow.

We find that capital market imperfection variables influence the probability of being in the high- or low-premium regime. This is because the flow measure of debt and the stock measure of

liquidity are statistically significant in the model. This implies that firms are likely to be in the HP regime when the stock of liquid assets increases and the flow measure of debt declines.

All the coefficients of the industry dummies, except IND9 are statistically significant in the LP regime. The coefficients of the industry dummies are all negative except that of IND8. This implies that industry specific characteristics have a negative influence on the corporate investment behavior of LP firms in agriculture, automobiles and tires, breweries, building materials, chemicals and paints, computer and office equipment, conglomerates, healthcare, industrial and domestic products, packaging, printing and publishing and textiles. The impact of industry specific characteristics on the corporate investment behavior of food, beverages and tobacco is positive. With the exception of IND13, the coefficients of the industry dummies are all positive and statistically significant for firms in the HP regime. This signifies that industry specific characteristics negatively influence the corporate investment behavior of firms in the HP regime, except those in the printing and publishing industry.

In the switching function, the coefficients of industry dummies IND1, IND6, IND7, IND8, IND9, IND10, IND11 and IND13 are statistically significant. This implies that firms in agriculture, computer and office equipment, conglomerates, food, beverages and tobacco, footwear, healthcare, industrial and domestic products and printing and publishing industries are likely to be in the HP regime.

In Table 6, we also report the coefficient of the year dummies for the low- and high-premium regimes and in the switching function. Macro conditions can also have a direct effect on investment, so year dummy variables have also been included in the investment equations. From Table 6, with the exception of year dummy for 1989 (YD1989), the coefficients of the year dummies are not statistically significant in the LP regime. All the coefficients of year dummies in the HP regime are positive and statistically significant. During recession, firms are more likely to face a high premium; therefore we expect a larger value of the coefficient of the year dummy. The period of study 1984-2000 falls during recession in Nigeria. The coefficients of the year dummies are larger for firms in the HP regime than LP regime. This is because firms are more likely to face a high premium during recession. These results imply that macro conditions affect the corporate investment behavior of firms in the HP regime from 1988 to 1999.

Table 6: Average Probability of being in HP Regime

| Year | Prob HP regime |
|------|----------------|
| 1988 | 0.857 |
| 1989 | 0.732 |
| 1990 | 0.714 |
| 1991 | 0.679 |
| 1992 | 0.679 |
| 1993 | 0.661 |
| 1994 | 0.661 |
| 1995 | 0.750 |
| 1996 | 0.536 |
| 1997 | 0.536 |
| 1998 | 0.346 |
| 1999 | 0.236 |

Source: Author's computation

The year dummies in the switching function are negative and statistically significant for 1988 to 1995 and 1997. The years 1996, 1998 and 1999 have statistically insignificant coefficients. This implies that firms were likely to be in the HP regime from 1988 to 1995 and 1997. These results can be explained by the behavior of major economic indicators during this period. The real gross domestic product (GDP) growth rate fell from 4.7 per cent in 1991 to 3.2 per cent in 1997. Gross national savings fell from 18 per cent in 1988 to 9.2 per cent in 1998. The growth rate of money supply was 32.6 per cent in 1991 and it fell to 8.1 per cent in 1995. These figures increased the probability of firms being in the HP regime between 1988 and 1997.

To summarize the consequences of the macro factors, we analyze the time-series changes in the average probability (across firms) that firms face a high premium on external finance. In Table 6 we present the ex ante probability of being in the HP regime. To obtain the ex ante probability of being in the HP regime, Tobin's q dummies were introduced: q that is equal or greater than 1 was given the value of 0, q less than 1 was given value 1.

The ex ante probability of being in the HP regime was obtained by averaging q dummies 1 multiplied by the year dummies across firms in each year. Since it incorporates the effects of both the year dummies and the changes in firm-specific variables, this average probability is a more complete summary indicator of the effects of macro shocks. This provides support that the severity of financing constraints varies over the business cycle and with the stance of monetary policy.

Table 6 reports average yearly value of the ex ante probability of being in the HP regime. We observed that the probabilities fluctuate between 24 percent and 86 per cent. The mean probability of being in the HP regime was high for the period 1988-1997. It was highest in 1988 (86 percent), decreasing to 66 percent in 1994 and picking up again to 75 percent in 1995. This suggests that the recession caused a severe financing problem for firms. The lower probability of being in the HP regime from 1996 to 1999 is an interesting finding, because during these years the capital market in Nigeria was relatively unregulated. In 1995, a series of liberalizations of the capital market took place. Notable are: (i) the Investment Promotion Commission Act No. 16 of 1995, and (ii) the Foreign Exchange (miscellaneous) Act No. 17 of 1995. These policies made it easier for firms to raise capital by lifting the ban on restrictions on the percentage of foreign ownership of shares and repatriation of profits. This result shows that liberalization led to a relaxation of constraints for those firms that had restricted access to credit in the pre-reform period.

Improvement in some major macroeconomic indicators also reduced the probability of being in the HP regime. Money supply grew by 16.93 per cent in 1997 and by about 32 per cent in 1999. The growth rate of credit to the private sector was 17.8 per cent in 1988; it increased by about 24 per cent in 1997 and 29 per cent in 1999¹⁷. This explains the reduction in the average probability of firms being in the HP regime to about 35 per cent in 1998 and 24 per cent in 1999.

6. Summary and Conclusion

The results of this study show that financial factors affect the investment behavior of Nigerian firms. Our approach emphasized that the relationship between information imperfections, financing constraints and investment varies across firms and industries, given capital market imperfections.

Adopting the switching regression model, we find that financial factors affect investment. However, cash flow differs across firms in the magnitude of its impact on investment. From the switching regression analysis, Tobin's q plays a significant role in corporate investment behavior of firms in both low- and high-premium regimes. The coefficient of Tobin's q is positive and statistically significant at the 1 per cent level of significance for firms with high net worth that face low premiums on external finance. It is negative and statistically significant at the 1 per cent level of significance for firms with low net worth in the high-premium regime. This indicates that an increase in market evaluation of investment opportunities and future profit prospects captured by Tobin's q results in an increase in corporate investments of firms in the low-premium regime. A decrease in Tobin's q will lead to an increase in corporate investments of firms in the high-premium regime.

On the other hand, cash flow is significantly associated with corporate investment in both regimes. The preceding year's cash flow has higher values in the high-premium regime than the low-premium regime and positively influences the corporate investment behavior of firms in the high-premium regime. Corporate investment behavior of firms in the low-premium regime is positively

¹⁷ Computed from data obtained from Central bank of Nigeria, Annual Reports and Statements of Accounts, various issues; Central Bank of Nigeria, Statistical Bulletin, various issues.

influenced by the current and preceding year's cash flow. This implies that cash flow matters for firms in both regimes.

We also find that variables that capture each firm's credit worthiness, asymmetric information, and agency problems such as a high level of liquidity and low level of interest-payment-to-profit ratios increased the probability of being in the high-premium regime. The stock of debt does not play an important empirical role but large firms have a greater probability of being in the high-premium regime. The likelihood of being in either the low or high regime varies over the business cycle with general macroeconomic conditions; if there is a recession a firm is likely to be in the high-premium regime.

The study's findings suggest the existence of imperfections in Nigeria's capital market, implying that some corporate firms would be financially constrained in the execution of their investment proposals. However, the extent and impact of this constraint is not uniformly distributed. The switching regression results also show that the relative importance of cash flow and future profit prospects to investment behavior vary over time and across firms. Our results have helped to shed light on the role played by capital market imperfections in the investment decisions of firms.

7. Implications of Findings

If capital market imperfections have led to binding financial constraints on corporate investment in Nigeria, several important implications arise for the study of macroeconomic investment fluctuations and the impact of public policy on capital spending.

Financing constraints in the capital market can magnify the macroeconomic effect of shocks to cash flow or liquidity that will reduce the access of some firms to low-cost finance and worsen their balance sheet positions. The part of the aggregate shock to investment that can be explained by financial effects could be substantial. Financing constraints could account for a large proportion of aggregate variability of investment.

Our findings that internal finance influences investment spending in addition to q for firms with high credit worthiness in the low-premium regime, could be consistent with the managerial waste hypothesis.¹⁸ Redistribution of funds away from such firms, either to shareholders or to tax payers, may change both the level of investment and its allocations to the extent that firms face information-related finance constraints.

Most studies of the effect of tax policies on corporate investment assume that the availability of finance does not limit investment because corporate firms respond to prices set in centralized securities markets, such as market interest rates or Tobin's q . The implication for investment is that the marginal tax rate from new projects matters for investment, while the average tax burden on returns from its investment does not matter. As we have explained earlier, for a firm that faces an imperfect market for external finance, it is not sufficient to focus on centralized securities markets. The amount of earnings devoted to taxes, and therefore the average tax burden on returns from existing projects matters for investment, possibly along with the incentive effects of marginal tax credits. The cash flow effects of changes in the investment tax credit or capital allowances may be more important for many firms (especially the older firms, and those dealing with computer and office equipment as well as the agricultural industry that have high cash flow/investment sensitivities) than the associated cost of capital effects of such policies.

The fact that the average tax rate matters for some firms (ranging from 23.6 per cent to 85.7 per cent)¹⁹ may not necessarily imply a need for changes in tax policies and incentives. The lemon problems still remain if the policy maker cannot distinguish project types better than private financiers.

¹⁸ The managerial waste hypothesis holds when managers concerned over-invest. In this case, available internal finance is invested in projects at levels not justified by market signals alone.

¹⁹ Average tax rate is computed as tax/profit before tax from data obtained from annual report of the 85 manufacturing firms in the sample from 1984 to 2000.

An additional concern relates to agency problems. Since policies that increase internal finance might encourage managers concerned to over-invest, it is important to understand the impact that public policies can have on investment through their effect on internal finance.

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