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VALUATION AND PRICING OF OIL AND GAS INDUSTRY'S EQUITY: EVIDENCE FROM THE NIGERIAN STOCK MARKET

BY

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MATRIC NO. 179506012

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BEING A DISSERTATION SUBMITTED TO THE DEPARTMENT OF BANKING AND FINANCE, FACULTY OF SOCIAL AND MANAGEMENT SCIENCES, ADEKUNLE AJASIN UNIVERSITY, AKUNGBA AKOKO, ONDO STATE, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.Sc.) DEGREE IN BANKING AND FINANCE

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CERTIFICATION

I hereby certify that this dissertation was carried out by **USHIE, PAUL OBOGO** with Matriculation Number **179506012** of the Department of Banking and Finance, Faculty of Social and Management Sciences, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria under my supervision.

PROF. S. O. AKINMULEGUN.

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19/05/2021

Date

DR. F. D. DARE

(Head of Department)

19-05-2021

Date

DEDICATION

This dissertation is dedicated to my parents, Mr. Moses Adeba Ushie and Mrs. Abosede Ushie.

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ABSTRACT

Previous studies have identified Capital Assets Pricing Model (CAPM) as an important and most used technique for evaluating the value of equity in stock market, especially in developed economies. However, its suitability in correctly pricing equity has not been established in developing countries like Nigeria, especially in the Oil and Gas Industry. Hence, this study examined the suitability of CAPM in correctly valuing equity in the Nigeria Oil and Gas industry and investigated the effect of market return on the individual firms.

Secondary data used in this study were sourced from the Central Bank of Nigeria statistical bulletin and the financial statements of eight (8) out of the twelve (12) quoted Oil and Gas firms in the Nigerian stock market from 2012 to 2018. This study compared Expected Returns (ER) using CAPM with Actual Returns (AR). The expected returns were obtained by adding risk-free rate to risk premium, while actual returns were obtained by adding dividend yield to capital gains. Chow's test and panel regression were used to achieve the study's objectives.

The Chow's test result was not significant with a p-value of 0.72 meaning that CAPM was not suitable in valuing equity in the industry. Also, a negative correlation of -0.26 was established between actual returns and expected returns. The panel regression, using Random effect, showed that market return was significant with a coefficient of 0.04. The individual company's risk (β) had a negative and significant effect on expected return with coefficient of -0.14. The study's coefficient of determination (R^2) indicated that 63.77% of variations in expected returns were accounted for by market returns and company's risk.

The study concluded that CAPM was not suitable in the valuation and pricing of equity in the Oil and Gas industry of the Nigerian stock market. It was recommended that the Nigerian stock exchange market should endeavour to license some market makers whose existence will help market prices to reflect the fundamentals of the companies concerned. Also, a model that will capture to a large extent earning growth rate, dividend payout ratio, and risk exposure variable be adopted in the Nigerian Stock Market so as to guide valuation and pricing of equity securities be formulated by stock market experts and professionals.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Investment involves the commitment of a firm's resources to short term and long-term assets in order to maximize future returns. It can also be seen as the commitment of funds in order to derive a future return. This future return would compensate the investor of the funds for the time during which the funds are off his hands, for the expected rate of inflation over the time, and for the risk or uncertainty involved. Akinmulegun (2015) opined that the motivation for investment is return. He however believed that the magnitude of return depends on how well a firm manages risks inherent in investment. Therefore, the first step in investment is the determination of the rate of return because it is the basis to which the investor would want to invest.

One of the major functions of the Nigerian capital market is the facilitation of financial intermediation between the surplus but unproductive economic unit and the deficit but productive economic unit. The Securities and Exchange Commission has the sole responsibility of regulating the process of channelization of funds in the Nigerian capital market. The capital market is divided into two; the primary and secondary market. Anyafo (2016) mentioned that the primary market is a branch of the capital market where securities are first issued and subscribed to which is sometimes referred to as the new issue market, securities sold in the primary market being launched into the market for the first time. In other words, the primary market is a market where newly issued securities are traded. The secondary market on the other hand is a market for trading of existing securities; a market where investors buy and sell previously issued securities. The issuing houses are examples of the primary market while an example of secondary market includes Nigeria

stock exchange, the doings of stockbrokers and dealers. One other function of the Nigerian capital market is that it gives an avenue for the trading of existing financial securities and assets through the secondary market. Hence, the capital market through the secondary market gives opportunity to those who want to trade on existing securities. These securities would be valued and priced; therefore, it is imperative that the value of the securities is not with bias. That is, it is important that the value of the securities is not either undervalued or overvalued.

Valuation can be regarded as an estimation of the worth of a security or an asset, especially one that is carried out by a professional valuer. It is the monetary worth of a security. There are different ways and methods through which the value of an asset can be determined but the Capital Assets Pricing Model established by Sharpe (1964), Lintner (1965), and Mossin (1966) has been the most and widely used method of valuing stocks and securities. Oke (2013) was of the opinion that the emergence of new stock markets globally and the big, and sometimes astonishing, returns offered by these markets have attracted the attention of investors and financial researchers around the world in recent times. The Capital Assets Pricing Model (CAPM) as introduced by Sharpe (1964), Litner (1965) and Mossin (1966) is so important that it is used for the estimation of the cost of capital. Its usefulness transcends the pricing of securities to the evaluation of the performance of managed portfolio (Oke, 2013). The CAPM postulates that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk as measured by the beta. The required rate of return, using the CAPM is based on some features as stipulated by Mohammad (2017). These are nature of the relationship and correlation between the stock returns and market index returns, in addition to the investment risk that the model divided it into systematic risk and non-systematic risk.

It therefore became unsurprising that many models and approaches are employed by researchers, professionals and other knowledgeable stakeholders worldwide in selecting portfolio and in stock valuation in order to appraise the risk exposure to different security assets. Nwude (2010) asserted that there is a widespread agreement in finance that the Capital Asset Pricing Model (CAPM) and the Whitebeck-Kisor Model (WKM) are good predictors of share price movements in the stock markets. The above assertion has been empirically validated in most developed economies with little empirical backings from developing economies (Elbannan, 2015; Herbert, Nwude & Onyilo, 2017).

Invariably, there are basically two types of securities; Equity security and Debt security. Equity securities represent a claim on the earnings and assets of a corporation. Equity securities represent possessing part of the company's capital. Debt securities are investments into the debt instruments of the company (Bashir & Ahmed, 2016).

The valuation of equity securities largely depends on the availability of accurate and reliable information (Agbam & Anyamaobi, 2018). Examining the value of a firm entails the summation of the current assets of the firm and the value of the firm's future prospects. Boyer, Lim and Lyons (2017) however stated that in order to have a fair and accurate valuation, the information available must sufficiently reflect the present condition of the firm and also its future prospect. Financial accounting statements are to a large extent, sufficient enough to report the current condition of the firm while financial analysts provide information about their assessment of the future prospect. Both of these sources provide the foundation of the information environment in which every firm operates. It is the interaction of these two complimentary information sources that provide for accurate and fair valuations in financial markets. It would then be understood that

markets with good accounting practices and a large number of active analysts should have market valuations which fully reflect the value of a firm's assets (Nwude, 2010).

1.2 Statement of the Problem

The CAPM is about expected return which is crucial in the determination of securities prices because investors are bothered about the rate of return from their investment. It is difficult to estimate the return on investment of securities, especially equity because of the degree of uncertainty and level of risk. Thus, the CAPM is introduced as a way of applying scientific methods to evaluate investments, especially in the financial market (Mohammad, 2017). The equity market has been fluctuating in the Nigeria stock market. The total annual market capitalization of equity securities has been fluctuating particularly from the last decade. In 2010, the total equity was pegged at ₦7,913.75 billion but witnessed about 21.14% decrease in 2011 as it fell to ₦6,532.58 billion. It further increased by ₦2,441.87 billion and ₦4,251.55 billion in 2012 and 2013 respectively but fell by 15.23% in 2014 to be pegged at ₦11,477.66 billion. Furthermore, the total annual market capitalization of the equity market also fell by 16.51% and 6.53% in 2015 and 2016 respectively to stand at ₦9,850.61 billion and ₦9,246.92 billion. The market witnessed a relatively high increase in 2017 at ₦13,609.47 billion but fell in 2018 to ₦11,720.72 billion (CBN, 2019).

The fluctuations in stock prices at times do not make economic sense given the economic reality of the companies. Sometimes stock prices went ahead of what the underlying business would earn, just as sometimes they fell below. The model that guides this cycle is quite hazy and there is need to unravel the mystery surrounding the issue of share price movement (Herbert, *et.al.*, 2017). There is currently no clear single 'best practice' for the valuation of assets and securities in

emerging markets. In these markets, there are various practices as seen in Bruner, *et.al.* (2002). These markets also differ from developed markets in areas such as transparency in financial reporting, volatility, governance, taxes, and transaction costs. These differences are quite likely to affect firm valuation. In fact, a premise in many of the presentations and most of the discussions was that these differences matter economically and warrant careful consideration in the application of valuation approaches (Bruner, *et.al.*, 2002).

The differences in the results from studies on the usage of the CAPM in the valuation of equity securities in different economies is one of the things that have informed this study. Different studies have identified CAPM as an important and most used technique for evaluating the value of equity in stock markets, especially in developed economies. However, its suitability in correctly pricing equity has not been established in developing countries like Nigeria, especially in the oil and gas industry. The study is based on equity securities because of the importance investors place on shares of listed firms in the stock exchange market. There are studies which supports that the CAPM is not applicable to some sectors of the Nigerian economy. Oke (2013) as well as Nwude (2010) concluded that the CAPM assumption of a higher return to a higher risk is not applicable in the Nigerian capital market. In other economies, Rossi (2016) also confirmed that original version of the CAPM (Sharpe-Lintner CAPM) is inadequate for explaining the risk-return tradeoff and the role that market risk plays in the determination of stocks' excess returns. Many other researchers were also of the opinion that the prediction of CAPM that the market risk premium is a significant explanatory variable in the determination of the asset risk premium was rejected, (Douglas, 1969; Black, 1972; Miller & Scholes, 1972; Banz, 1981; Fama & French, 1992; Davis, 1994).

According to Adedokun and Olakojo (2012), the Nigerian stock exchange market has been experiencing financial melt-down since 2008. This downturn led to the need for appropriate measure to evaluate the daily values of securities in the Nigerian stock market. To attain sustainable development in the economy, the capital market must be efficient in its functioning. Thus, this also affects the liquidity, diversification of risk and mobilization of funds, (Anyanwu, 1965; Okereke, 2000). It has been however seen that stock prices fluctuate at various times and these fluctuations do not make economic sense because it does not aid planning and affects the economic reality of the quoted companies. Sometimes stock prices went ahead of what the underlying business would earn, just as sometimes they fell below. The model that controls this cycle is somewhat obscured, so it is important to examine issues around share price movements and its valuations. It has been validated in several stock markets that the capital asset pricing model, especially in developed economies, is the most used model for valuation of equity securities (Mohammad, 2017).

The Nigerian oil and gas sector has been the largest sector in the country and is greatly challenged in the valuation of equity despite the huge characteristics of the sector. Hence, the study looks at the applicability of CAPM in correctly valuing equity security in the oil and gas sector of the Nigerian stock market. A brief description of the activities of the oil and gas sector is made thus; The oil and gas sector of the Nigerian stock exchange market includes all companies engaged in operating and/or developing oil and gas field properties, and companies primarily engaged in recovering and producing liquid hydrocarbons from oil and gas field gases. Companies primarily engaged in the wholesale distribution of crude petroleum and petroleum products, including liquefied petroleum gas, from bulk liquid storage facilities are also included in this major group.

It is within this purview that the study intends to examine the applicability of this valuation technique on the equity market of the oil and gas industry in Nigeria especially with the recent development and fluctuations experienced in the value of equity, number of equity and the market capitalization of equity.

1.3 Research Questions

The following questions were formulated to guide the study.

1. How has the CAPM helped in correctly valuing equity securities of the oil and gas industry in the Nigeria stock market?
2. Does market return of equity in the oil and gas industry have any significant effect on the required rate of return of individual firms?
3. What effect does individual stock beta has on expected return of stocks of the Oil and Gas Industry?

1.4 Research Objectives

The broad objective of this study is to examine the valuation and pricing of equity security in the Nigerian stock market. The specific objectives are to;

1. investigate the suitability of CAPM in correctly valuing equity of the oil and gas industry in the Nigerian stock market.
2. examine the effect of market return of equity in the oil and gas industry on the rate of return of individual firms.

3. examine the effect of individual stock beta on expected rate of return of stocks of the oil and gas industry.

1.5 Research Hypotheses

The research hypotheses are presented in a null form;

1. CAPM is not significantly applicable in the valuation of equity securities of the oil and gas industry in the Nigerian stock market.
2. Market return of equity in the oil and gas industry does not have any significant effect on rate of return of individual firms.
3. Individual stock beta does not have any significant effect on expected return of stock of the oil and gas industry.

1.6 Significance of the Study

The findings of this study will be beneficial to all firms or organisations in the oil and gas sector and also served as a guide to other firms. Potential investors too will find this study important because it will assist them in correctly valuing securities before they invest in such security. The study is important in that it will help policy makers, capital market investors and corporate managers to understand the dynamics involved in correctly valuing equity, especially in the oil and gas industry. The study will also assist in describing the stock price movement in Nigeria in order to validate any relationship between the model of valuation and stock valuation and pricing in Nigeria.

The findings of this study will assist corporate managers and operators in the stock exchange market in their investment decisions. Furthermore, policy makers like the security and

exchange commission in the stock market will be assisted in formulating policies on equity share pricing so that investors' confidence can be fostered. The study will also help to achieve increase in trading activities in the stock exchange market which in turn, will increase the volume of trade; the increased volume of trade will shoot up the gross domestic product of the economy and growth will be achieved in the stock market as well as the economy at large.

This study will be of great benefits to the investors as it represents a fundamental area around which workable investment and financing decisions revolve. Proper valuation of financial securities is crucial in achieving profitability. When deciding on which stock to transact in order to have a justifiable reward valuation is needful. This work will bring to light and remind potential investors the valuation status of the Nigerian oil and gas stocks. This knowledge will help them to make informed investment and financing decisions that can enhance their investment value, which is a sure way to wealth creation and poverty eradication. This study will undoubtedly provide a basis upon which other researchers in the capital market issues can explore other sectors of the market.

1.7 Scope of the Study

The study's choice of the oil and gas sector of the stock market is informed by the volume of activities in the sector. The oil and gas sector of the Nigerian economy is found to be the largest and most important sector of the economy due to its contribution to the gross domestic product of the economy. Therefore, the findings and conclusions to be derived from this work is related to the oil and gas stocks in Nigeria. The study covers the period of seven years (2012- 2018). This period was selected because of the availability of complete information from the sampled oil and gas firms and also to examine the behaviour of equity stock especially during the advent of global

economic recession and aftermath. The study covers only the stocks of the oil and gas industry in the secondary arm of the Nigeria stock market. In order to accomplish the stated objectives of the study, daily official price lists of the exchange and annual reports of the companies in the oil and gas industry were collected over the period, January, 2012 to December, 2018. The study is also premised on the Capital Asset Pricing Model (CAPM) because it is the most used stock market model.

1.8 Operational Definition of Terms

Pricing: In the context of this study, pricing is seen as the amount the share of a firm in the oil and gas industry is sold or bought in the Nigeria stock exchange market.

Valuation: This refers to the estimated worth of a security or stock. It represents the amount at which the unit share of a firm in the oil and gas industry is supposed to be bought or sold, given proper analysis of the company's financial statement.

Equity: This represents the portion of equity capital of the firm in the oil and gas industry which is traded on the floor of the stock exchange market.

Debt: Debt security is a negotiable liability or loan instrument bought by an investor and sold by a company who needs to raise funds.

Earnings Yield: This represents the percentage of each Naira invested in the stock of a company in the oil and gas industry which was eventually earned by the company. Earnings yield is the reciprocal of price earnings ratio and it is equally the earnings per share divided by the market price per share.

Price-Earnings Ratio: This is the reciprocal of the earnings yield. The price-earnings ratio is used to understand if the company's share has been overvalued or undervalued in the oil and gas industry.

Present Value: This is the current worth of a share or portfolio of a company in the oil and gas industry.

Book Value: This refers to the value or worth of an equity security as it is seen in the financial statements of the company in the industry.

Intrinsic Value: This is used to mean the worth of an equity security when it is evaluated without recourse to the market value of the equity.

Market Value: This is known as the current price at which a unit share of the company in the industry is valued and sold in the Nigerian stock market.

Cash flow: This is the amount of money that moves in and out of a company in the oil and gas industry.

Dividend: Dividend is the return on investment in the equity security of firms in the oil and gas industry. It refers to what an equity shareholder gets for investing in shares or stock in the oil and gas industry.

Portfolio: This refers to a combination of many investments which can be attributed to the oil and gas industry and which is held by one person.

Investment: This is the buying of equity shares of the oil and gas industry in order to sell at a future date to make a higher return.

Capital: Capital is the amount of money or asset a firm in the oil and gas industry uses in the investment process.

Assets: These are properties of firms in the oil and gas industry which are used by the companies to disseminate investment activities.

Stock Market: The stock market is the market where shares and stock of firms in the oil and gas industry are been bought and sold in the Nigerian economy.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Valuation

Valuation can be said to involve a process or route and a set of procedures used in the determination of the economic value of an asset. Nwude (2010) opined that valuation lies at the heart of much of what is done in finance, whether it is market efficiency, corporate governance, merger and acquisition transactions, financial reporting, taxable events to determine the proper tax liability, litigations, wills and estates, divorce settlements, business analysis or comparison of different investment analysis, or decision rules in capital budgeting. Valuation is employed in the financial market by its participants in the determination of securities prices or assets prices.

One of the essences of valuation is to determine the real value of an asset. There are many concepts of value. For example, transaction value is the market value of the firm equity plus the market value of the firm preferred stock plus the value of the firm debt plus the transaction fees, minus the cash balances and market securities, all these measured at the close of transaction. An asset is valued to be the price that a well-informed and willing buyer pays to a well-informed and willing seller. Book value is the asset historical cost less its accumulated depreciation. Market value is the price of an asset as determined in a competitive market place. Intrinsic value is the present value of the expected future cash flows discounted at the decision maker's required rate of return. The result of a value calculation under the income approach is generally the fair market value of the subject company since the entire benefit stream of the subject company is more often valued.

There is a value attached to each unit of a common stock of a company owned by an investor. The common stock of any company represents the unit of ownership of the said company. Dividends are paid to common stockholders that also have elements of valuation. In the event of liquidation of the firm, the preferred stockholders are first paid off after which a pro-rata share of the remaining assets are given to the ordinary shareholders. For equitable sharing of the assets, there is need for proper valuation. In stock investments, stock valuation models are designed to identify undervalued and overvalued securities (Herbert, *et.al.*, 2017).

Proper stock valuation will assist investors to understand which sector seem relatively attractive to invest in. A security is said to be undervalued if its price is judged to be less than it would be if investors had the same perception of the company as that produced by the use of the valuation model. However, an overvalued security is one whose market price is greater than it would be if all investors had the same perception of the company as that provided by the model and noncyclical business. Therefore, it is important to ascertain the value of a common stock before one would invest in it and this poses a question. 'What is the value of a share of a company? There is no clear-cut answer to the question because it is the basis for endless arguments in the field of finance. It can however be said that the value of a share is the price it commands in the stock market. That is true enough, but not very satisfying. Two basic components have been suggested to form the value of a common stock; dividends and capital appreciation and the rate of return (Fischer & Jordan, 2008).

Nevertheless, yearly income flows until the end of time is not at the disposal of investors. Although, if investors knew the cash inflows at the end of the period, they would have just discounted the inflow to its present value to establish the value of the share. However, since the investors know not the cash inflow, income flow forecast is then done by the investors. This

income flow forecast is used in assisting investors to the valuation of stock, although, this forecast has called for a scope of error and disagreement in finance.

2.1.2 Types of Valuation Techniques

I. Earnings Yield

Earnings yield refers to the earnings per share for the most recent 12-month period divided by the current market price per share (Fischer & Jordan, 2008). The earnings yield, which is the inverse of the price earnings ratio, shows the percentage of each Naira invested in the stock that was earned by the company. Through the reinvestment of retained earnings, the value of a firm can be expected to grow. Growth will therefore be seen in the rising share prices of the company. Therefore, one can view earnings yield as the driver of both capital gains and dividends, the two forms in which shareholders receive most of their income from shares. One of the criticisms and disadvantage of earnings yield as a measure of valuation is that it has been viewed as an accountant concept and an intelligent financial expert can coin out earnings of a company from whatever he desires (Jacek, 2014).

Consequently, they prefer measures less prone to manipulation, such as sales or cash flow, which comes in various shapes and sizes. Still others prefer to look at the value of a firm's net assets. None of these measures is perfect. The best course may be to weigh all of them. Shareholders are entitled to a share of all dividends in perpetuity. Even if the company's stock does not currently have a dividend yield, chances are that at some point in the future there could be some sort of dividend. A company can repurchase its own shares using its excess cash, rather than paying out dividends to shareholder. Nwude (2010) believes that this effectively drives up the stock price by providing a buyer as well as improving EPS by decreasing the number of shares

outstanding. Mature, cash flow positive companies tend to be much more liberal with share repurchase as opposed to dividends simply because dividends to shareholders are taxed twice.

II. Asset Based Valuation

The asset-based valuation is a valuation technique that is based on the net asset of a company. The net asset value is identified by subtracting total liabilities from total assets. The asset-based valuation approach is based on the principle of substitution in the sense that no rational investor will pay more for the business assets than the cost of procuring the assets of similar economic utility. The market approach is rooted in the economic principle of competition in the sense that in a free market, the supply and demand forces will drive the price of business assets to certain equilibrium.

Tuller (1990) noted that everyone has his own theory about the most equitable and accurate method of valuation, and that each business interest naturally tends to favour the valuation method that best suits his own self-interests. He says that finance companies value a business at what the assets will bring at liquidation auction. Investment bankers and venture capitalists interested in rapid appreciation and high returns on their investment, value a business at discounted future cash flow. He argues that the value of assets might be interesting to know, but hardly anyone buys a business only for its balance sheet assets. The whole purpose is to make money, and most buyers feel that they should be able to generate at least as much cash in the future as the business yielded in the past. Based on this perception, many buyers view Discounted Cash Flow (DCF) method as the most relevant of all valuation methods for it tells them what the business has historically provided to its owners in terms of cash. This method typically takes financial data from the company's previous 3 years in drawing its conclusions. Johansen (2000) submits that balance

sheet-based valuations are most often employed when the business under examination generates most of its earnings from its assets. In this case, the balance sheet method highly favoured is the Current-market-value-adjusted assets values as listed on the balance sheet on historical cost levels.

2.1.3 Approaches to Common Stock Valuation

Traditionally, an enterprise can be valued based on either its earnings or its net assets value or some combination of the two. In equity valuation, various techniques, assembled under two major approaches have been devised over time (Buchanam 2000; Damodaran 2006; Johansen 2000; Medaglia 1999; Slee 1999; Tuller 1990; and Yegge 1996). The approaches are;

I. The Discounted Cash Flow (DCF) Valuation Approach

As a result of the crash of the stock market in United States of America (USA) in 1929, the reports of earnings or any other measure of value apart from cash became unacceptable to investors. This is because tangible assets value gradually became less well correlated with the total value of the company as determined by the stock market. As a result of this, Williams (1938) in his text on 'The Theory of Investment value' articulated the DCF as a valuation method for stocks/financial assets, projects or company using the concept of time value of money. Though, Fisher (1930) in his text on "The Theory of interest" also expressed the DCF method in modern economic terms but not related to stock's valuation. However, the first book to explicitly connect the present value concept with dividends was 'The Theory of Investment Value' by Williams (1938) where he states that 'A stock is worth the present value of all the dividends ever to be paid upon it, no more, no less. He further stated that present earnings, outlook, financial condition, and capitalization should bear upon the price of a stock only as they assist buyers and sellers in estimating future dividends. Graham (1934) used a series of screening measures that include low

Price Earnings (PE), high dividend yields, reasonable growth and low risk that highlighted stocks that would be undervalued using a dividend discount model.

Bohm-Bawerk (1903) provided an explicit example of present value calculations using a house purchase with twenty annual installments payments. Fisher (1907 and 1930) suggested four alternative approaches for analyzing investments, which he claimed would yield the same results. He argued that when confronted with multiple investments, one should pick the investment (a) that has the highest present value at the market interest rate; (b) where the present value of the benefits exceeded the present value of the costs the most: (c) with the 'rate of return on sacrifice' that most exceeds the market interest rate or (d) that, when compared to the next most costly investment, yields a rate of return over cost that exceeds that market interest rate. The first two approaches represent the NPV rule, the third is a variant of the IRR approach and the last is the marginal rate of return approach.

All the views expressed describe the DCF models, which is also called the absolute value models. The absolute value models determine the value of a firm based on all its expected future cash flows discounted to the present value. The discount is based on an opportunity cost of capital, which is sometimes called a discount rate, and is expressed as a percentage. There are four alternatives of DCF models in practice, and theorists have long argued about the advantages and disadvantages of each. The first is the equity free cash flows on an asset which are discounted at a required rate of return to get the value of the asset. The second one talks about the expected equity free cash flows which are first adjusted for risk to arrive at risk-adjusted to certainty-equivalent cash flows, and then they are discounted by the risk-free rate so as to ascertain the value of the asset. In the third place, is the Adjusted Present Value (APV), where a business is valued first without the effects of debt using the firm free cash flows and later consider the marginal effect of

borrowed money on the firm value; and lastly, valuation of a business or asset can be as a function of the excess returns (i.e., economic value added) we expect it to generate on its investments. The various useable cash flows are;

1. Equity free cash flows (ECF) discounted at cost of equity
2. Certainty-equivalent-equity free cash flows (CEFCF) discounted at risk-free rate;
3. Firm free cash flows (FFCF) discounted at the WACC before tax (i.e., the adjusted present value approach)
4. Excess returns (i.e., economic profit) discounted at the required return to equity;

II. Relative Valuation Approach

Relative valuation is a generic term that refers to the notion of comparing the price of an asset to the market value of similar assets (Cohen, 2004). The relative value approach determines the value of a firm by discerning the prices of related companies usually called the guideline companies that sell in the market. That is, the relative valuation estimates the value of an asset by looking at the pricing of comparable assets relative to a common variable like earnings, cash flows, book value or sales. The observed prices serve as valuation benchmarks. From the prices, price multiples such as the price-to-earnings or price-to-book value ratios are calculated.

Furthermore, one or more price multiples are used to value the firm. For example, the average price-to-earnings multiple of the guideline companies is applied to the subject firm's earnings to estimate its value. Many price multiples can be calculated. Most are based on a financial statement element such as a firm's earnings (price-to-earnings) or book value (price-to-book value) but multiples can be based on other factors such as price-per-subscriber, price-to-cash

flow. An advantage of this approach is that it provides information about how the market is currently valuing securities at several levels, that is, the aggregate market, alternative industries, and individual stocks within industries. It also generates alternative relative valuation ratios for the aggregate market, for an industry relative to the market, and for an individual company relative to the aggregate market, to its industry, and to other stocks in its industry. Its demerit is that it provides information on current valuation only, and gives no clue on whether the current valuation is appropriate. However, the relative valuation techniques are appropriate to consider when there is a good set of comparable entities, and that the aggregate market and the guideline companies are not either seriously undervalued or overvalued.

2.2 Theoretical Review

2.2.1 Dividend Discount Model (DDM)

Gordon and Shapiro (1956) introduced the dividend discount model when they valued a company's stock using an assumption of constant growth in payments a company makes to its common equity shareholders. The dividend discount model has three key inputs which are; dividend per share, the growth rate in dividend per share, and the required rate of return. The DDM is a way of valuing a company based on the theory that the stock is worth the discounted sum of all of its future dividend payments. In other words, it is used to evaluate stocks based on the net present value of the future dividends. The DDM is a quantitative method used for predicting the price of a company's stock based on the theory that its present-day price is worth the sum of all its future dividends payments, when discounted back to their present value. The DDM attempts to calculate the fair value of a stock irrespective of the prevailing market conditions, and takes into consideration the dividend payout and the market expected returns. Financial theory states that the

value of a stock is the worth of all the future cash flows expected to be generated by the firm discounted by an appropriate risk-adjusted rate. We can use dividends as a measure of the cash flows returned to the shareholder.

According to Terry and Keith (2007), one technique for valuing equities is to calculate the present value of all the expected future dividends. Williams (1938); Gordon (1962); Fuller and Hsia (1984) also confirmed that the best way to value equity securities is by estimating the present value of the expected future cashflows. Damodaran (2006) reasoned that when investors buy stock in publicly traded companies, they generally expect to get two types of cash flows namely, the dividends during the holding period and an expected price at the end of the holding period, and since the expected price is itself determined by future dividends, the value of a stock is the present value of dividends through infinity. DDM prices a stock by adding its future cash flows discounted by the required rate of return that an investor demands for the risk of owing the stock.

By this view, a share price is calculated with reference to estimated future annual dividend payments in perpetuity, based on the assumptions of infinite stock holding period, since the company is assumed to last forever. Although, equity values are generally considered to be a function of expected future earnings, the dividend discounted models treat dividends as a proxy for earnings and thus account for future earnings implicitly. Thus, DDM formula is given as the intrinsic value being equal to the sum of present value of the dividends plus the value of stock sale price.

Gordon and Shapiro (1956) stated three types of DDM

Zero Growth DDM: This assumes that all the dividends that are paid by the stock remain one and same forever until infinite. Zero growth assumes that the dividend

always stays the same. I.e., there is no growth in dividends. Therefore, the stock price would be equal to the annual dividends divided by the required rate of return. Stock Value = Annual Dividend / Required Rate of Return. This is basically the same formula for calculating the present value of perpetuity, and can be used to price preferred stock, which pays a dividend that is a specified percentage of its par value. A stock based on zero-growth model can still change in price if the required rate of return changes or when perceived risk changes.

Constant Growth DDM: This is based on the assumption that dividends grow at a fixed and constant percentage annually. The dividends are not variable and are constant over time. This can also be called the Gordon Growth Model which assumes that dividends grow by a specific percentage each year. Constant growth model can be employed in valuing companies that are matured and whose dividends increase steadily over the years. Growth rate in dividend is generally denoted as g, and the required rate of return by Ke. One other key assumption is that the required rate of return (Ke) also remains constant every year. Constant growth model gives the present value of an infinite stream of dividends that are growing at a constant rate. The formula is given as: Stock Value = $D_0(1+g) / (K_e-g)$ which is, $D_1 / (K_e-g)$

Where:

D_1 = value of dividend to be received next year

D_0 = value of dividend received this year

g = growth rate of dividend

Ke = discount rate

Variable Growth DDM or Non-Constant Growth: This model may divide the growth into two or three phases. The first one will be a fast-initial phase, then a slower transition phase and then ultimately ends with a lower rate for the infinite period. The variable growth rate DDM is much closer to reality as compared to the other two types of dividend discount models. This model solves the problems related to unsteady dividends by assuming that the company will experience different growth phases.

2.2.2 Free Cash Flows Discount Model (FCFDM)

Damodaran (2006) submits that the value of an asset is a function of the expected cash flows on that asset. He also submitted that asset with high and predictable cash flows should have higher values than the asset with low and unstable cash flows. Free Cash Flow can be Free Cash Flow to the entire firm (FCFF) or Free Cash Flow to equity only (FCFE). The FCFF is one prior to the payment of interest to the debt holders and deducting funds needed for capital expenditures. If the total firm's operating free cash flow is used, the appropriate discount rate to use is the Weighted Average Cost of Capital (WACC). The total discounted value of the FCFF minus the value of debt gives the value of equity. The value of a firm is equal to the present value of all cash flows during the forecast period.

That is, Value of a firm = $FCFF_t / (1+WACC)_t$

Where:

t=1 If the firm's free cash flow is expected to experience perpetual constant growth rate, the value can be obtained thus:

Value of a firm = FCFF (1+g) / WACC

However, no firm can grow at a stable rate forever and it is expected that free cash flows and earnings growth must be equal, which is also not realistic. To handle this abnormality, a two-stage growth model that allows for an initial phase where the growth rate is not a stable growth rate and a subsequent steady state where the growth rate is stable and expected to remain so for the long-term, was developed. Thus: Value of a firm = $FCFF_t / (1+WACC)_t + \{FCFFn+I/(WACC-g)\} / (1+WACC)_n$

Where:

t=1

Likewise, the direct valuation of equity using its free cash flow gives its value as n Value of Equity = $FCFEt/(1+Ke)_t$

Where:

t=1, If the equity free cash flow is expected to experience perpetual constant growth rate on the free cash flow, the value can be obtained thus:

Value of Equity = FCFE (1+g) / Ke

If the FCFE is expected to experience a period of temporary supernormal growth and later has a stable growth, the 2-stage growth model is used thus: n Value of Equity = $FCFE_t / (1+Ke)_t + \{FCFEn+1 / (Ke-g)\} / (1+Ke)_n$

Where:

t=1, FCFF = Free cash flow to the entire firm FCFE = Free cash flow to equity only WACC = Weighted Average Cost of Capital Ke = Cost of equity capital t = time period n = number of time period g = growth rate. The forecast period is the time period for which the individual yearly cash flows are input to the DCF formula. There are no fixed rules for determining the duration of the forecast period, and cash flows after the forecast period can be represented by a fixed number such as annual growth rates. The projected future continuing value is determined using the CFn (1 + gn) / (wacc – gn). The present value of the continuing value is then obtained by discounting the projected future continuing value using $(1 + WACC_n)$.

2.2.3 Markowitz Portfolio Theory

Markowitz (1952) introduced the Markowitz theory which is a portfolio construction theory that determines the minimum level of risk for an expected return. It assumes that investors will favour a portfolio with a lower risk over a higher risk for the same level of return. In Markowitz's model, an investor selects a portfolio at time t-1 that produces a stochastic return at time t. Markowitz illustrates that through costless risk reduction, efficient portfolios can be formed from the portfolio that dominate all other portfolios and assets in terms of risk reward characteristics, resulting in what is referred to as the Markowitz efficient frontier. There are some fundamental assumptions underlying the Markowitz model. The assumptions include complete and frictionless markets, rational investors with a marginal disutility of wealth seeking maximum utility, and investors utilizing the same information, basing their investment decisions on expected value and risk, where risk is defined as the standard deviation of expected returns.

2.2.4 Capital Assets Pricing Model

Capital Asset Pricing Model (CAPM) is the theoretical framework with which this study is built. CAPM is one of the earliest theories that build on the earlier work of Markowitz (1959) on diversification and modern portfolio theory (Afolabi, *et.al.*, 2017). Oke (2013) stated that the CAPM is an integral part of the development of the modern capital market theory and is an offshoot of the general equilibrium models of the determination of the prices of capital assets under conditions of uncertainty. Definitely, from the portfolio seminar works of Markowitz in 1952 and 1959, a revolution was found in the theory of finance which laid the foundations of modern capital market theory.

Another version of the CAPM was introduced by Black (1972), specifically different in that it relaxed the assumption of unlimited borrowing and lending at the risk-free rate. However, Black introduced the assumption that there are unrestricted short sales of risky assets. The fundamental difference between the Sharpe-Lintner version of the model and the Black is in the treatment of the zero beta assets, the asset uncorrelated with the market (Dayala 2012). In the Sharpe-Lintner version this is the risk-free rate by default (R_F), while in Black's model the only condition is that this zero-beta asset should be less than the expected market return, so that the premium for beta is positive. While relevant from an empirical angle because Black's model can justify a flatter slope as a result of a higher zero beta asset, from a fundamental angle both models are highly consistent. The CAPM was found from the excellent work of Markowitz (1952 and 1959) which was on the model of portfolio choice and on Tobin's separation theorem (Tobin 1958).

Markowitz's treatment of investor portfolio selection as a problem of utility maximization under conditions of uncertainty is a path breaking contribution. Markowitz deals mainly with the special case in which investor preferences are assumed to be defined over the mean and variance of the probability distribution of single-period portfolio returns, but it is clear that he is aware of the very special nature of these assumptions. Markowitz's treatment of the portfolio problem is completely normative but positive implications from his approach for the general equilibrium models of asset prices are derived by Treynor (1961), Sharpe (1964), Lintner (1965), and Mossin (1966). Sharpe and Lintner turn the Markowitz mean-variance portfolio model into a testable prediction about the relation between risk and expected return by identifying a portfolio that must be mean-variance efficient

In Markowitz's model, an investor selects a portfolio at a previous period (time t-1) that produces a stochastic return at t. The model assumes investors are risk averse and, when choosing among portfolios, they care only about the mean and variance of their one-period investment returns (Fama & French, 2004). As a result, investors choose "mean-variance-efficient" portfolios, in the sense that the portfolios 1) minimize the variance of portfolio return, given expected return, and 2) maximize expected return, given variance. Thus, the Markowitz approach is often called a "mean-variance model'. The portfolio model provides an algebraic condition on asset weights in mean-variance-efficient portfolios. The CAPM turns this algebraic statement into a testable prediction about the relation between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market of all assets. Sharpe (1964) and Lintner (1965) add two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance-efficient. The first assumption is complete agreement. Given market clearing asset prices at t-1, investors agree on the joint distribution of asset returns from t -1 to1.

If this distribution is the true one-that is, it is the distribution from which the returns we use to test the model are drawn. The second assumption is that there is borrowing and lending at a risk-free rate, which is the same for all investors and does not depend on the amount borrowed or lent. Also, the CAPM provides a relatively accurate prediction of the relationship that exists between a financial risk and the expected return (yield). The usefulness of the model lies in the fact that, on the one hand it offers the possibility of comparison of different variants of placement in the financial markets and, on the other hand, justifies the estimate on the scientific basis of the expected future value of profits generated by a financial instrument Anghel and Paschia, (2013). Investors who have a portfolio of securities may like to add some more securities to the existing portfolio in order to diversify or reduce the risks. So, it is appropriate to study the extent of risks of a security in terms of its contribution to the riskiness of a portfolio. The capital Asset Pricing Model (CAPM) measures the risk of a security in relation to the portfolio. It considers the required rate of return of a security in the light of its contribution to total portfolio risk. The CAPM holds that only undiversifiable risk is relevant to the determination of expected return on any asset.

The CAPM was founded on some assumptions as provided by Sharpe (1964), Lintner (1965) and Mossin (1966). The investor is expected to be risk-averse, maximize utility of terminal wealth, have similar expectations towards risk and return, have identical time horizon for which securities are bought and sold, and must have free access to all available information. Furthermore, investors are expected to have some risk-free assets with no investment restrictions, there must be no transaction costs and taxes, and that the available assets must be fixed divisible. However, among the criticism of CAPM as opined by Roll (1977) is that market portfolio has a mean-variance tautology and market portfolio is unobservable in the real world.

Furthermore, the flaws in the CAPM include the following; in regressions the intercept is consistently higher than the proxy for the risk free rate (Douglas, 1969; Black, Jensen & Scholes, 1972; Miller & Scholes, 1972; Blume & Friend, 1973); and Fama & MacBeth, 1973), the relation between beta and average return is too flat (Blume & Friend, 1973); Black, Jensen, & Scholes, 1972); and Stambaugh, 1982), and there is strong evidence that other variables capture variation in expected return missed by beta (Basu 1977).

Roll (1977) further argued that it is practically impossible to totally observe the Market Portfolio; therefore, it is also impossible to test the validity of the CAPM and that every efficient portfolio satisfies the CAPM equation exactly. Also, among other things based on pricing anomalies and the assumption of significant psychological influences on investors' decision-making processes, proponents from the area of behavioral finance question the relevance of the assumption set, such as rational investors and efficient markets. Miller (1977) argued that it is an impossible assumption that all investors have identical expectations of a future that is uncertain. Ross (1977) arbitrage pricing theory allows for additional (macro-economic) factors with factor specific betas to be included for the calculation of fair discount rates. Regardless, within the boundaries imposed by the underlying assumptions, the fundamental validity of the CAPM is fully unscathed, and in spite of such contending models, the CAPM still is the dominant model and paradigm for understanding Risk and Return in equilibrium, (Dayala, 2012).

2.2.5 Price-Earnings Model

It is model developed by Whit-beck Kisor in the 19th Century in order to test the relationship between variables like growth rate, dividend payment rate and risk in growth rate using multiple regression technique and indicate the impact of all three variables on the Price-

earnings ratio, the coefficient of the equation indicates that 1% increase in growth rate would cause 1.5 units of increase in the P/E ratio, one percent increase in dividend payout would results in 1.5 unit increase in P/E ratio. Hence the above equation indicates higher growth, higher dividends and lower risk will results in high P/E and vice-versa.

The difficulties attached to the estimation of cash flows and the inability of companies to pay dividends have led some investors to argue that the best way of valuing securities is by discounting earnings or variants of earnings (Nwude, 2010). Ohlson (1995) starts with the DDM but adds on overlay of what he terms a *clean surplus* relation, where the goodwill on the balance sheet represents the present value of future abnormal earnings. He goes on to show that the value of a stock can be written in terms of its book value and capitalized current earnings, adjusted for dividends. Feltham and Ohlson (1995) build on the same argument to establish a relationship between value and earnings. Penman and Sougiannis (1997) also argue that Generally Agreed Accounting Practice (GAAP) earning can be substituted for dividends in equity valuation, as long as analysts reduce future earnings and book value to reflect dividend payments.

One other way to value equity securities is to value the entire business by discounting the free cash flow to the firm at before-tax WACC and then remove the debt value. The foundation of the valuation of firm model is embedded in the work of Miller and Modighani (1958) where they note that the value of a firm can be written as the present value of its after-tax operating cash flows. In their study, it was opined that a firm with a stable growth rate and that growth rate can be sustained till perpetuity can be valued using $Ve = FCFF_{n+1} / (WACC - gn)$.

Where EFCFn+1 = Expected free cash flow to the firm next year

WACC = Weighted Average cost of Capital

gn = Growth rate in the free cash flow to the firm (Forever)

The general version of the model can be written as the present value of expected free cash flows to the firm that is, $Ve = FCFF_t / (1+WACC)_t$ t=1. If the firm reaches a steady state after n years and starts growing at a stable growth rate gn after that, the value of the firm can be written as Value of Operating Assets of the Firm = $FCFF_t / (1+WACC)$ t + $[FCFFn+1 / (WACC - gn)_t] / (1+WACC)_t$ t = 1.

2.3 Empirical Review

2.3.1 Empirical Evidence from Developed Economies

Nguyen, *et.al.* (2020) examined whether beta, proxied for systematic risk, should be considered valid in the application of the CAPM at industry level for Australia using daily data on 2200 stocks listed on the Australian securities exchange from 2007 to 2016. The study employed the ordinary least square method of data analysis and discovered that selection of portfolio construction, estimating technique, and news about economic conditions significantly affects the view whether or not beta should be considered as valid measure of systematic risk. This suggested that CAPM is not applicable in pricing securities in the Australian stock market.

Garg (2019) looked at the impact of employing CAPM in estimating the performance of the Nordic stock market. The study selected, through random sampling, 35 companies and estimated data using the ordinary regression. It was discovered in the study that the Nordic stock market had a systematic risk of 99% lower than the index and that the Nordic stock outperformed the market's expected return based on CAPM predictions. The study concluded that CAPM was not an accurate model to be used in measuring expected returns of investment in the Nordic markets.

Boyer, *et.al.* (2017) had a task to estimate the weighted average cost of capital of three (3) Brazilian firms: Embraer, an aerospace conglomerate which earns approximately 20% of its revenue from Brazil, Brasil Foods, a food producer and processing firm which earns about 40% of its revenue from Brazil, and Via Varejo, a retail household appliances and electronics through retail stores which earns all its revenue in Brazil. Estimating a firm's cost of equity is a fundamental component in determination of the overall cost of capital. In their study, five (5) different and commonly used approaches to estimating the cost of equity for firms based in emerging market were stated and then applied to the three (3) firms. The first approach was the use of the single factor CAPM and assumes beta will capture country risk. In the second approach, the country risk premium is added to the single factor CAPM while in the third approach, the country risk is included in the risk-free rate. The fourth approach was calculated using the country specific equity risk premium while the fifth approach employed the country weighted average based on where revenue is generated. It was discovered in the study that for firms with significant country risk, the first approach may underestimate the cost of equity for some firms. The study also revealed that global beta was used in approaches 1 and 5 while local beta was employed in approaches 2, 3 and 4. Therefore, Via Varejo has a higher cost of equity, compared to the other approaches, since all revenues are earned in Brazil.

Saporito (2017) examined the efficiency and the validity of the capital asset pricing model, at Irish stock exchange, for a sample period of 25 companies which were collected from the ISE database between 2001 and 2011. The study divided the data collected into three sub-periods so as to examine the pre, during and after the global financial crisis between 2007 and 2008. The study employed the ordinary least square method of data analysis and it was discovered that the intercept was non-zero. It was further discovered in the study that despite the statistically non-significance

of CAPM, the co-movement of risk-return was more evident and positive during the crisis period than in the other sub-periods. Thus, CAPM is not a valid model in helping to predict the asset prices at Irish stock exchange.

Rossi (2016) had a comprehensive and critical literature review on the subject matter, capital asset pricing model. The attraction of the CAPM is that it offers powerful intuitively appealing predictions regarding how to measure risk and of the relationship between expected return and risk. It provides the methodology for quantifying risk and translating it into estimates of expected return on equity. The CAPM is based on the idea that not all risk should affect the prices of securities or assets. It provides an insight into the kind of risk that is relevant in affecting return and also a methodological translation of risk into estimating expected return on equity.

Demircioglu (2015) investigated CAPM in Turkey based on the sources of information from the Istanbul stock exchange with emphasis on the cement and power generation and distribution sectors. The study had a scope from January, 2012 to December, 2013 with 10 companies selected from both sectors. Using the ordinary least square, the study discovered that CAPM is not applicable in Turkey cement and power generation and distribution sector.

Bod'a and Kanderová (2014) used monthly data of the USA S&P 500 index stock for 10 years that was between 2003 to 2012. The aim of the study was to check the linearity of the relationship between CAPM beta and stock returns. The study divided data into two subsequent non-overlapping 5-year sub periods. The ordinary least square model was used as the method of data analysis and it was discovered that there is no linear relationship between beta and stock returns. This signified that CAPM was not applicable in valuing the stock in the S&P 500 market because the linearity assumption of CAPM was invalidated.

Jacek (2014) measured the performance of construction companies listed on the Warsaw stock exchange with respect to two different portfolios: family and non-family controlled. In confirming this objective, the portfolios were measured in three sub-periods: pre-crisis period: 2006-2007; crisis period: 2008-2009; and post-crisis period: 2010-2012. It is to discover whether the family-controlled firms underperformed or outperformed their non-family-controlled peers in terms of expected returns and risk. Employing the Ordinary Least Square technique, the study discovered that the relationship between return and risk holds in the case of the Warsaw stock exchange. It was also discovered in the study that returns of family-controlled companies significantly outperformed their non-family-controlled peers in the period of crisis.

Kozarević and Džafić (2014) studied to present the possibilities of applying the CAPM model to determine the cost of capital for the company whose shares are quoted on the Sarajevo stock exchange. The study period was from 2010 to 2012, using weekly data. The study employed ordinary least square and found out that despite certain limitations, an approach to determining the cost of capital through CAPM is still valid and usable in the Sarajevo stock exchange.

Bornholt (2013) tested CAPM by analyzing the three inefficiencies in the U.S. market using 48 industries, from 1963 to 2009, finding and confirming that beta anomaly which was derived from the portfolios composed by low beta stocks have higher average returns than the one predicted by the CAPM. However, portfolios characterized by high beta stocks show a lower average return, tends to reduce after 1993. Furthermore, the book-to-market equity anomaly, or value anomaly, which observes that firms with high book-to-market equity ratio have higher average return than those which have a lower ratio, can be ignored if it is estimated the industry cost of equity and lastly, the momentum anomaly, where the stocks with high average returns in one period show higher average returns in the next period continues through all the period

examined. The study exerted that CAPM fails its application to industries but it is more appropriate for stocks.

Acqua, *et.al.* (2012) examined the reasons for differences in the industrial composition between two stock market indices, the Italian FTSE MIB and the Chinese Shanghai Composite Stock Exchange. A specific application of the CAPM in emerging capital markets, and specifically the effects of the industrial structure of a stock market on industry betas was the objective of the study. Weekly observations were taken from 40 active companies in the Italian FTSE MIB and 980 observations from the Shanghai composite stock market which makes a total number of 1020 of companies. Observations included three types of original data across ten different industrial sectors for a period of five years between January, 2007 and December, 2011, for a total of 256 weeks. The study revealed that it is possible to strengthen the intuition that structural differences in the industrial composition and the inherent riskiness of the two countries exist. The study firstly found that the industrial composition of a stock market yields valuable information about a country's economy. Secondly, a statistically significant cross-country difference in average industry betas in all the 10 industrial sectors analyzed is identified. The study concluded by countering the economic intuition that returns in emerging markets are riskier due to the unstable economic and political environment, and should therefore be associated with higher betas.

Bilgin and Basti (2011) examined the existence of an unconditional relationship between beta and returns in Istanbul stock exchange. The study collected data from the ISE website for a period of 5 years (January, 2006 to December, 2010) which was divided into 23 months sub-periods. Using an unconditional testing approach developed by Fama and MacBeth, the study discovered that there was no meaningful relationship between betas and risk premiums, therefore CAPM is not valid in ISE over the sample period.

Novak and Petr (2004) studied the impact of CAPM beta, market value of equity and momentum on stock return on the Stockholm stock exchange. The study also employed ordinary least square and discovered that none of the factors, including CAPM beta was significant in explaining stock returns on the Stockholm stock exchange market. This study also discovered that CAPM was not valid in valuing the stock market prices in the Stockholm stock market.

2.3.2 Empirical Evidence from Developing Economies

Anwar and Kumar (2018) looked at the Indian stock market with the aim to test whether the assumptions of CAPM holds in the market, using NIFTY 50 companies from 2009 to 2016. The study made use of time series regression to determine stocks' beta and cros-sectional regression to assess the relationship between beta and stock returns. The study's data was subcategorized into portfolios based on size and value. The results indicated that CAPM beta was not robust in explaining stock returns of the NIFTY 50 companies. The study discovered that CAPM did not hold in the Indian stock market.

Sreenu (2018) used the Indian stock exchange market to test the three-factor model of Fama using daily and annual average data of 54 companies between 2010 and 2016. The study developed regression models for both the CAPM and Fama models. The results indicated that the intercepts of both models were statistically not significant. This showed that CAPM was applicable in pricing securities in the Indian stock market since an insignificant coefficient implies that beta is the only factor explaining variability of returns.

Karp and Vuuren (2017) studied the validity of CAPM and the Fama French Three-Factor model in the South African Johannesburg stock market. The study employed data of 46 companies listed on the JSE from 2010 to 2015, they constructed portfolios using an annual sorting procedure

based on size and book-to-market. It was discovered in the study that CAPM is poor in explaining stock returns.

Lee, Cheng and Chong (2016) examined the context of the emerging markets, by analyzing the Kuala Lumpur Stock Exchange (KLSE) and its 60 stocks from 2010 to 2014, using weekly data. The study discovered that CAPM seems to be a good predictor of the stock prices. The study also discovered, by using two-phase regression, that beta results positively related to the expected return and it is confirmed a linear relationship. This implies that investors could use CAPM to estimate and predict the systematic risk and prices of stocks in the Malaysia stock market.

Elbannan (2015) had a review of the basic theory of the capital asset pricing model in order to shed the light on the model by discussing the assumptions, the evolution of the Sharpe and Lintner model, and reviewing the literature on the relaxation of model assumptions and the critiques of the CAPM. Markowitz (1959) model suggests that investors choose a portfolio that will minimize the variance of portfolio return, given a specific level of variance. Sharpe (1964) and Lintner (1965) extended the work of Markowitz which depends on the tradeoff between risk and return, and introduce their models with two additional assumptions. The first assumption is borrowing and lending at a risk-free rate and the second assumption is that all investors have homogenous expectations which results in estimating identical probability distribution for future return. In contrast to the CAPM, the APT contends that there are many factors that affect returns. The differences between the CAPM and APT is based on a linear return generating process as a first principle, and it neither requires utility assumptions nor is it restricted to a single period.

Faris (2010) primarily embarked on a study to determine the factors affecting the equity return of studied banks stock and secondarily, it was to identify whether there is a significant

relationship between return of listed commercial banks with some microeconomic factors. The scope of the study was between 2005 to 2008 and data were collected from the Amman Stock Exchange (ASE) and the listed banks' annual reports. The study was modelled using the Ordinary Least Square method. Thus, the dependent variable is the market price of stock while the independent variables were net asset value per share, dividend percentage, earnings per share, lending interest rate, inflation rate, and gross domestic product. The study discovered that the factors affecting asset prices are numerous and inexhaustible. The factors can be categorized into firm (bank), industry, country and international or market and non-market factors, and economic and non-economic factors. It was also discovered in the study that a highly positive and significant relationship existed between market price of stock and net asset value per share; market price of stock dividend percentage gross domestic product, and negative significant relationship is found on inflation and lending interest rate.

Sehgal and Pandey (2010) embarked on the study with the view to understanding which standalone value driver is best for forecasting prices, and to evaluate whether the combination of value drivers forecasts prices better than standalone value drivers. The study explored 13 sectors of the Bombay Stock Market out of 20 major sectors, covering 145 companies which accounts for about 75% of the market capitalization as well as trading activities in India. In their study which covered the period 1990 to 2007, data, comprising yearly value drivers on a per-share basis, that is, EPS, BV, sales and cash flows, have been extracted from Thomson-Reuters Datastream Software. In order to compute the forecasted price, the Ordinary Least Square estimation was employed. It was discovered in the study that the price to earnings ratio provides the best price forecast for most of the sample sectors. In the combination of four multiples pairwise in providing information about future price forecast, the BV-sales combination provides the best forecast results

both at the sectoral level and at the market level. Therefore, the study concluded that the P/E ratio is the best standalone multiple outperformed BV-sales, which is the best value driver combination in terms of pricing error minimization.

The determination of the specific macroeconomic variables affecting the pricing of securities in the Lithuanian economy is the main thrust of the study embarked on by Tvaronaviciene and Michailova (2006). After a comprehensive discussion of the different theories of stock prices, the study employed the multiple regression analysis. The following macroeconomic variables were considered in their study: foreign direct investment, state budget revenue, state budget expenditure, gross domestic product at current prices, consume prices index, broad money supply, average profitability of government bonds, and inflation. The study found that stock market reacts to various leading indicator series, the most important of which are money supply, inflation rate, GDP, CPI, FDI, and government bond's profitability.

James (2002) in his study attempted to shed more light on the impact that stock markets have had on China's economic development. The study had a scope that was between 1991 and 1998 and data were analyzed using the ordinary least square, specifically to check for the efficient market hypothesis. The findings of his study revealed that stock market in China has not really helped in the economic developmental process. It was discovered that the continual usage and promotion of stock market only has helped in the raising of funds and modernization and has not promoted State Owned Enterprises (SOEs) neither has it significantly improved the efficiency with which capital is allocated in the Chinese economy.

Bruner *et al.* (2002) examined a general review of studies made by different authors on capital assets pricing model. According to them, there was no general single best practice for the

valuation of assets and securities in emerging economies unlike the developed economies that have seem to converge on mainstream valuation practices. There are also some distinguishing characteristics between the emerging markets and developed markets in the areas of transparency in accounting, liquidity, corruption, volatility, governance, taxes, and even transaction costs. It is important to state that these differences in characteristics are likely to affect the valuation of a firm. Bruner *et al* defined the value of a firm as the sum of its current assets and the value of its future prospects. It is therefore imperative to understand by proper and accurate information, the present condition of the firm and its future prospects so that a more accurate and fair valuation can be made. Transparency is a vital characteristic if accounting information is to be considered useful in the determination of the value of a firm. The valuation of firms in any market also depends on the degree to which investors' rights are protected.

Benn (2001) analyzed the technological and economic forces driving change in the securities trading industry, and also examines the implications for developing markets. The study discovered that modern telecommunications infrastructure is important for taking full advantage of the latest trading and settlement technology. Particularly, it helps in eliminating distance costs and facilitates the widest possible network of direct market participants.

Ongkrutaraksa (1996) revisited the relevant theories and evidences regarding the informational efficient capital markets. The study explored the normative theory of perfect capital markets, the stochastic notion of random walk, the martingale theory, and various forms of market efficiency under the efficient markets' hypothesis. Ongkrutaraksa concluded for the area of informational efficient capital markets that there is little evidence that stock prices exhibit consistent patterns that could be used to predict their future movement. However, stock prices tend to follow a long-run upward drift with random fluctuations around these trends. The study

further found out that new information sets that are not yet reflected in stock prices have tremendous value for those acquirers to be able to realize abnormal returns.

2.3.3 Empirical Evidence from Nigeria

Afolabi, *et.al.* (2017) discussed the effect of capital asset pricing model on the monthly stock values of 20 listed firms in Nigeria and also assessed the correlation between capital pricing asset model and the Nigerian stock exchange. 110 stock returns of firms which form part of the formation of the NSE all-share Index for the period of January, 2006 to December, 2015 were obtained and used in achieving the objectives of the study. The All-Share Index represents the market weighted value and it also reflects the general trends of the Nigerian stock market. On employing the ordinary least square method of data analysis, it was discovered in the study that CAPM assumption of higher returns attributed to higher beta is found to be valid in the Nigerian stock market but invalidates the assumption that the intercept equals zero and also the assumption that the slope of the SML should be equal to the excess return on the market portfolio was also found to be invalidated. It was concluded in the study of Afolabi *et al* that the CAPM is not applicable in the NSE as there was no evidence of correlation between the NSE and CAPM.

Herbert, Nwude and Onyilo (2017) aimed at determining the beta coefficients of the equity stocks on the Nigerian Stock Exchange, with sectoral focus on the chemicals and paints industry. Daily official list for the quoted chemicals and paints industry was used to determine the return on the market through the NSE's composite market index, the All-Share Index between January 2000 and December 2012. The study employed the use of the Ordinary Least Square (OLS) and it was discovered in the study that stocks in the chemicals and paints industry exhibited risky features during the period of study.

Bashir and Ahmad (2016) examined the impact of the Nigerian capital market performance indicators on the economic growth of the Nigerian economy using three performance indicators namely; Market capitalization and Value of transaction. In measuring the growth in the economy, the Gross Domestic Product was used as a proxy. In the study which covers the period of 2005 and 2014, the study revealed that the capital market indicators have an insignificant impact on economic growth using the Ordinary Least Square and ANOVA method. Bashir and Ahmad also found that while value of transaction exerted a negative influence on economic growth, market capitalization is found to have a positive impact on economic growth. It was therefore suggested in their study that the Nigerian stock market should encourage companies to raise fund so that the stock market performance indicators can be improved and thus, economic growth in the country would be on the increase too. It was also recommended that transparency should be upheld so that investors can be more confident in transacting with the stock market.

Akinmulegun (2015) investigated the theoretical underpin of the relationship between an investment's risk and return in the context of Capital Asset Pricing Model between 1985 to 2014. The study aimed at conducting and empirically test whether the standard form of CAPM is valid in the context of the Nigerian Stock Exchange (NSE). The study used ordinary least square method of data analysis and discovered that credence to the linear structure of the CAPM equation; there exist a linear relationship between risk and return of a portfolio. The study also found that the CAPM is not verified in the Nigerian stock market between the periods under investigation.

Edame and Okoro (2013) investigated the impact of capital market on the economic growth process in an emerging market like Nigeria. Numerous and well obvious transformations have been observed in the Nigerian capital market over the years. Thus, the study established a linkage between capital market and economic growth as a central position in development. The study

employed the neoclassical growth model which specifies output as a linear function of Labour (L), Capital (K) and the index of technology (A). The model was specified as GDP being a function of capital market capitalization, number of deals, value of transaction, and interest rate. The result of their study revealed that using a scope of 1970 to 2010, there is a positive relationship between market capitalization and economic growth in Nigeria. Similarly, the number of deals also exerts a positive relationship with economic growth in Nigeria. However, a negative relationship is found between interest rate and economic growth in Nigeria.

Oke (2013) examined the validity or otherwise of the propositions of the CAPM in the Nigerian stock market in the aftermath of the global economic crisis. In his study, the test was conducted using weekly data for a period of three years from January, 2007 to February, 2010. Using the ordinary least square method, data were obtained from the Nigerian stock exchange market. The study found that in applying the CAPM to the Nigerian stock market, stock returns from 110 companies listed on the floor of the Nigerian stock market invalidate the CAPM's predictions that higher risk (beta) is associated with a higher level of return and that the intercept should be equal to zero when estimating SML is also invalidated.

Lawal and Okunola (2012) tested whether stock market prices granger causes stock market operations and economic growth. Their study saw stock price regressed on interest rate, inflation rate, fiscal deficit, exchange rate, money supply, gross domestic product, market capitalization, and volume of total transaction of the Nigerian stock exchange. The study employed the use of the Error Correction Model and it was discovered that the present stock price adjusts rapidly to changes in interest rate, inflation rate, exchange rate, broad money supply, gross domestic product, market capitalization and the volume of transaction. It was also discovered in their study that a negative insignificant relationship exists between stock prices and interest rate. On the issue of

causality, the study revealed that there is a unidirectional relationship between exchange rate and stock price with the direction of causality running from exchange rate to stock price. Also, stock prices can be used to determine or predict money supply, stock prices ganger causes volume of transaction whereas, gross domestic product granger causes stock prices in the Nigerian stock market. It was therefore important to invigorate and strengthen the financial market by encouraging more companies to get listed on the floor of the market. It is also imperative to monitor stock prices so as to prevent volatility in the prices which could drastically affect the performance of the stock exchange market.

Osamwonyi and Asein (2012) attempted to empirically examine within the CAPM framework the relationship between market risk proxy by beta and security return within the Nigerian capital market for the period 2001 to 2005. The study made use of quarterly data gotten from the CBN and the financial statements of the selected listed firms in the Nigerian stock market; the study was tested using the Ordinary Least Square and it was discovered in the study that 10 out of a total 14 listed companies conform to the CAPM relationship between beta and return. This means that a significant positive relationship exists between security returns and risk in the Nigerian capital market. Osamwonyi and Asein therefore recommended that investors and portfolio managers should improve the methods employed in optimizing their portfolios even as the market rewards market risk significantly.

2.4 Summary of Empirical Review of Literature

Table 2.1 Summary of Empirical Review

/n	Author	Objective(s)	Method	Results
.	Nguyen, Vu, Vo, and McAleer (2020)	Should beta be considered valid in the application of the CAPM at industry level in Australia?	OLS	selection of portfolio construction, estimating technique, and news about economic conditions significantly affects the view whether or not beta should be considered as valid measure of systematic risk.
	Gard (2019)	Impact of employing CAPM in estimating the performance of the Nodic stock market.	OLS	CAPM was not an accurate model to be used in measuring expected returns of investment in the Nordic stock market.
	Anwar and Kumar (2018)	The study aimed to test whether the assumptions of CAPM holds in the market	OLS	The study discovered that CAPM did not hold in the Indian stock market.
	Boyer, *et.al.* (2017)	Effect of weighted average cost of capital on three Brazilian firms.	OLS	It was discovered that different approach to valuation affect the firms differently.
	Saporito (2017)	efficiency and the validity of the capital asset pricing model at Irish stock exchange.	OLS	It was discovered in the study that despite the statistically non-significance of CAPM, the co-movement of risk-return was more evident and positive during the crisis

				period than in the other sub-periods.
5.	Rossi (2016)	Critical review of literature on CAPM	-	CAPM is based on the idea that not all risk should affect prices of securities.
6.	Demircioglu (2015)	CAPM in Turkey based on the sources of information from the Istanbul stock exchange with emphasis on the cement and power generation and distribution sectors.	OLS	CAPM is not applicable in Turkey cement and power generation and distribution sector.
7.	Boďa and Kanderová (2014)	linearity of the relationship between CAPM beta and stock returns.	OLS	there is no linear relationship between beta and stock returns. This signified that CAPM was not applicable in valuing the stock in the S&P 500 market.
8.	Jacek (2014)	Performance of construction companies listed on the Warsaw stock exchange	OLS	Returns of family-controlled companies significantly outperformed their non-family-controlled peers.
9.	Kozarević and Džafić (2014)	possibilities of applying the CAPM model to determine the cost of capital for the company whose shares are quoted on the Sarajevo stock exchange.	OLS	CAPM is still valid and usable in the Sarajevo stock exchange.
10.	Bornholt (2013)	CAPM and inefficiencies in the U.S. market.	OLS	The study exerted that CAPM fails its application to industries but it is more appropriate for stocks

11.	Acqua, *et.al.* (2012)	Reasons for differences in the industrial composition between the Italian FTSE MIB and Chinese Shanghai composite stock exchange.	OLS	Economic intuition that returns in emerging markets are risker due to unstable economic and political environment is countered.
12.	Bilgin and Basti (2011)	existence of an unconditional relationship between beta and returns in Istanbul stock exchange.	OLS	there was no meaningful relationship between betas and risk premiums, therefore CAPM is not valid in ISE over the sample period
13.	Novak and Petr (2004)	impact of CAPM beta, market value of equity and momentum on stock return on the Stockholm stock exchange	OLS	CAPM was not valid in valuing the stock market prices in the Stockholm stock market.
Evidence from Developing Economies				
14.	Anwar and Kumar (2018)	The study aimed to test whether the assumptions of CAPM holds in the market	OLS	The study discovered that CAPM did not hold in the Indian stock market.
15.	Sreenu (2018)	The three-factor model of Fama and the Indian stock exchange market.	OLS	CAPM was applicable in pricing securities in the Indian stock market since an insignificant coefficient implies that beta is the only factor explaining variability of returns.
16.	Karp and Vuuren (2017)	validity of CAPM and the Fama French Three-Factor model in the South African Johannesburg stock market.	OLS	CAPM is poor in explaining stock returns.

17.	Lee, *et.al.* (2016)	CAPM and the Kuala Lumpur stock exchange.	Two-phase regression	investors could use CAPM to estimate and predict the systematic risk and prices of stocks in the Malaysia stock market.
18.	Elbannan (2015)	Review of the basic theory of CAPM	-	The difference between CAPM and APT is based on a linear return generating process as a first principle.
19.	Faris (2010)	Factors affecting the equity return of stocks in Amman stock exchange	OLS	Highly significant and positive relationship existed between market price of stock and net asset value per share.
20.	Sehgal & Pandey (2010)	To evaluate whether the combination of value drivers forecast prices better than standalone value drivers.	OLS	P/E ratio is the best standalone multiple which outperformed BV-sales, which is the best value driver combination.
21.	Tvaronaviciene and Michailova (2006)	Specific macroeconomic variables affecting pricing of securities in Lithuanian	OLS	Stock market react to various leading indicators, the most important of which is money supply.
22.	James (2004)	Impact of stock market development on China's economic development	OLS	Firm, industry, country, and international market and non-market factors affect China's economic development.
23.	Bruner, *et.al.* (2002)	Review of general empirical studies on CAPM across different developed and developing economies	OLS	Valuation of stocks in any market depends on the degree to which investors' right are protected.

24.	Benn (2001)	Technological and economic forces driving change in the securities trading industry in developing markets	OLS	Modern telecommunications infrastructure is important for taking advantage of the latest trading and settlement technology.
25.	Ongkrutaraksa (1996)	A revisit of relevant theories and evidences regarding the informational efficient capital market	Correlation	Stock prices tend to follow a long-run upward drift and that new information sets that are not yet reflected in stock prices have tremendous value for those acquires to be able to realie abnormal returns.
Evidence from Nigeria				
26.	Afolabi *et al.* (2017)	Examine the effect of CAPM on monthly stock values of listed firms in Nigeria.	OLS	CAPM is not applicable in the NSE as there was no evidence of correlation between the NSE and CAPM.
27.	Herbert, Nwude, and Onyilo (2017)	Determining the beta coefficient of the equity stocks on the Nigeria stock exchange	OLS	Stock in the chemicals and paints industry exhibited risky features.
28.	Basir and Ahmed (2016)	Examined the impact of the Nigeria capital market performance indicators on the economic growth	OLS	Capital market indicators have an insignificant impact on economic growth.
29.	Akinmulegun (2015)	Theoretical underpin of the relationship between an investment risk and return.	OLS	CAPM is not verified in the Nigerian stock market even though there exist a linear relationship between risk and return.

30.	Edame and Okoro (2013)	Examined the impact of capital market on the economic growth process	OLS	There is a positive relationship between market capitalization and economic growth in Nigeria.
31.	Oke (2013)	Examined the validity or otherwise of the propositions of the CAPM in the Nigeria stock market	OLS	The CAPM is not applicable in the Nigerian stock market.
32.	Lawal and Okunola (2012)	Does stock market prices granger cause stock operations and economic growth	ECM	There is a unidirectional relationship between exchange rate and stock prices.
33.	Osamwonyi and Asein (2012)	Examined the relationship between market risk and security return	OLS	There is a significant positive relationship between security returns and risk in the Nigerian capital market.

Source: Researcher's Compilation (2020).

2.5 Gaps in the Literature

The following gaps have been identified from the review of the summarized literature in Table 2.1

1. From the reviewed literature, and to the best of the researcher's knowledge, an assessment of the valuation and pricing of equity security has not been explored in the Oil and Gas industry of the Nigerian stock exchange market.

2. Studies reviewed have used several methods ranging around CAPM and the OLS, however, this study used the Chow's test to examine whether there is any statistical difference in the mean values of expected return and actual return in the oil and gas industry.

3. Many of the reviewed literature has focused more on the risk-return trade off, i.e., the relationship between risk and return of an asset. This study will also take a look at the relationship that exists between the return on the whole of the market and the return of the individual companies in the industry.

2.6 Conceptual Framework

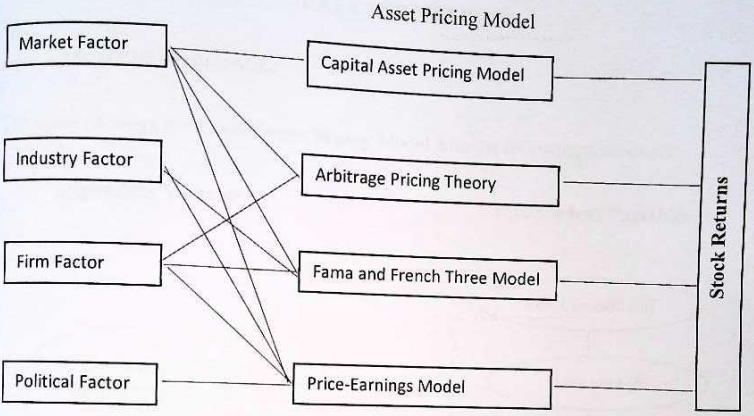

Figure 2.1 Conceptual framework showing the relationship between models reviewed and effect on stock returns.

CHAPTER THREE

DATA AND METHODS

3.1 Theoretical Framework

The study employs the Capital Asset Pricing Model with the following framework;

Dependent Variable **Independent Variables**

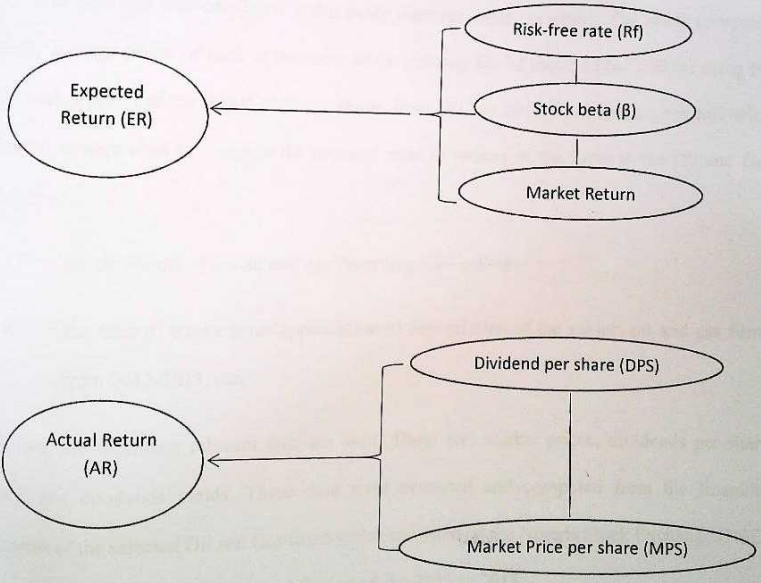

Figure 3.1 Relationship between the dependent variable and independent variables.

3.2 Research Design

The research design for this study is ex-post facto design because the study used information which is readily available and obtained from reliable sources, to analyze and validate the research hypotheses for inference purpose. In this type of research design, the researcher has no control over the variables.

3.3 Nature and Sources of Data

The data that was employed in this study were secondary in nature. The study computed monthly average prices of each of the firms in the industry for 72 months (2012-2018) using the daily market prices of the firms' ordinary shares from 2012 to 2018. Furthermore, the following information were used to compute the required rates of returns of the firms in the Oil and Gas industry:

i. the dividends of the oil and gas firms from 2012-2018,

ii. the rates of equity price appreciation or depreciation of the subject oil and gas firms from 2012-2018, etc.

Therefore, the following relevant data are used. These are: market prices, dividends per share history, and dividends yields. These data were extracted and computed from the financial statements of the selected Oil and Gas firms which are listed on the Nigeria Stock Exchange (NSE) and Central Bank of Nigeria Statistical Bulletin from 2012 to 2018.

3.4 Population and Sample

The study population were made up of all quoted Oil and Gas firms in Nigerian Stock Exchange market for the period January 2012 to December 2018. A total of twelve (12) firms are

quoted on the floor of the Nigerian Stock Exchange between the study periods. These firms are; 11 (Mobil) Plc., Anino International Plc., Capital Oil Plc., Conoil Plc., Eterna Plc., Forte Oil Plc., Japaul Oil and Maritme Service Plc., MRS Oil Nigeria Plc., Oando Plc., Rak Unity Pet. Comp. Plc., Seplat Petroleum Development Comp. Plc., and Total Nigeria Plc. However, eight (8) firms were selected based on the availability of information on these firms. Also, some of these firms became listed after the year 2012 while others have been delisted by the stock market before the year 2018. The following firms were therefore selected based on the availability of complete information; 11 (Mobil) Plc., Conoil Plc., Eterna Plc., Forte Oil Plc., Japaul Oil and Maritme Service Plc., MRS Oil Nigeria Plc., Oando Plc., and Total Nigeria Plc.

3.5 Model Specification

This study, in order to achieve the first objective, employed the CAPM which was built by Sharpe (1964), Lintner (1965), and Mossin (1966) and adopted by Mohammad (2017); Boyer, *et.al.* (2017); Rossi (2016); Akinmulegun (2015); Elbannan (2015); Mashriki and Shehab (2014); Oke (2013); Hasan, *et.al.* (2011); and Nwude (2010).

The model is stated as;

$$R_{it} = R_{ft} + \beta \{R_{mt} - R_{ft}\} \quad (3.1)$$

Where;

R_{it} represents the return on individual oil and gas firm at time t

R_{ft} represents the risk-free rate as proxy by the Federal Government Treasury Bill rate at time t

R_{mt} is the return on the market which will be proxy by the equity market All Share Index (ASI) at time t

β_{it} is the stock beta (a measure of systematic risk) of the individual oil and gas firm at time t.

Furthermore, the second and third objectives of the study were achieved through the model;

$R_i = f(R_{mt}, \beta_{it})$, (3.2)

Econometrically, $R_{it} = \lambda_0 + \lambda_1 R_{mt} + \lambda_2 \beta_1 + \mu_t$ (3.3)

Where;

R_{it} is the return on the individual firm

R_{mt} is the market return

β_{it} is the beta factor of the individual firm

λ_0, λ_1, and λ_2 are parameters to be estimated

μ_t is the stochastic error term.

3.6 Measurement of Variables

In this study, the required rate of return was derived based on the Capital Asset Pricing Model (CAPM). The expected required returns of the firms were calculated based on the CAPM and it was compared with the actual return of the firms to check whether the stocks were properly valued and priced. It was therefore necessary to derive values for each of the variables in the CAPM equation.

3.6.1 Method of Data Analysis

In achieving the first objective which was to determine the method of valuation that is suitable in the Nigerian Oil and Gas Industry, under the CAPM, different techniques were adopted.

First the study made use of the trend analysis (Mohammad, 2017; Herbert, Nwude, & Onyilo, 2017), the chow's model testing of difference of two means, and the comparison of actual return with expected return of the CAPM in order to check whether the oil and gas equity is properly priced or otherwise (Nwude, 2010).

The second and the third objectives were achieved through employing a panel data ordinary least square regression as adopted by Mashriki and Shehab (2014) and Mohammad (2017), the student t-test as well as the F-test. Specifically, the study employed the Random Effect Model which was based on the assumption that variations across entitles is assumed to be random and uncorrelated with the independent variables included in the model (Green, 2008).

The random effect is given as:

$$Y_{it} = \beta X_{it} + \alpha + \mu_{it} + \varepsilon_{it} \qquad (3.4)$$

Where Y_{it} is the dependent variable (return on individual firm) at time $_t$,

X_{it} is the independent variable (return on the market and individual stock beta) at time $_t$

μ_{it} is the between-entity error, and

ε_{it} is the within-entity error.

3.7. Estimation of the Variables

3.7.1 Estimating the Individual Firm's Expected Rate of Return

The CAPM posited that if the risk-free rate of the market and the return on the market portfolio are known, the required rate of return on any risky asset will depend on the coefficient of the stock's beta. It tells us that the required rate of return on an asset is equal to the risk-free rate

plus a fraction (or multiple) or the market risk premium, where the fraction (or multiple) is represented by the asset's beta coefficient. Thus, $R_i = R_f + \beta_i (R_m - R_f)$.

Where R_i = the expected required rate of return

R_f = risk free rate

β_i = each equity risk relative to the market

R_m = market rate of return.

3.7.2 Estimating the Risk-Free Rate (R_f)

The risk-free rate represented the earnings on zero-risk assets. In reality, Federal Government (FGN) Treasury Bill for short-term and long-term are used to represent risk free rate of interest. This is because the FGN Treasury bill and bonds have a fixed amount of interest payment and the government is not likely to default. In this study the average rate of all the maturity tranches of FGN Treasury bills issued for each year was used as a good proxy for ascertaining the risk-free rate.

3.7.3 Estimating the Beta Coefficient (β)

Beta coefficient measures the non-diversifiable risk. It shows how the price of a stock or security responds to market forces. The beta coefficient was estimated using the conventional approach of the London Business School Risk Management Service. It followed the usage of the ordinary least square by relating historical returns on an investment to a proxy for the market portfolio returns. This is usually represented by the equation of a straight line: $Y = \alpha + \beta x$, where 'α' is the intercept of a straight line or 'alpha' coefficient, and 'β' is the slope or 'beta' coefficient. However, due to some statistical errors in capturing the data and approximations, the estimated betas using the linear regression are biased estimate of the underlying beta of a security. Therefore,

to correct for the bias, the study employed a technique for adjusting betas developed by Merrill Lynch and as adopted by Mohammad (2017) and Nwude (2010). The technique is given as Adjusted beta = Raw beta (0.67) + 0.33 in order to correct the bias in estimating beta. The significance of the above formula is that it pushes high betas down to 1.0 and low betas up to 1.0 as well as solving for the bias in the estimation of the betas using the linear regression.

3.7.4 Estimating the Market Return (Rm)

NSE All-Share-Index (ASI) was used as a proxy for market rate of return. NSE ASI was established on January 02, 1984 as a base date and set at 100 as a base value to which all subsequent values of the index can be related. It is a real time index because it is recalculated at the end of every trading day and captures the population of all listed shares. The ASI was extracted from the CBN statistical bulletin but was converted into percentage using the formula;

$$\text{All-Share-Index (\%)} = \frac{[ASI_2 - ASI_1]_x\ 100}{ASI_1} \qquad (3.5)$$

Where;

ASI_1 is the ASI of the previous period

ASI_2 is the ASI of the current period

3.7.5 Estimating the Actual Rates of Return of an Asset (R_i)

In order to estimate the annual actual rates of return on each of the individual firms' stock, the capital gain for each week of the year was first estimated. The capital gain is the difference between the weekly opening price of the stock and the closing price. The capital gain was then added to the dividend yield for the stock for the year. The summation of the capital gain and the

dividend yield under each month gave the monthly rates of return. The geometric mean of the monthly returns was therefore computed and multiplied by 12 to obtain the annual rates of return for each of the firms. The return on a security was computed as

$$D + \frac{P_t - P_{t-1}}{P_{t-1}} \quad (3.6)$$

Where

D = Dividend earned in a financial year.

P_{t-1} = Stock price at the beginning period

P_t = Stock price at the end period

3.7.6 Geometric Mean

The geometric mean is a single measure of periodic growth rate which if repeated n times will transform the opening value into the terminal value. To measure the annual growth rate over n years, the appropriate model for geometric mean is as follows:

$$GM = (1+g_1)(1+g_2)(1+g_3)\text{----------}(1+g_n)^{1/n} - 1 \quad (3.7)$$

Where

g is the periodic growth rates expressed as decimals.

In this study, the Growth rate in earnings were computed using the Geometric mean of the respective year's earnings growth rates from 2012 to 2018.

CHAPTER FOUR

DATA PRESENTATION, ANALYSES AND FINDINGS

4.1 Data Presentation

The Capital Assets Pricing Model (CAPM) expressed a linear relationship between the expected return of any security and the expected return of the market as a whole. The expected return of the market as a whole could be calculated using the stock market index. In the Nigerian context, the All-Share Index (ASI) was used to represent the market return of the stock in the industry. Table 4.1 showed the market annual return and the risk-free rates as computed.

Table 4.1 Summary of market annual return (%) and annual risk-free rates (%)

ITEMS	2012	2013	2014	2015	2016	2017	2018
Monthly GM rate of return (%)	2.83	3.29	-1.5	-1.65	-0.51	2.91	-1.16
Annual rate of return (%)	33.96	39.48	-18	-19.8	-6.12	34.92	-13.92
Risk free rate of return (%)	17.2	13.34	15.99	16.28	18.5	18.98	14.55

Researcher's Computation (2020); CBN Statistical Bulletin (2019)

One of the assertions of the CAPM is that expected rate of return on an asset equal to the addition of the risk-free rate and the risk premium. The risk-free rate for the period of study as extracted from the Federal Government Treasury Bills issued in the Central Bank of Nigeria (CBN) statistical bulletin are displayed in Table 4.1. The risk premium equals to the market risk premium ($R_m - R_f$) multiplied by the individual stock beta. The individual stock beta (β) is used as a measure of the sensitivity of each oil and gas stock to the market. It is also for this sensitivity that the holder of the stock is rewarded by the firm. The firm's stock beta is calculated using the linear regression method, $\beta = [n\sum R_i R_m - \sum R_i R_m] / [n\sum R^2_m - (\sum R_m)^2]$. The estimated beta values for the Nigerian quoted oil and gas selected firms are shown in Table 4.2.

Table 4.2 The betas of the oil and gas industry stocks

FIRMS	2012	2013	2014	2015	2016	2017	2018
11 Mobil	-0.1323	0.3836	0.3434	0.4841	0.1022	0.0352	0.7722
Conoil	-0.8693	-0.0787	1.6566	0.9598	0.062	0.8593	0.5042
Eterna	0.4506	1.6231	0.0352	0.9531	0.7655	0.464	0.1558
Oando	0.5712	0.2362	0.8727	1.0335	0.4975	0.8794	-0.3132
Total	0.3367	-0.2194	0.2094	0.7521	0.1893	0.4372	0.2429
Forte Oil	1.134	-1.4857	1.9983	0.3635	-0.6013	0.1491	0.2027
Japaul	0.3769	0.3099	0.3836	0.33	0.33	0.33	0.3032
MRS	-0.3802	-0.3534	0.4975	0.397	0.0486	0.4975	0.5511

Researcher's Computation (2020).

The expected rate of return on an individual stock as explained by the CAPM depends on three things which are, time value of money, the value of market risk, and the reward for bearing market risk. The risk-free rate (R_f)measures the time value of money, market risk is measured by market risk premium, R_m - R_f, which is the same for all stocks. To derive the expected return using CAPM, we plugged in the estimated values of the risk-free rate, R_f, the market risk premium, $R_m - R_f$, and the beta (β) into the equation, $R_i = R_f + \beta_i (R_m - R_f)$. The result of the expected returns from this process are presented in Table 4.3.

Table 4.3 Stocks expected annual rates of return (%) by CAPM

FIRMS	2012	2013	2014	2015	2016	2017	2018
11 Mobil	20.68214	11.39898	22.6966	-2.52244	24.51958	16.36464	10.72761
Conoil	2.526216	5.21029	-4.93286	-54.1693	18.72196	-12.9	-1.92221
Eterna	-22.7232	181.0062	14.6795	-67.5166	52.19731	25.76368	12.47007
Oando	-24.9774	15.88624	28.00708	-120.845	-9.38985	39.32932	26.62386
Total	-5.92456	8.658004	12.23965	-3.2746	26.35595	6.537288	6.381273
Forte Oil	-47.2112	-390.265	91.46579	23.4046	116.1391	13.01898	-6.52067
Japaul	-12.4394	6.268082	9.856236	10.9076	12.395	12.7166	-16.6038
MRS	48.92389	-4.5067	27.43748	5.05284	17.181	-13.3277	9.507435

Researcher's Computation (2020)

Furthermore, the actual returns of the stocks were calculated using the model, Ri = Dividend Yield + Capital Gain Yield, are presented in Table 4.4.

Table 4.4 Stocks actual annual rates of return (%)

FIRMS	2012	2013	2014	2015	2016	2017	2018
11 Mobil	-4.91514	13.38613	40.18434	-17.7533	82.06265	-51.9802	14.00252
Conoil	38.77594	131.0746	5.250568	-48.2926	34.96981	-12.0005	-11.1524
Eterna	-52.538	129.0207	-0.61258	-38.2951	95.54374	62.063	13.07615
Oando	-41.364	26.35908	29.76	-116.4	-32.5078	58.71751	0.738868
Total	-43.6409	41.81294	4.545897	-0.68488	68.42446	-2.9544	-10.9506
Forte Oil	-28.4458	297.0377	55.40098	37.08244	-142.69	-21	-89.4
Japaul	-32.7968	42.24414	0	0	0	0	-88.2
MRS	-64.039	64.76427	40.36786	-10.1621	-5.97069	-40.9571	5.4

Researcher's Computation (2020)

4.2 Data Analysis and Findings

4.2.1 Descriptive Statistics

The descriptive statistics of the explained and the explanatory variables are presented in Table 4.5 where minimum, maximum, mean and standard deviation of the data for the variables in the study were described.

Table 4.5 Summary of descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
ER	56	3.058672	67.17855	-390.2653	181.0062
AR	56	7.542195	66.01084	-142.6897	297.0377
RM	56	-1.112143	64.60938	-143.88	285
Adj-beta	56	0.368525	0.5717481	-1.4857	1.9983

Researcher's Computation (2020)

The result in Table 4.5 revealed that the average expected return for firms in the Oil and Gas industry stood at 3.05% while the maximum was 181.00% and minimum was -390.26%. This implies that equity stocks in the oil and gas industry produce about 3.05% rate of return if the CAPM is employed in valuing stocks. The result also signifies that on the highest, equity stocks could produce about 181.0% return using CAPM and -390.26% on the minimum using CAPM However, actual return as calculated by the addition of the dividend yields of the firms and the capital gains had an average rate of 7.54%, its maximum value stood at 297.03% while minimum was -142.68%. By implication, in the oil and gas industry, actual return of equity stock produced a percentage higher than the percentage when CAPM was employed. The return on the market had an average value of -1.11% while it was 285% on the maximum and -143.88% minimally. The

risk of the individual companies as adjusted using the Merrill lynch method produced an average value of 0.36% while it stood at -1.48% minimally and 1.99% on the maximum.

4.2.2 Correlation Matrix

The correlation coefficient was carried out to inquire the linear association between expected return and actual return in order to support the suitability of the CAPM in the valuation and pricing of equity in the Nigerian stock market. The result of the correlation matrix was presented in Table 4.6.

Table 4.6 Correlation matrix

	ER	AR	RM	Adj-beta
ER	1.0000			
AR	-0.2631	1.0000		
RM	-0.2591	0.9875	1.0000	
Adj-beta	0.3441	-0.1790	-0.1877	1.0000

Researcher's Computation (2020).

The correlation coefficient between expected return as calculated using the CAPM and actual return stood at -0.2631. This signifies that there is a negative but weak association between expected return and actual return. It therefore means that expected return and actual return are not associated with each other. Therefore, it could be an indication that CAPM is not suitable in the valuation and pricing of equities in the industry. The correlation coefficient between expected return and market return was also negative at -0.2591 which indicates that market return and expected return as computed using CAPM do not move in the same direction. However, it was discovered in the result of the correlation matrix that a positive and very strong relationship existed between market return in the stock market and actual return of individual oil and gas firm. The result indicated that increase in actual return is associated with increase in market return and this association is very strong so that the coefficient stood at 0.9875.

Furthermore, a positive but weak association was discovered between expected return and risk of the firms (β). The correlation coefficient between expected return and actual return was 0.3441 and this conformed with the preposition of Sharpe, Lintner and Mossin on CAPM. However, the correlation coefficient between actual return and beta stood at -0.1790 which indicates that a negative and weak association existed between beta and actual return. This association do not follow the higher the risk the higher the return preposition. It stressed that the higher the risk in the market, the lower the actual return of individual oil and gas firms. In the same vein, market return exerted a negative association with risk of the individual firm. The correlation coefficient between market return and risk stood at -0.1877 which showed that a weak but negative association existed between the market return and risk.

4.3 Residuals Test

Residual test like the multicollinearity, heteroskedasticity, Hausman specification test, and Breusch and Pagan Lagrangian Multiplier test are conducted to further strengthen the result of model.

4.3.1 Multicollinearity Test

The study conducted robustness test to improve the validity of the statistical inferences made in the study. Multicollinearity is investigated in panel regression by using tolerance and variance inflation factor (VIF) value. An insignificant tolerance value indicates that variable under consideration is almost a perfect linear combination of the explanatory variable already in the equation and that it should not be included in the regression equation. The tolerance value and VIF are employed in this study to test for multicollineraity of the explanatory variables. The result of multicollinearity test is presented in Table 4.7

Table 4.7: **Multicollinearity test**

Variable	VIF	1/VIF
Beta	1.03	0.971452
MR	1.03	0.971452
Mean VIF	1.03	

Researcher's Computation (2020).

From the result of the variance inflation factor, the mean VIF was 1.03 indicating that the model is free from the problem of multicollinearity because the mean VIF is less than 10. Because the variance inflation factor for the predictor proxies were consistently less than 10 (safe region) while tolerance range were as well consistently less than 1 suggested that the incidence of the occurrence of multicollinearity may not likely affect the inference drawn from this study. Hence, the final outcome of this study is considered free from the effect of multicollinearity thereby becoming valid.

4.3.2 Heteroscedasticity Test

One of the important assumptions of classical linear regression model is that the disturbances appearing in the population regression are homoscedastic. Breusch-Pagan/Cook-Weisberg is used to test the null hypothesis that the error variances are all equal. That is, the variances in the error term are homoscedastic.

Table 4.8 Summary of Heteroscedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Chi2(1)	2.68
Prob > chi2	0.6924

Researcher's Computation (2020).

In the result obtained from the heteroscedasticity test, the chi-square had a value of 2.68 with its probability at 0.6924. This showed that the test is not significant and it implies that the

study cannot reject the null hypothesis which states that the variances in the error term are homoscedastic, that is, equally distributed.

4.3.3 Hausman Specification Test

The Hausman (1978) specification test is used to check for the appropriate model between the Fixed effect and Random effect Ordinary Least Square (OLS). Hausman specification was conducted under null hypothesis that random effect estimate is appropriate and alternate hypothesis fixed effect estimate is appropriate. The result of Hausman test is shown in the table 4.9

Table 4.9 Hausman specification test

Chi2	**17.00**
Prob chi2	0.3400

Researcher's Computation (2020).

In order to choose the best model between the fixed effect and random effect estimate, Hausman specification test was carried out. However, the result of the Hausman test produced a chi-square value of 17.00 with probability of 0.3400. Therefore, we cannot reject the hypothesis that random effect is appropriate than the fixed effect because the Hausman test is not significant at 5% significance level. Hence random effect result would be used for this study and the details of fixed effect estimate will be presented in the appendix for clarity. However, this study further run Breusch and Pagan Lagrangian multiplier test for random effects to choose between the random effect estimate and pool regression estimate as displayed in Table 4.10.

Table 4.10 Breusch and Pagan Lagrangian Multiplier Test for Random Effects Model

Ho: Constant variance	
Fitted values of SHP	
Chi^2 (1)	21.0821
Prob chi^2	0.0006

Researcher's Computation (2020)

In order to further establish the reliability of the Random effect, the study further carried out the Lagrangian multiplier test for random effects. The null hypothesis of the test is that Pooled regression is preferred to the Random effect regression. The result of the Lagrangian multiplier test showed a Chi-square value of 21.0821 with probability value of 0.0006. This showed a significant result; thus, we reject the hypothesis that states that pooled regression is appropriate. Therefore, the study proceeded to interpret the result of the Random effect and includes the result of the Pooled regression in the appendix.

4.4 Presentation of Regression Results

4.4.1 Objective One

Suitability of CAPM to the Nigerian Oil and Gas Industry

The Chow's test was used in establishing the suitability of CAPM to the Oil and Gas Industry equity in Nigeria. The result of the Chow's test is presented in Table 4.11.

Table 4.11 Summary of Chow's Test for Equality of Means between Series

Method	df	Value	Probability
Wald Statistic	110	0.016530	0.9918
t-test	110	0.356240	0.7223
Satterthwaite-Welch t-test*	109.9662	0.356240	0.7223
Anova F-test	(1, 110)	0.126907	0.7223

Researcher's Computation (2020)

The Chow's test was employed to test the suitability of CAPM in the valuing and pricing of equity in the Oil and Gas industry in Nigeria. The result of the Chow's test has a Wald Statistic value of 0.016530 with a Chi-square probability of 0.9918. This result showed that CAPM was not significant in correctly valuing and pricing equity in the industry. The null hypothesis states that the means between the actual return and expected return of stocks in the industry are not equal. The study cannot therefore reject that the means between the two series are not equal. This implies that CAPM cannot be used to obtain the market prices of stocks in the Oil and Gas industry in Nigeria between the study period.

The study also went further to establish the suitability of CAPM in the Oil and Gas industry through the comparison on the actual returns with the expected returns and displayed this comparison on a line graph as shown in Figure.

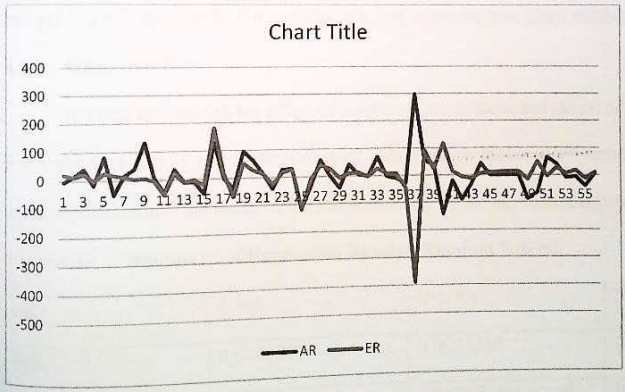

Figure 4.1 Trend Analysis between Actual Returns and Expected Returns

In Figure 4.1, the line graph showed the trend of actual returns against the expected returns, as calculated using the CAPM. The line graph showed that CAPM was not suitable in valuing stock prices in the industry in Nigeria. In economies where CAPM is used in the stock pricing

systems, actual returns follow expected return. In Figure 4.1, it can be seen that there were huge deviations between expected returns and actual returns.

Furthermore, to confirm that CAPM was not suitable in valuing and pricing of equity in the Oil and Gas industry, the study established the valuation status of stocks of the selected quoted companies between the study period. The aim was to establish stocks which were correctly priced in the industry between the sample period using the CAPM and the result and Table is presented in Appendix 6.

From the result of the valuation status of stocks in the Oil and Gas industry listed in Appendix 6, it was discovered that no Oil and Gas company's equity was correctly valued/priced when compared with the CAPM. It was observed that the stocks were either overvalued/overpriced or undervalued/underpriced. This further strengthened that CAPM was not suitable in the valuation and pricing of equity in the Oil and Gas industry in the Nigeria stock market.

4.4.2 Objective Two

In order to establish the effect of market return on expected return of individual oil and gas firms and the effect of individual firm stock beta (risk) on the expected return, the study employed panel regression and the result of the Random effect of the regression is presented in Table 4.13.

Table 4.12 Summary of Regression Results (Random Effect)

ER	Coef.	Std. Err	Prob
MR	0.0446277	0.0067214	0.000
Beta	-0.01419269	0.0176646	0.000
Cons.	5.927844	0.0352555	0.000

Wald chi2(2) = 93.27
prob > chi2 = 0.0000

R- Sq: within = 0.0000
Between = 0.0000
Overall = 0.6377

Researcher's Computation (2020)

The results of the Random effect regression as shown above indicated that market return exerted a positive and significant effect on expected return using CAPM. The coefficient of market return in the result was 0.0446277 and this signified that a percentage increase in market return will produce about 4.4% increase in expected return of the individual firms. It therefore connotes that the individual firms expected return would perform based on the performance of the market as a whole. This result is in line with the assertions of CAPM. It also conforms with the result from the study of Mohammad (2017).

4.4.3 Objective Three

On the effect of stock market beta on required return of the firms in the industry, the result of the random effect OLS indicated that market risk has a negative relationship with required return. The coefficient of stock beta (risk) on required return is -0.1419269 and this implied that a percentage increase in stock beta (risk) will lead to 14.19% decrease in required return. This relationship is found to be significant. It also does not conform to the assumptions of CAPM which stated that stock market beta has a positive relationship with required return.

Coefficient of Determination (R^2)

The coefficient of determination was used in measuring the extent to which changes in the dependent variable is explained by changes in the independent variables. The result of the study showed that overall coefficient of determination stood at 0.6377 and this meant that about 63.77% of the variations in required return are explained by variations in market return and individual company beta (risk).

F-Statistics

The F-statistics is used in measuring the joint significance of the independent variables on the dependent variable. The F-statistics in the result of the study has a Wald chi2(2) value of 93.27 with probability value of 0.0000. This showed that both market return and individual stock beta have joint significant effect on required return. This indicated that the overall model is statistically significant and it's fit for the study. It further implies that explanatory variables have significant impact on outcome variable.

4.5 Discussion and Implications of Findings

The Chow's test and trend analysis result revealed that CAPM was not statistically significant in suitably valuing and pricing of equity in the Oil and Gas industry in the Nigerian stock market. The implication of this is that CAPM was not used as a tool in the valuation and pricing mechanism. It showed that the Nigerian stock market did not rely on any pricing technique as this could be a form of outsmarting the market by some privileged information investors in the market. Thereby, using the pricing technique such as the CAPM to outperform others in the market and make super normal profit from speculations was not possible in the Nigerian stock market. The unsuitability of CAPM in the Nigerian stock market is back up by the study of Afolabi *et al.* (2017); Akinmulegun (2015); Oke (2013); and Nwude (2010) which stated that CAPM is not verified in the Nigerian stock market. However, the result of the study is against what Mohammad (2017) discovered as regards S&P 500 stock market, USA.

The regression result which addressed the effect of market return on expected or required return and the effect of individual company risk as measured by beta on expected return revealed different results. Market return had a positive and significant effect on expected return and this implied that when the performance of the Nigerian stock market is on the increase, equity of the

oil and gas industry would be on the increase also. This result is backed up by the result of Herbert, Nwude and Onyilo (2017) and Mohammad (2017). Furthermore, the individual stock beta exerted a negative and significant effect on expected returns in the Oil and Gas industry. This result was also discovered by Herbert, Nwude and Onyilo (2017); Akinmulegun (2015); and Oke (2013). However, the result does not conform with what Afolabi *et al.* (2017) and Osamwonyi and Asien (2012) discovered.

The result of this study implies that investors in the stock market, especially those who buys and sells equity stocks in the oil and gas industry, cannot employ their knowledge of the CAPM to value and price these stocks because it could transcend to either underpricing the stocks or underpricing them. This means that it will be important for investors and stock market participants to value and price equity stocks using fundamental analysis of the market and firms in which they would want to trade with. By implication also, the regression result means that industry's unsystematic risk as measure by the beta showed that stock prices and value are likely to reduce with increase in unsystematic risk, that is, risk that cuts across all the industries. Investors and participants in the stock market also would understand that with an increased performance in the All-Share Index, individual firm's equity stocks in the oil and gas industry is likely going to experience increase in value because of the positive relationship found between market return and return of individual firms.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study examined the suitability of CAPM in correctly valuing and pricing equity of the Oil and Gas industry in the Nigerian stock market. The study also investigated the effect of market return on expected return on the basis of the CAPM and also the effect of individual company risk as measured by stock beta on the expected rate of return.

The study result revealed amongst others that CAPM was not suitable in correctly valuing and pricing equity in the industry from the result of the Chow's test, trend analysis as well as comparison between actual return and expected return. On the other hand, the study revealed through the random effect OLS that market return had a positive and significant effect on expected return and that individual company beta, which is a measure of risk, had a negative and significant effect on expected return of equity in the Oil and Gas industry.

5.2 Conclusion

Firstly, it is concluded that CAPM is not the mechanism through which equity stocks are been priced. Secondly, the study also found that market return exerted a positive and significant effect on expected return and therefore concluded that the CAPM assumption of the positive relationship between market return and expected return is sustained and validated. However, individual stock beta had negative and significant relationship with expected return which means that the axiom of CAPM stating that higher beta is associated with higher return is not validated.

5.3 Recommendations

Based on the findings and conclusion of this study, the following recommendation were provided;

1. A model that will capture to a large extent earning growth rate, dividend payout ratio, and risk exposure variable be adopted in the Nigerian Stock Market so as to guide valuation and pricing of equity securities be formulated by stock market experts and professionals.

2. The Nigerian stock exchange market should endeavour to license some market makers whose existence will help market prices to reflect the fundamentals of the companies concerned.

3. It is also advised that government should engage actively in the equity stock market so as to curb the problem of unsystematic risk in the industry and provide solid basis for which share prices will not be fluctuating but reflect the true values.

4. Investments in the market should be encouraged through stability in the market and enticing so as to pool enough funds for investment purpose. Thereby, performance of the market may be encouraged.

5. The government should provide enabling environment to support activities of the stock market in other to reduce the risks associated with the market and also increase returns.

5.4 Contribution to Knowledge

This study has contributed to the body of knowledge in the following ways;

1. The result of this study has made investors in the stock market to understand that the CAPM was not suitable in the valuation and pricing of equity in the Oil and Gas industry.
2. The study had also helped investors to understand that there is positive and significant relationship between beta (systematic risk factor) and expected return on the securities in the Oil and Gas industry.
3. The study has contributed to the body of knowledge by assisting stock market participants to understand the effect of market return on the individual firms in the Oil and Gas industry.
4. The study serves as a point of reference to other researchers in the capital market.

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APPENDICES

Appendix 1: The Nigerian Stock Exchange All Share Index 2012 – 2018

Appendix 2: NSE Market Rates of Return & Risk-Free Rates (%)

Appendix 3: List of Oil and Gas Firms Quoted on the NSE between 2012 – 2018 with their Monthly Share Prices

Appendix 4: Stock Variables

Appendix 5: Chow's Test

Appendix 6: Stock Valuation Status using CAPM

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Appendix 10: Random Effect Regression

Appendix 11: Fixed Effect Regression

Appendix 12: Diagnostic Test

Appendix 1: The Nigerian Stock Exchange All Share Index 2012 – 2018

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
20,875.83	20,123.51	20,652.47	22,045.66	22,066.40	21,599.57	23,061.38	23,750.82	26,011.64	26,430.92	26,494.44	28,078.81
-	-0.04	0.03	0.07	0.00	-0.02	0.07	0.03	0.10	0.02	0.00	0.06
31,853.19	33,075.14	33,536.25	33,440.57	37,794.75	36,164.31	37,914.33	36,248.53	36,585.08	37,622.74	38,920.85	41,329.19
0.13	0.04	0.01	-0.00	0.13	-0.04	0.05	-0.04	0.01	0.03	0.03	0.06
40,571.62	39,558.89	38,748.01	38,492.13	41,474.40	42,482.48	42,097.50	41,532.31	41,210.10	37,550.24	34,543.05	34,657.15
-0.02	-0.02	-0.02	-0.01	0.08	0.02	-0.01	-0.01	-0.01	-0.09	-0.08	0.00
29,562.07	30,103.81	31,744.82	34,708.11	34,310.37	33,456.83	30,180.30	29,684.84	31,217.77	29,177.72	27,617.45	28,642.25
-0.15	0.02	0.05	0.09	-0.01	-0.02	-0.10	-0.02	0.05	-0.07	-0.05	0.04
23,916.15	24,570.73	25,306.22	25,062.41	27,663.16	29,597.79	28,009.93	27,599.03	28,335.40	27,220.09	25,333.39	26,874.62
-0.17	0.03	0.03	-0.01	0.10	0.07	-0.05	-0.01	0.03	-0.04	-0.07	0.06
25,036.24	25,329.08	25,516.34	25,758.51	29,498.31	33,117.48	36,864.71	35,504.62	35,439.98	36,680.29	37,944.60	38,243.19
-0.03	-0.03	0.01	0.01	0.15	0.12	0.11	-0.04	-0.00	0.03	0.03	0.01
44,343.65	43,330.54	41,504.51	41,268.01	38,104.54	38,278.55	37,017.78	34,848.45	32,766.37	32,466.27	30,874.17	31,430.50
0.16	-0.02	-0.04	-0.01	-0.08	0.00	-0.03	-0.06	-0.06	-0.01	-0.05	0.02

Source: NSE ASI collected from NSE

Appendix 2: NSE Market Rates of Return and Risk-Free Rates of Return (%)

ITEMS	2012	2013	2014	2015	2016	2017	2018
Monthly GM rate of return	2.83	3.29	-1.5	-1.65	-0.51	2.91	-1.16
Annual rate of return	33.96	39.48	-18	-19.8	-6.12	34.92	-13.92
Risk free rate of return	17.2	13.34	15.99	16.28	18.5	18.98	14.55

Source: Author's Computation; CBN Statistical Bulletin

Appendix 3: Monthly Official Prices of the Quoted Oil and Gas Firms

FIRM	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
MOBIL PLC	2012	-	-	-	116.08	123.01	132.9	131	118.75	114.5	115	109.7	109.25
	2013	114.71	125.97	122.08	124	118	118	117.81	120	106	110.05	115.5	117.95
	2014	115.62	121.15	120.2	125.01	115	125	137	160	170	173.01	170.5	165.5
	2015	155.01	155	153	167	150.5	150	150	148.2	147.13	143.05	146.3	132.31
	2016	152	140.6	159.95	153.95	143.02	157.95	170	170.1	179.27	_	180.5	280
	2017	286.94	279	268.1	315	315.4	270.44	237.53	253	167	162	161	159
	2018	184.87	205.4	184	185	183.5	168.1	183	180	180	175.2	176.5	175
CONOIL	2012	_	_	_	24	_	24.19	20.54	23	18.75	20.5	19.76	19.62
	2013	21.52	22	25.1	26.33	24	23	_	32.01	_	30.24	45.2	_
	2014	64.54	49.42	49.12	49.31	48.9	48.01	62.25	59.24	63.89	46.51	46.77	46.77
	2015	36.21	34.4	32	40	36.6	41	39.05	38.81	31.63	26.04	26.04	26.04
	2016	23.51	23.51	16.56	19.1	17.27	21.85	24.25	23.96	20.61	31.46	34.11	32.41
	2017	37.4	33.72	33.25	33.25	31.59	32.22	42.34	38.22	29	26.2	28	27
	2018	28	37.35	35	32	33.25	33.35	30	24.3	24.3	21.9	22.5	22.5
ETERNA	2012	2.71	2.71	3.9	3.45	3.25	2.89	2.85	1.98	2.3	2.3	2.09	1.38
	2013	2.08	5.11	4.1	3.3	2.71	3.05	3.2	3.05	2.77	2.7	2.5	4.2
	2014	4.3	4.92	3.85	3.64	3.43	3.51	4.33	3.8	3.9	3.8	3.67	3.39
	2015	2.84	2.8	2.75	3.2	2.75	2.8	2.42	2.23	1.92	1.91	1.55	1.62
	2016	1.95	1.8	1.73	1.75	2.41	3.14	2.55	2.24	2.63	2.94	2.95	2.98
	2017	3.22	3.49	3.12	3.23	3.18	3.91	3.75	3.62	3.5	3.29	3.7	4.15
	2018	4.26	5.68	5.75	6.32	6.49	6.3	6.73	6	6.7	6.25	6.05	4.2
FORTE OIL	2012	_	_	_	10.99	10.8	10.05	11.41	10	10.95	10.3	9.89	8.4
	2013	8.51	17.54	13	14.14	14	15.4	17.14	41.99	35.7	38.01	71.03	108.3
	2014	92.87	94.71	89.9	100	141.55	187.14	164.17	181.92	188.42	225	179.17	183.33
	2015	189.17	185.75	170.94	185.93	178	169	185	189.99	248.5	250	281.7	260.94
	2016	328	282.94	324.9	278.57	203.64	205	187	184	177	166.93	125.99	56.39
	2017	80.21	67.66	47	47.78	42.66	46	52	58.62	49.7	48.1	41.29	45.6
	2018	42	50	44.5	41	43	35.15	32.85	25.05	20	20.05	22	18

JAPAUL	2012	0.98	0.8	0.72	0.64	0.56	0.64	0.66	0.64	0.59	0.6	0.58	0.55
	2013	0.55	0.65	0.86	0.66	0.6	0.59	0.54	0.51	0.5	0.5	0.5	0.5
	2014	0.56	0.57	0.51	0.5	0.5	0.5	0.57	0.53	0.51	0.5	0.5	0.5
	2015	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2016	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2017	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2018	0.5	0.48	0.56	0.57	0.5	0.22	0.36	0.29	0.25	0.22	0.2	0.2
MRS	2012	–	–	37.22	33.6	33.25	34.68	32.29	–	–	30.68	27.7	25.01
	2013	22.58	24.88	26.18	22.4	18	16.7	19	–	–	–	34.34	39.88
	2014	–	–	–	51.72	49.14	48.92	66.5	58.9	58.69	53.2	53.2	53.2
	2015	50.54	48.02	48.02	48.02	48.02	48.02	48.02	47.18	47.18	47.18	47.18	47.18
	2016	47.18	47.18	44.83	44.83	42.59	34.71	34	33.92	36.79	41.89	43.35	43.24
	2017	41.08	40	37.08	37.08	37.08	37.08	35.44	37.2	26.65	30.39	28.83	27.05
	2018	28.5	26.15	27	29.7	29.75	32.55	28.55	28.55	28.55	28.55	28.55	28.55
OANDO	2012	–	18.77	24.13	21.76	15.81	16.15	13.88	13.83	13.83	11.51	10.85	11.58
	2013	12.4	13.11	14.25	16.8	15	16	13	12.7	11.3	10.5	11.02	14.7
	2014	25.46	20.11	20	16	15.65	19	28.5	27.8	27.5	25	22.74	19.73
	2015	16.87	15.6	13.97	15.22	18.78	18.51	15.5	11.9	11.65	11	5.71	5.8
	2016	5.9	4.2	3	4.38	4.35	6.78	6.38	5.32	5	5.4	4.71	3.96
	2017	4.66	4.59	4.7	4.86	5.76	8.4	7.02	7.7	6.7	5.93	5.99	5.99
	2018	5.99	5.99	5.99	5.99	9.6	6.75	6.4	5.75	5.3	5	5.3	4.7
TOTAL	2012	190.01	180.5	162.91	132.71	132.01	125.41	130	128.01	130	130	125	117.3
	2013	126.59	141	149	180	142	160.03	158	155	157.9	157	159	165.05
	2014	173.3	171.02	166	181.45	153.14	167	178	171.5	180	173.07	165	162
	2015	149	144	140	179.9	155.3	165.3	164	160	151	154.9	149	147.01
	2016	148.02	142.5	144	147	156.03	169.9	182	190.57	240	309.75	327.75	264
	2017	288.05	285	281	260	265	270	273.1	270	233	225	236	240
	2018	230	225	232	236.6	222.4	201.7	210	183	189.7	183	198	198

SOURCE: Nigeria Stock Market

Appendix 4: Stocks Variables

Coy	Year	DPS	MPS	DIV YLD %	RM %	AR %	BETA%	Rf	ER	ADJ BETA
11 Mobil	2012	500	118.91	4.20	-9.12	-4.92	-0.69	17.20	20.68	-0.13
	2013	600	117.51	5.11	8.28	13.39	0.08	13.34	11.39	0.38
	2014	660	141.50	4.66	35.52	40.18	0.02	15.99	22.69	0.34
	2015	720	149.79	4.81	-22.56	-17.75	0.23	16.28	-2.52	0.48
	2016	800	171.58	4.66	77.4	82.06	-0.34	18.50	24.51	0.10
	2017	800	239.53	3.34	-55.32	-51.98	-0.44	18.98	16.36	0.03
	2018	800	181.71	4.40	9.6	14.00	0.66	14.55	10.72	0.77
Conoil	2012	100	21.30	4.70	34.08	38.78	-1.79	17.20	2.52	-0.86
	2013	400	27.71	14.43	116.64	131.07	-0.61	13.34	5.21	-0.07
	2014	100	52.89	1.89	3.36	5.25	1.98	15.99	-4.93	1.65
	2015	300	33.99	8.83	-57.12	-48.29	0.94	16.28	-54.16	0.95
	2016	310	24.05	12.89	22.08	34.97	-0.4	18.50	18.72	0.06
	2017	200	32.68	6.12	-18.12	-12.00	0.79	18.98	-12.9	0.85
	2018	200	28.70	6.97	-18.12	-11.15	0.26	14.55	-1.92	0.50
Eterna	2012	50	2.65	18.86	-71.4	-52.54	0.18	17.20	-22.72	0.45
	2013	40	3.23	12.38	116.64	129.02	1.93	13.34	181.00	1.62
	2014	80	3.88	20.63	-21.24	-0.61	-0.44	15.99	14.67	0.03
	2015	80	2.40	33.34	-71.64	-38.30	0.93	16.28	-67.51	0.95
	2016	80	2.42	33.02	62.52	95.54	0.65	18.50	52.19	0.76
	2017	100	3.51	28.46	33.6	62.06	0.2	18.98	25.76	0.46
	2018	70	5.89	11.88	1.2	13.08	-0.26	14.55	12.47	0.15
Oando	2012	239	15.65	15.28	-56.64	-41.36	0.36	17.20	-24.97	0.57
	2013	30	13.40	2.24	24.12	26.36	-0.14	13.34	15.88	0.23
	2014	0	22.29	0.00	29.76	29.76	0.81	15.99	28.00	0.87
	2015	0	13.38	0.00	-116.4	-116.40	1.05	16.28	-120.84	1.03
	2016	25	4.95	5.05	-37.56	-32.51	0.25	18.50	-9.38	0.49
	2017	100	6.03	16.60	42.12	58.72	0.82	18.98	39.32	0.87
	2018	150	6.06	24.74	-24	0.74	-0.96	14.55	26.62	-0.31
Total	2012	1100	140.32	7.84	-51.48	-43.64	0.01	17.20	-5.92	0.33
	2013	1100	154.21	7.13	34.68	41.81	-0.82	13.34	8.65	-0.21
	2014	1100	170.12	6.47	-1.92	4.55	-0.18	15.99	12.23	0.20
	2015	1400	154.95	9.04	-9.72	-0.68	0.63	16.28	-3.27	0.75
	2016	1700	201.79	8.42	60	68.42	-0.21	18.50	26.35	0.18
	2017	1700	260.51	6.53	-9.48	-2.95	0.16	18.98	6.53	0.43
	2018	1700	209.12	8.13	-19.08	-10.95	-0.13	14.55	6.38	0.24
Forte Oil	2012	115	10.31	11.15	-39.6	-28.45	1.2	17.20	-47.21	1.13
	2013	396	32.90	12.04	285	297.04	-2.71	13.34	-390.26	-1.48
	2014	250	152.35	1.64	53.76	55.40	2.49	15.99	91.46	1.99

	2015	250	207.91	1.20	35.88	37.08	0.05	16.28	23.40	0.36
	2016	250	210.03	1.19	-143.88	-142.69	-1.39	18.50	116.13	-0.60
	2017	0	52.22	0.00	-21	-21.00	-0.27	18.98	13.01	0.14
	2018	0	32.80	0.00	-89.4	-89.40	-0.19	14.55	-6.52	0.20
Japaul	2012	19	0.66	28.64	-61.44	-32.80	0.07	17.20	-12.43	0.37
	2013	30	0.58	51.72	-9.48	42.24	-0.03	13.34	6.26	0.30
	2014	0	0.52	0.00	0	0.00	0.08	15.99	9.85	0.38
	2015	0	0.5	0.00	0	0.00	0	16.28	10.90	0.33
	2016	0	0.5	0.00	0	0.00	0	18.50	12.39	0.33
	2017	0	0.5	0.00	0	0.00	0	18.98	12.71	0.33
	2018	0	0.36	0.00	-88.2	-88.20	-0.04	14.55	-16.60	0.30
MRS	2012	70	31.80	2.20	-66.24	-64.04	-1.06	17.20	48.92	-0.38
	2013	23	24.88	0.92	63.84	64.76	-1.02	13.34	-4.50	-0.35
	2014	75	54.83	1.37	39	40.37	0.25	15.99	27.43	0.49
	2015	88	47.88	1.84	-12	-10.16	0.1	16.28	5.05	0.39
	2016	110	41.21	2.67	-8.64	-5.97	-0.42	18.50	17.18	0.04
	2017	173	34.58	5.00	-45.96	-40.96	0.25	18.98	-13.32	0.49
	2018	0	28.75	0.00	5.4	5.40	0.33	14.55	9.50	0.55

Source: Nigeria Stock Exchange Market

Appendix 5: Chow's Test

CHOW'S TEST

Test for Equality of Means Between Series
Date: 02/12/20 Time: 15:51
Sample: 2000 2055
Included observations: 56

Method	df	Value	Probability
Wald Statistic	110	0.016530	0.9918
t-test	110	0.356240	0.7223
Satterthwaite-Welch t-test*	109.9662	0.356240	0.7223
Anova F-test	(1, 110)	0.126907	0.7223

Appendix 6. Stock Valuation Status using CAPM

FIRMS	YEAR	R_m	R_f	R_m-R_f	B	ER	AR	AR-ER	Valuation Status
11 Mobil	2012	-9.12	17.20	-26.32	-0.69	20.68	-4.92	-25.60	Undervalued
	2013	8.28	13.34	-5.06	0.08	11.40	13.39	1.99	Overvalued
	2014	35.52	15.99	19.53	0.02	22.70	40.18	17.49	Overvalued
	2015	-22.56	16.28	-38.84	0.23	-2.52	-17.75	-15.23	Undervalued
	2016	77.4	18.50	58.9	-0.34	24.52	82.06	57.54	Overvalued
	2017	-55.32	18.98	-74.3	-0.44	16.36	-51.98	-68.34	Undervalued
	2018	9.6	14.55	-4.95	0.66	10.73	14.00	3.27	Overvalued
Conoil	2012	34.08	17.20	16.88	-1.79	2.53	38.78	36.25	Overvalued
	2013	116.64	13.34	103.3	-0.61	5.21	131.07	125.86	Overvalued
	2014	3.36	15.99	-12.63	1.98	-4.93	5.25	10.18	Overvalued
	2015	-57.12	16.28	-73.4	0.94	-54.17	-48.29	5.88	Overvalued
	2016	22.08	18.50	3.58	-0.4	18.72	34.97	16.25	Overvalued
	2017	-18.12	18.98	-37.1	0.79	-12.90	-12.00	0.90	Overvalued
	2018	-18.12	14.55	-32.67	0.26	-1.92	-11.15	-9.23	Undervalued
Eterna	2012	-71.4	17.20	-88.6	0.18	-22.72	-52.54	-29.81	Undervalued
	2013	116.64	13.34	103.3	1.93	181.01	129.02	-51.99	Undervalued
	2014	-21.24	15.99	-37.23	-0.44	14.68	-0.61	-15.29	Undervalued
	2015	-71.64	16.28	-87.92	0.93	-67.52	-38.30	29.22	Overvalued
	2016	62.52	18.50	44.02	0.65	52.20	95.54	43.35	Overvalued
	2017	33.6	18.98	14.62	0.2	25.76	62.06	36.30	Overvalued

	2018	1.2	14.55	-13.35	-0.26	12.47	13.08	0.61	Overvalued
Oando	2012	-56.64	17.20	-73.84	0.36	-24.98	-41.36	-16.39	Undervalued
	2013	24.12	13.34	10.78	-0.14	15.89	26.36	10.47	Overvalued
	2014	29.76	15.99	13.77	0.81	28.01	29.76	1.75	Overvalued
	2015	-116.4	16.28	-132.68	1.05	-120.84	-116.40	4.44	Overvalued
	2016	-37.56	18.50	-56.06	0.25	-9.39	-32.51	-23.12	Undervalued
	2017	42.12	18.98	23.14	0.82	39.33	58.72	19.39	Overvalued
	2018	-24	14.55	-38.55	-0.96	26.62	0.74	-25.88	Undervalued
Total	2012	-51.48	17.20	-68.68	0.01	-5.92	-43.64	-37.72	Undervalued
	2013	34.68	13.34	21.34	-0.82	8.66	41.81	33.15	Overvalued
	2014	-1.92	15.99	-17.91	-0.18	12.24	4.55	-7.69	Undervalued
	2015	-9.72	16.28	-26	0.63	-3.27	-0.68	2.59	Overvalued
	2016	60	18.50	41.5	-0.21	26.36	68.42	42.07	Overvalued
	2017	-9.48	18.98	-28.46	0.16	6.54	-2.95	-9.49	Undervalued
	2018	-19.08	14.55	-33.63	-0.13	6.38	-10.95	-17.33	Undervalued
Forte Oil	2012	-39.6	17.20	-56.8	1.2	-47.21	-28.45	18.77	Overvalued
	2013	285	13.34	271.66	-2.71	-390.27	297.04	687.30	Overvalued
	2014	53.76	15.99	37.77	2.49	91.47	55.40	-36.06	Undervalued
	2015	35.88	16.28	19.6	0.05	23.40	37.08	13.68	Overvalued
	2016	-143.88	18.50	-162.38	-1.39	116.14	-142.69	-258.83	Undervalued
	2017	-21	18.98	-39.98	-0.27	13.02	-21.00	-34.02	Undervalued

	2018	-89.4	14.55	-103.95	-0.19	-6.52	-89.40	-82.88	Undervalued
Japaul	2012	-61.44	17.20	-78.64	0.07	-12.44	-32.80	-20.36	Undervalued
	2013	-9.48	13.34	-22.82	-0.03	6.27	42.24	35.98	Overvalued
	2014	0	15.99	-15.99	0.08	9.86	0.00	-9.86	Undervalued
	2015	0	16.28	-16.28	0	10.91	0.00	-10.91	Undervalued
	2016	0	18.50	-18.5	0	12.40	0.00	-12.40	Undervalued
	2017	0	18.98	-18.98	0	12.72	0.00	-12.72	Undervalued
	2018	-88.2	14.55	-102.75	-0.04	-16.60	-88.20	-71.60	Undervalued
MRS	2012	-66.24	17.20	-83.44	-1.06	48.92	-64.04	-112.96	Undervalued
	2013	63.84	13.34	50.5	-1.02	-4.51	64.76	69.27	Overvalued
	2014	39	15.99	23.01	0.25	27.44	40.37	12.93	Overvalued
	2015	-12	16.28	-28.28	0.1	5.05	-10.16	-15.21	Undervalued
	2016	-8.64	18.50	-27.14	-0.42	17.18	-5.97	-23.15	Undervalued
	2017	-45.96	18.98	-64.94	0.25	-13.33	-40.96	-27.63	Undervalued
	2018	5.4	14.55	-9.15	0.33	9.51	5.40	-4.11	Undervalued

Researcher's Computation (2020).

Appendix 7: Descriptive Statistics

```
     1.  (/v# option or -set maxvar-) 5000 maximum variables
. edit
. *(6 variables, 56 observations pasted into data editor)
. summarize er ar rm adjbeta
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
```

er	56	3.058672	67.17855	-390.2653	181.0062
ar	56	7.542195	66.01084	-142.6897	297.0377
rm	56	-1.112143	64.60938	-143.88	285
adjbeta	56	.368525	.5717481	-1.4857	1.9983

Appendix 8: Correlation Matrix

```
pwcorr er ar rm adjbeta
```

	er	ar	rm	adjbeta
er	1.0000			
ar	-0.2631	1.0000		
rm	-0.2591	0.9875	1.0000	
adjbeta	0.3441	-0.1790	-0.1877	1.0000

Appendix 9: Pooled Regression

```
     1.  (/v# option or -set maxvar-) 5000 maximum variables
. edit
. *(6 variables, 56 observations pasted into data editor)
. regress loger logmr logb
```

Source	SS	df	MS		
				Number of obs	= 56
				F(2, 53)	= 46.64
Model	.016451183	2	.008225592	Prob > F	= 0.0000
Residual	.009347802	53	.000176374	R-squared	= 0.6377
				Adj R-squared	= 0.6240
Total	.025798986	55	.000469072	Root MSE	= .01328

loger	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logmr	.0446277	.0067214	6.64	0.000	.0311463	.0581091
logb	-.1419269	.0176646	-8.03	0.000	-.1773577	-.1064961
_cons	5.927844	.0352555	168.14	0.000	5.85713	5.998558

Appendix 10: Random Effect Regression

Random-effects GLS regression — Number of obs = 56

Group variable: id — Number of groups = 8

R-sq: within = 0.0000 — Obs per group: min = 7

between = 0.0000 — avg = 7.0

overall = 0.6377 — max = 7

Wald chi2(2) = 93.27

corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

loger	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
logmr	.0446277	.0067214	6.64	0.000	.0314541	.0578014
logb	-.1419269	.0176646	-8.03	0.000	-.1765489	-.1073048
_cons	5.927844	.0352555	168.14	0.000	5.858745	5.996944
sigma_u	0					
sigma_e	.01425528					
rho	0	(fraction of variance due to u_i)				

Appendix 11: Fixed Effect Regression

```
. estimates store re
. xtreg loger logmr logb, fe
Fixed-effects (within) regression               Number of obs      =        56
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.6377                         Obs per group: min =         7
       between =      .                                       avg =       7.0
       overall = 0.6377                                       max =         7

                                                F(2,46)            =     40.48
corr(u_i, Xb)  =      .                         Prob > F           =    0.0000

------------------------------------------------------------------------------
       loger |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       logmr |   .0446277   .0072147     6.19   0.000     .0301053    .0591501
        logb |  -.1419269   .0189611    -7.49   0.000    -.1800936   -.1037602
       _cons |   5.927844    .037843   156.64   0.000      5.85167    6.004018
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  .01425528
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(7, 46) =     0.00                 Prob > F = 1.0000
```

Appendix 12: Diagnostic Test

Appendix 12a: Variance Inflation Factor

```
. vif
    Variable |       VIF       1/VIF
-------------+----------------------
        logb |      1.03    0.971452
       logmr |      1.03    0.971452
-------------+----------------------
    Mean VIF |      1.03
```

Appendix 12b:Heteroskedasticity Test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of loger
         chi2(1)      =    2.68
         Prob > chi2  =   0.6924
```

Appendix 12c:Ramsey Test

```
. estat ovtest
Ramsey RESET test using powers of the fitted values of loger
       Ho:  model has no omitted variables
                  F(3, 50) =      3.56
                  Prob > F =      0.5401

. xtset id year, yearly
       panel variable:  id (strongly balanced)
```

time variable: year, 2012 to 2018

delta: 1 year

Appendix 12d: Lagrangian Test

```
. estimates store re

. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        loger[id,t] = Xb + u[id] + e[id,t]

        Estimated results:

                     |       Var     sd = sqrt(Var)
             ---------+-----------------------------
                loger |   .0004691       .0216581
                    e |   .0002032       .0142553
                    u |          0              0

         Test:   Var(u) = 0

             chibar2(01) =     0.71

             Prob > chibar2 =  0.0000

. reusch and Pagan Lagrangian multiplier test for random effects

        logar[id,t] = Xb + u[id] + e[id,t]

        Estimated results:

                     |       Var     sd = sqrt(Var)
             ---------+-----------------------------
                logar |   .0715225       .2674369
                    e |   8.09e-06       .0028449
                    u |          0              0

         Test:   Var(u) = 0

                         chibar2(01) =    21.0821

                         Prob > chibar2 =   .0006
```