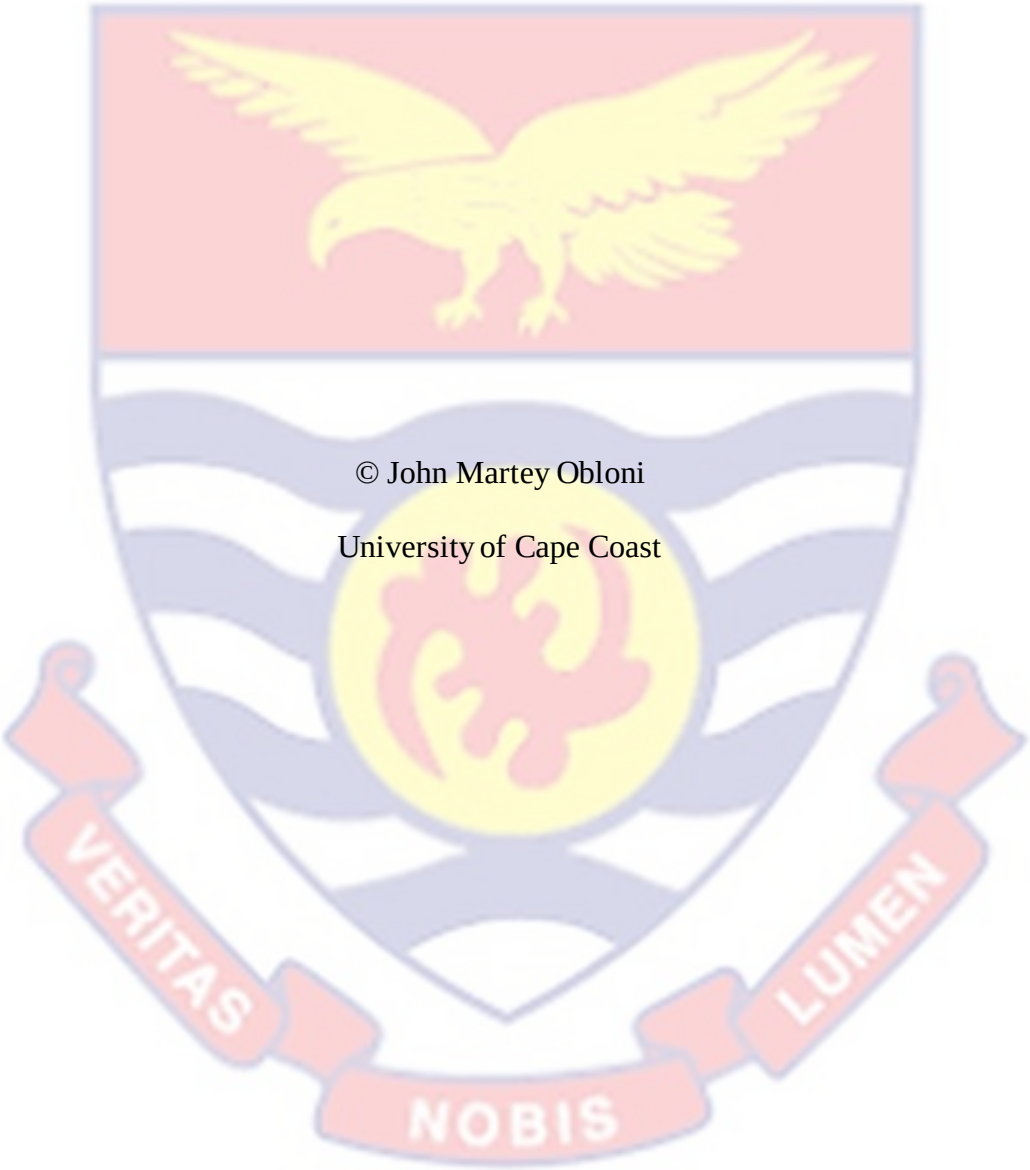
UNIVERSITY OF CAPE COAST

DOWNSTREAM PETROLEUM PRICES AND STOCK MARKET RETURNS IN GHANA: PRE AND POST DEREGULATION ANALYSIS

JOHN MARTEY OBLONI

2022



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DOWNSTREAM PETROLEUM PRICES AND STOCK MARKET RETURNS IN GHANA: PRE AND POST DEREGULATION ANALYSIS

BY

JOHN MARTEY OBLONI

Thesis submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Commerce Degree in Finance.

AUGUST 2022

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:..... Date:.....

Name: John Martey Obloni

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature:…… Date:……

Name: Prof. John Gartchie Gatsi

ABSTRACT

The thesis analysed the impact of downstream petroleum prices on stock returns in Ghana with respect to downstream petroleum sector deregulation. After a Chow test, the monthly data employed was split into the pre-(09/2009 to 05/2015) and post-deregulation (06/2015 to 02/2021). The Auto-Regressive Distributed Lag estimator was used in establishing the long- and short-run relationship between the variables while controlling for exchange rate, lending rate, treasury bill rate, economic activity, and inflation. The findings indicated a cointegrating relationship among the variables. Further, for the pre-deregulation period, at the 5 percent significance level, it was found that downstream petroleum prices had a negative effect on stock returns in the long run, while there was insignificant relationship in the short run. However, in the post-deregulation era, at the 5 percent significance level, petroleum prices had an insignificant relationship with stock returns in both the long- and short-run dynamics. It was concluded that the deregulation did not have any adverse effect on investors' returns. Listed firms, perhaps, may have ignored the shocks from downstream petroleum prices in the pre-deregulated era but diverted the shocks from influencing returns on investment in the post-deregulated period. In light of the findings, it is recommended that the government develops policies that stabilise the macroeconomic environment to stimulate stock performance on the Ghana Stock Exchange. Furthermore, it is recommended that policymakers review policies affecting fuel prices, exchange rates, treasury bill rates, lending rates, economic activity, and inflation that promoted stock market returns which were implemented before the deregulation. Finally, investors, firms, and financial experts are recommended to take into cognisance the downstream petroleum pricing policies of the economy to accurately analyse and price assets.

KEY WORDS

Deregulation

Downstream petroleum sector

Fuel subsidies

Ghana

Petroleum prices

Stock returns

Subsidy removal

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DEDICATION

To the Obloni family

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
APT	Arbitrage Pricing Theory
ARDL	Autoregressive Distributed Lag
BDC	Bulk Distribution Companies
EA	Economic Activity
EXR	Exchange Rate
GoG	Government of Ghana
GSE	Ghana Stock Exchange
LR	Lending Rate
NF	Inflation
NPA	National Petroleum Authority
PP	Petroleum Prices
SR	Stock Returns
TBR	Treasury Bill Rate

CHAPTER ONE

INTRODUCTION

The economy of Ghana has increasingly been dependent on the consumption of imported petroleum products. This especially, exposes the economy's productive sectors to the price volatilities from the international crude oil market. The Government of Ghana's (GoG) quest to deal with this exposure led to the subsidisation of the prices of downstream petroleum products till June 2015. However, subsidisation not being sustainable, resulted in the deregulation policy. The deregulation policy entailed a full cost pass-through to the downstream petroleum sector from the international crude oil market. Fluctuations in petroleum prices affect the economy's productive sectors, highlighting the possible implications on Ghana's stock returns (Zankawah & Stewart, 2020; Addae & Ackah, 2017; Long & Linag, 2018). Therefore, this empirical investigation analyses the implication of downstream petroleum prices on stock market returns with respect to the deregulation policy in Ghana.

Background of the study

Petroleum products have an instrumental role in supporting the operations of the Ghanaian economy's productive sectors. As a net importer of petroleum products, fluctuations in the prices from the international crude oil market have implications for Ghana, especially the economy's productive sectors (Zankawah & Stewart, 2020). According to the dividend discounting model, unfavourable prices of petroleum products affect firms' production costs, consequently altering profit margins and eventually influencing firms' stock prices.

The implications of the volatilities in petroleum prices on stock returns have been prominent in literature (Zankawah & Stewart, 2020; Tetteh, Adenutsi & Amoah, 2019; Zhu, Li, & Yu, 2012 and 2011). Hu *et al.* (2018) opined that the prevailing economic conditions and policies in the downstream petroleum sector of most economies suggest the exclusivity of the implications of petroleum prices volatilities on an economy. In retrospection, through the National Petroleum Authority (NPA), GoG implemented the deregulation policy in June 2015. The purpose is to ensure full passthrough of petroleum products' costs from the international crude oil markets to domestic consumers. Prior to the deregulation policy in 2015, the government subsidised fuel prices, which suggested that fuel subsidies acted as a shield to limit the possible adversities of international crude oil price volatilities on the productive sectors.

Nonetheless, economic efficiency considerations suggest that domestic petroleum prices are fully deregulated and pegged with world oil prices. This is because regulating (fixing) and subsidising the prices of downstream petroleum products is not sustainable for an economy. Price regulation and subsidy also deprive the government of finances from meeting competing productive public spending. Consequently, the deregulation reform relieved the government from the recurrent petroleum subsidies payments. It allows the downstream petroleum industry players to ensure the passthrough of the6 total cost of petroleum products' imports to consumers. The deregulation policy was also instituted in light of fuel consumption subsidies in Ghana amounting to US$ 276 million in

2011, GoG spending US$ 85 million on fuel subsidies in the mid of 2014, and the continuous depreciation of the Ghana Cedi.

Subsidising petroleum products consumption warranted the government to fix and regulate the retail prices of the products. The government subsidised the differences in the retail prices and the full passthrough cost of petroleum products. However, the quantum of subsidies was increasing (averagely GHC 300 million per year), which posed threats to fiscal sustainability in terms of spending on productive ventures like infrastructure (Consumer Unity and Trust Society [CUTS], 2015).

The downstream petroleum price deregulation of Ghana has liberalised oil marketers to adjust their prices in response to the domestic market demand and international oil market supply. This ensures full passthrough of petroleum products' cost to consumers, with NPA using an agreed pricing template. This initiative with NPA was expected to promote healthy competition that leads to lower petroleum product prices for Ghanaians and improvements in efficiency in the downstream industry (CUTS, 2015). Consequently, there have been variabilities in ex-pump fuel prices before the deregulation, unlike after the policy. Figure 1 describes the monthly average of ex-pump fuel prices (downstream petroleum prices) from 2009 to 2021.

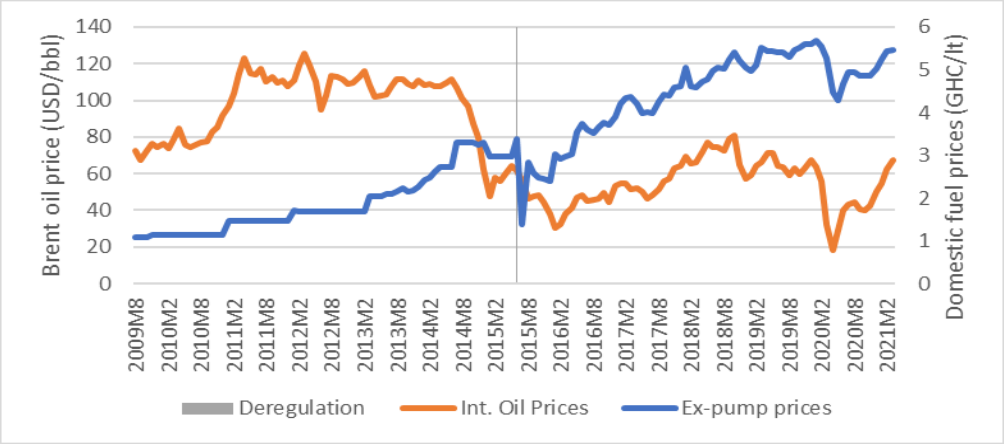

Figure 1: Monthly trend of average petroleum prices
Source: Field data (2021)

Figure 1 indicates that average ex-pump petroleum prices in Ghana have generally been on the rise for the past decade, even after the deregulation. However, the trend for the pre- and post-deregulation era has not been in tandem with the world's crude oil pricing trend. Prices of petroleum products were relatively stable for the major parts of the pre-deregulation era, unlike the deregulated era, where there have been fluctuations in prices.

Zankawah and Stewart (2020) opined that fluxes in petroleum product prices have severe implications on an economy. The supply of petroleum products is a paramount source of input for oil-consuming firms in the economy. Therefore, the price fluctuations have the potency to affect stock returns of listed entities in the productive sectors. Saidi, Adam, Rahim, and Rosnawintang (2019) discussed that changes in petroleum prices drive inflation, affecting firms' cost of production, thereby affecting firms' profit maximization. In response, through monetary policies, the central government raises interest rates to control inflation (Benada, 2014). However, this causes higher borrowing costs for firms in the

domestic economy and, consequently leads to a potential devaluation of the Ghana cedi. All things being equal, the depreciation of the cedi will then affect firms that rely on foreign inputs.

Investors are drawn to the wealth maximisation of their assets or stocks in light of varied economic conditions. The performance of firms increases shareholders' value and the share price due to the high demand for profitable shares (Gatsi, Appiah, & Wesseh, 2016; Gatsi, 2011). Thus, the discounted cash flow approach of equity valuation suggests that shocks from downstream petroleum prices affect the expected cash flows of a firm, thereby impacting the returns on investment. The Ghana Stock Exchange (GSE) composite index reflects stocks of listed companies in Ghana, and has shown fluctuations in asset returns over time, as demonstrated in Figure 2.

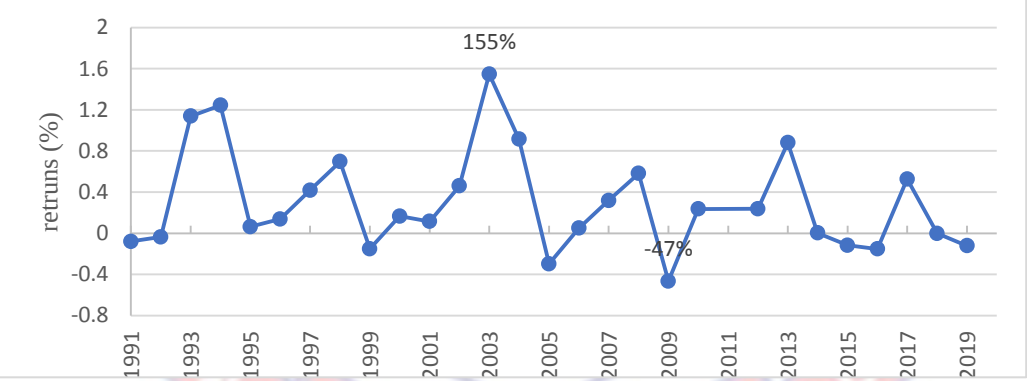

Figure 2: Yearly trend of the GSE returns (1991-2019)
Source: Field data (2021)

The historical highest performance of the GSE occurred in 2003. Scholars claim it was a result of the smooth transfer of power in 2001 after several overthrows of governments within short periods of governance (Aliyu, 2012). Thus, the smooth transfer occasioned by lasting periods of political stability

attracted investors to invest in Ghana's Stock Market. Again, the GSE recorded its historical losses of 47% in 2009. Some scholars are of the view that the low performance was attributable to the rippling impact of the worldwide financial crisis (Zankawah, 2018).

Furthermore, Ghana's stock market, in terms of market capitalisation, is dominated by the mining sector, followed by the finance, information communication and technology (ICT), distribution, and the manufacturing sectors (GSE December market report, 2015; 2020).

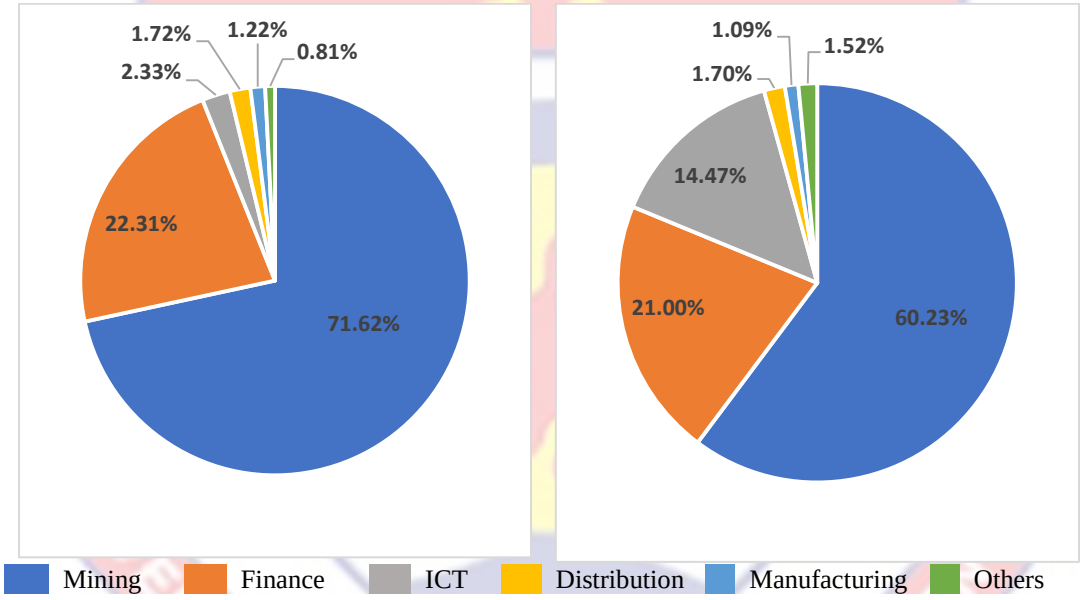

Figure 3: GSE Market Capitalisation (GH ¢ mm), 2015 and 2020 respectively
Source: Field data (2021)

Thus, petroleum products' pricing dynamics may affect the returns of the mining, distribution, and manufacturing sectors due to their heavy reliance on petroleum products for production. The finance and ICT sectors may also be affected by rising costs in their operations.

Consequently, this research investigates the effect of downstream petroleum product prices on stock market returns in Ghana, considering the pre- and post-deregulation era.

Statement of the problem

The Government of Ghana removed subsidies and price controls from the downstream petroleum sector to ensure fiscal sustainability in its public expenditure. Thus, the shocks in prices from the international crude oil market were formerly cushioned by the government from influencing the domestic prices of petroleum products through subsidies. However, though there was the expectation that the deregulation would lower petroleum products prices in light of healthy competition (CUTS, 2015), the prices have still been rising relative to crude oil prices, as seen in Figure 1.

Listed companies comprise manufacturing and mining companies that heavily rely on petroleum products in their operations. Price surges of petroleum products can affect the cost of operations of these firms in the short term (Nyarko, 2018), and alter their profitability and asset returns in the long term (Tetteh *et al.*, 2019). Thus, the discounted cash flow model suggests that shocks from downstream petroleum prices affect the expected cash flows of a firm, thereby eventually impacting the returns on investment in the long term. There have also been two pricing eras in the downstream petroleum sector that may have affected aspects of the economy, especially returns on investment in different manners.

Further, there is an abundance in the literature of research, for instance, Hu *et al.* (2018), Zhu *et al.* (2012), and others, establishing the link between

international crude oil prices and stock returns in various economies. There have also been studies, for instance, Zankawah and Stewart (2020), Tetteh *et al.* (2019), and others, in Ghana focusing on the international crude oil prices and stock returns relationship. Nevertheless, the impact of ex-pump prices on stock returns in Ghana has been understudied in literature (for instance: Andoh, 2019; Nyarko, 2018). Further, there seems to be no study that addresses the impact of prices of downstream petroleum products on stock returns with respect to the deregulation policy in Ghana. Therefore, this study fills this empirical gap in the literature by investigating the effect of prices of downstream petroleum products on stock returns considering the deregulation policy in Ghana.

Moreover, studies by the likes of Andoh (2019) and Nyarko (2018) seem not to have measured downstream petroleum prices adequately in other to establish its effect on stock market returns. These studies proxy downstream petroleum prices with either petrol or diesel prices, which is not adequate. Proxying downstream petroleum prices with a single product's price underestimate the impact of downstream petroleum prices on stock returns, as listed firms do not consume a single line of a petroleum product. Thus, the consumption of petroleum products differs across sectors and firms on the GSE.

According to NPA (2021), the downstream petroleum products' consumption over the years centres on diesel (majorly consumed by the industrial sector), petrol (transport sector), and liquefied petroleum gas (LPG) (domestic sector and some industries). To fill this gap, this study, therefore, employs a weighted average of diesel, petrol, and LPG prices.

This study adds to knowledge because the extant studies have attested to the disparities that surmount in the literature regarding the asset returns and petroleum prices nexus (Hu *et al.*, 2018; Zhu *et al.*, 2012). Thus, concentrating on the downstream petroleum and stock returns with respect to the deregulation policy adds to empirical knowledge in such area. Nonetheless, the relationship between the variables is contingent on the prevailing economic conditions, like deregulation policies which is exclusive to other countries (Hu *et al.*, 2018).

Purpose of the study

The main purpose of the research is to ascertain the impact of downstream petroleum products prices on stock market returns in Ghana, considering the pre- and post-deregulation era.

Research objectives

Specifically, the objectives of the study are;

1. to evaluate the long-run effect of downstream petroleum prices on stock market returns before the deregulation in Ghana
2. to determine the short-run effect of downstream petroleum prices on stock market returns before the deregulation in Ghana.
3. to assess the long-run effect of downstream petroleum prices on stock market returns after the deregulation in Ghana.
4. to investigate the short-run effect of downstream petroleum prices on stock market returns after the deregulation in Ghana.

Research Hypotheses

1. Ho - There is no significant long-run effect of downstream petroleum prices on stock market returns before the deregulation in Ghana.
2. Ho - There is no significant short-run effect of downstream petroleum prices on stock market returns before the deregulation in Ghana.
3. Ho - There is no significant long-run effect of downstream petroleum prices on stock market returns after the deregulation in Ghana.
4. Ho - There is no significant short-run effect of downstream petroleum prices on stock market returns after the deregulation in Ghana.

Significance of the Study

The research revealed the utmost importance to the Government of Ghana, investors, firms, and the repository of academic research.

This study would help the Government of Ghana formulate policy frameworks toward businesses' sustainability, expansion, and profitability while ensuring that there is a full passthrough of international oil price changes to domestic consumers. The research applied variables of interest and other relevant macroeconomic variables in its analysis. Consequently, appropriate macroeconomic policies could be made.

Investors and firms can use the outcome of this empirical investigation to appeal to the government for an enabling economic environment to maximize national wealth. Since this research examines the relationships among the variables, investors and firms can rely on it to detect potential opportunities and challenges emanating from the prevailing economic conditions.

Delimitations

The study is limited to Ghana's economy as the variables employed pertain to the economy. The study utilised stock returns from stock indexes on the GSE, and as such, the findings were only true for the listed companies. Monthly data spanning September 2009 to February 2021 was analysed. The scope of this empirical work is again restricted to the variables and econometric techniques that were employed. This study assumed that Ghana's downstream petroleum had been fully deregulated since June 2015.

Limitations

There are wide varieties of petroleum products in Ghana. Using weighted average monthly prices of petrol (gasoline), diesel (gasoil), and liquefied petroleum gas (LPG) as the proxy for petroleum products prices makes the measurement not comprehensive. Further, the weights on the prices of diesel, petrol, and LPG are static and does not capture the varied monthly consumption patterns of the products. However, it provides an average to work with.

Definition of Terms

- **Downstream petroleum deregulation policy:** The downstream petroleum deregulation policy was a policy that the Government of Ghana passed to remove subsidies and price controls to deregulate petroleum prices in the downstream petroleum sector. This was effective from 6th June 2015.

- **Downstream petroleum prices:** Downstream petroleum prices refer to the ex-pump prices of imported petroleum products at the downstream petroleum market.

- **Stock returns** are the profit or loss arising from the trade of stocks on the GSE.

- **International crude oil prices:** These are international prices for crude oil on the international market. Most studies proxy prices of petroleum products with international crude oil prices.

Organisation of the study

The research is into five structured chapters. Each Chapter encompassed the following, in order of their presentation in the write-up: Chapter one captured the background, statement of the problem, the purpose, research hypotheses, significance, delimitations, limitations, definition of terms, and organisation of the study. The following chapter emphasised the study's literature review covering the study's theoretical, conceptual, and empirical bases. The third chapter three touched on the research methodology, highlighting the adopted research design, data sources, and data processing and analysis. The following chapter presented the findings that emerged, which attracted discussions. The last chapter put forward the summary of the research, including the findings, and based on that conclusion, and recommendations were made.

Chapter summary

This chapter introduces the topic under investigation. The background of the study covered the issues worthy to analyse the impact of downstream petroleum prices on stock market returns with respect to the deregulation policy in Ghana. The statement of the problem also presented a clear case for the conduct of this research. The significance, delimitation, limitations, and the structure of the research work were presented in this introductory part.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This research analyses the impact of downstream petroleum product prices on stock market returns before and subsequent to the downstream petroleum deregulation in Ghana. The theoretical underpinnings and conceptual basis of this empirical work is provided in this part. Related literature was also reviewed to support the empirical base of the research. The literature review indicates how scholars have contributed to the knowledge of the nexus of petroleum prices and asset returns and gaps in the body of knowledge that this research explores.

Theoretical review

The research was underpinned by the Arbitrage pricing theory, price theory, theory of economic regulation, and discounted cashflow model.

Arbitrage Pricing Theory (APT)

Markowitz (1952) laid the foundations for modern portfolio management. Sharpe (1964) and Linter (1965) subsequently contributed towards the invention of the Capital Asset Pricing Model (CAPM). The model provides an estimate for the link between the risks and expected return of a financial asset. Bodie, Kane, and Marcus (2010) referred to the CAPM as a single-index or single-factor model because the market index is applied as a representation of risks that may affect a portfolio's returns. Thus, the market portfolio's return summarises the broad impact of risk elements from the macroeconomic environment. Contrarily, the

APT by Ross (1976) ignores the use of a market proxy and focuses directly on the unique sources of risks that may affect the returns of an asset. APT is useful for quantifying the different factors that are likely to influence returns on asset over time.

Ross (1976) suggested that firm-specific risks and multiple factors of systemic risks determine returns on financial assets. The main thrust of this theory is consideration for remote risks and indicators of stock returns. The APT rests on three key propositions. First, the returns on an asset can be determined by a factor model. Second, there are various assets to diversify away firm-specific risks, and finally, arbitrage opportunities are not persistent in a well-functioning financial market (Bodie *et al.*, 2010). The APT considers several factors motivated by the macroeconomic environment (such as, variations in oil prices, interest, and exchange rates), which may influence stock returns. This theory accounts for the various systematic components of the risk of securities to improve the APT model's explanatory power. However, the major demerit is that, APT provides no basis for determining essential risk elements that have potencies to alter the securities' returns.

The potency of the theory capturing the multiple risk factors of the macroeconomic effects of the fluctuations in downstream petroleum prices on stock returns, makes it appealing. The theory suggests that investors are keen on diversifying their portfolios, but will choose their profile of risk factors to assess risks associated with their returns considering the premiums and sensitivity of the macroeconomic risk factors (Kremer, Talmaciu & Paterlini, 2018). Thus,

investors would find it disincentive to invest when prices of petroleum products negatively affect stock returns during the deregulation era where prices of petroleum products are unstable. The APT offers investors a model for estimating stocks' theoretical fair market value (Uddin & Yu, 2020). Thus, the APT functions with a model that considers multiple or various sources of risks.

Therefore, fluctuations in downstream petroleum product prices are systematic risks that firms cannot diversify. Thus, in the post-deregulation era, where there are frequent changes in the prices of petroleum products, downstream petroleum prices become a risk that firms cannot choose to ignore. Phong, Van, and Bao (2019) stated that APT theory assumes a linear regression between stock returns and the broad elements of the macroeconomy. Consequently, assuming linearity in the link between stock market returns and downstream petroleum prices, the APT was employed.

Theory of Economic Regulation

This theory emanated from the works of Stigler (1971), and contributions to the theory were articulated by Petzman (1976, 1989) and Becker (1983, 1985). The central theme of the theory assumes that the government regulates industries for some benefit. The theory of economic regulation suggests that, through economic regulations, subsidies can be granted by the government, and restrictions can be placed on the entry or exit of firms in an industry (Hertog, 2010). The theory further posits that prices in an industry can be controlled, and the government can prevent collisions in industries. Inferences from the public interest approach to economic regulation suggest that economic regulation of

economic actors, like firms, promotes the public interest. Such promotion is observed as the finest possible distribution of scarce resources for welfare maximization of the society.

Hertog (2010) stated that public interest approach assumes market failures make regulation economically inevitable, and deregulation occurs with the development of more efficient institutions. Bello (2019) emphasized that deregulation is borne out of regulation, and they are intricately intertwined. Thus, there is no deregulation without a prior regulation. Evolving literature suggests that the importance of economic deregulation is realized when the market promotes equality in the distribution of income as a result of less government regulation (Cooke, Hague, Tiberti, Cockburn, & Lahga, 2016).

Economic deregulation increases the welfare of individuals and collective groups when there is a market failure (Korinek & Kreamer, 2013). According to the Progressive School of thought, allocating a scarce resource should be progressive, benefit the poor rather than the rich (Coady *et al.*, 2010). Thus, making economic deregulation useful in scarce resource allocation. Hertog (2010) argued that deregulation is employed when intuition exists with foreseen and unforeseen implications about economic regulations.

The theory explains the decision of the Government of Ghana to regulate the petroleum product prices before 2015, premised on the notion of promoting the social interest. The objective, then, was to ensure that petroleum products were affordable to the public. The regulation of fuel prices brought about price controls, which resulted in subsidising payments to suppliers. However, extant

studies suggest that subsidising petroleum products is regressive. Subsidies, according to the Progressive School of thought, benefit the rich more than the poor (Cooke *et al.*, 2016; Coady *et al.*, 2010). Furthermore, subsidising fuel prices was not sustainable and resulted in debts. The institution of deregulation was found to be economically efficient. Thus, emphasises that the retail prices of petroleum products are deregulated (Olujobi, 2021).

Price Theory

The Price theory stipulates that, price of a product emerges from the fundamentals of demand and supply of the product (Maduka, Ihorne, & Anochiwa, 2015). The price theory suggests that the optimal market price for a said product is where the marginal benefit gained by consumers who demand the product equates to the marginal costs of the seller (Baye & Prince, 2014). Thus, in the hypothetical perfectly competitive market structure, price equals marginal costs to ensure the efficient allocation of resources. All things being equal, any adjustments in marginal costs result in adjustments to the product's price.

Price reacts instantly when there are cost adjustments, otherwise, there would be losses or no profit realisation (Baye & Prince, 2014). Therefore, sellers that do not immediately increase prices will incur losses in times of increases in costs. On the other hand, in times of cost reductions, sellers who do not immediately reduce their prices will not make sales. Consequently, the theory of price postulates that, in both situations indicated above, sellers are obligated to alter prices instantly to new cost conditions as defined by their profit-maximising behaviour or motive in a competitive market (Chou & Tseng, 2015).

The implication of the Price theory is that, the deregulation policy has allowed OMCs to determine their prices for their products with the forces of demand and supply. Thus, one key concept underpinning the price theory is the absence of restrictions to price adjustments as market conditions change (Xiao, Zhou & Wen, 2018). Therefore, OMCs transmit any shocks from the international to downstream domestic petroleum market in the post-deregulation era. This is unlike the pre-deregulation era, where the government, through subsidies, shields price shocks from the international oil market to the downstream petroleum sector.

All other things being equal, the changes in downstream petroleum prices in the pre-deregulation era had minimal impact on stock returns. In other words, firms may not respond to changes in downstream petroleum prices during the pre-regulation era since prices were kept stable by the government. In the deregulated era, since prices reflect sudden and frequent shocks from the international oil market, sellers may likely be responsive to shocks in the downstream petroleum prices.

Discounted Cash Flow Model

This stock valuation model indicates that a financial asset's value is dependent on the asset's future expected cash flows. The model assesses the value of a stock at the present time based on projections of the cash flows the stock will accrue in the future. Thus, the value of the stock is analysed by finding the present value of all future cash flows of the stock. Consequently, the macroeconomic

environment can affect the expected future cash flows of stocks (Degiannakis, Filis, & Arora, 2017).

In effect, the link between downstream petroleum prices and stock returns could extensively be explained by the discounted cash flow model (Enwereuzoh, Odei-Mensah, & Owusu, 2021). Enwereuzoh *et al.* (2021) explained that, the summation of all the discounted cashflows of a stock determines the price of the stock. Hence, movements in the expected cash flows of a stock affects its price. Consequently, changes in downstream petroleum prices alter firms' expected cash flows (Mohanty, Nandha, Turkistani, & Alaitani, 2011). As major firms on the GSE, such as mining, manufacturing firms and others, consume petroleum products, surges in the downstream petroleum prices increase the production costs of these firms. This eventually leads to a decrease in the firms' profitability; thus, expected cash flows are affected (Enwereuzoh *et al.*, 2021; Degiannakis *et al.*, 2017).

The study relies on all the theories to establish the relationship between all the variables. Thus, drawing from the discounted cash flow model and APT, the study hypothesises that movement in downstream petroleum price is a systematic risk that firms cannot diversify which could affect the expected cash flows of an asset, thereby affecting returns. Further, in light of the price theory and theory of economic regulation, downstream petroleum prices relatively fluctuates because OMCs adjust their prices instantly with new cost developments in petroleum products, due to the deregulation policy. Therefore, the hypothesised impact of

downstream petroleum prices on stock returns will vary before and after the deregulation.

Conceptual review

Overview of the Stock Market in Ghana

Unlike the stock markets in other economies dominated by two or more stock exchanges, Ghana's stock market is organised solely by the Ghana Stock Exchange (GSE), The GSE started as a private company limited by guarantee and incorporated in 1989 under the then Ghana's Companies Code, 1963 (Act 179). The entity in 1994 converted its legal status of operation to a public company limited by guarantee. The fundamental objective of the GSE was to establish a common platform where buyers and sellers of securities could interact.

Further, the GSE was established to regulate the granting of quotations to securities in the securities market and regulate the dealings and exchange of information among members. Also, the GSE was to co-operate with stock exchanges in other economies and with other stock brokers' associations. Thus, the aim of the entity is to ensure efficiency in the securities market to promote economic development through access to funds and investment. This is with the vision to be globally recognised financial instruments market essential to the economy of Ghana. The governance of the exchange is done by a council.

The GSE reported two indices since 2011, the GSE Composite Index (GSE-CI) and the GSE Financial Stocks Index (GSE-FSI). The GSI-CI is based on the volume-weighted average closing price of all listed stocks. The GSE-CI consists of all ordinary shares listed on the GSE at total market capitalisation,

excluding listed companies with their shares listed on other markets. Listed stocks of companies from the insurance and banking sectors is captured by the GSE-FSI. All ordinary shares of stocks listed on GSE are included in the GSE-FSI, representing total market capitalisation, excluding listed companies with their stocks listed on other markets.

Since late 1990, the GSE has experienced moments of success and downturns. In 1993, GSE had 15 companies listed with a total of GHC 10 million market capitalisation value, and in 2020, it had 39 listings with a market capitalisation of GHC 54.36 billion. Figure 4 presents the summary of the trend of the Ghana's stock market index. The index has generally fluctuated. In 1994, the index recorded a striking high return of 124%.

The increases in return from losses in the early 1990s could result from the GSE's conversion to a full-fledged public company limited by guarantee. Given the consistency from the previous (1993) year's return of 114%, this remarkable feat enabled the GSE to be adjudged the best among several emerging stock markets worldwide. Since the inception of the GSE to date, the index recorded an all-time high return of 155% in 2003, which granted the GSE ranking among the best-performing stock market, globally (Aliyu, 2012). This all-time high could be because of the political stability in Ghana, culminating from 2000 with the smooth transfer of power from one government to another. It was a remarkable event that ever occurred in the political history of Ghana.

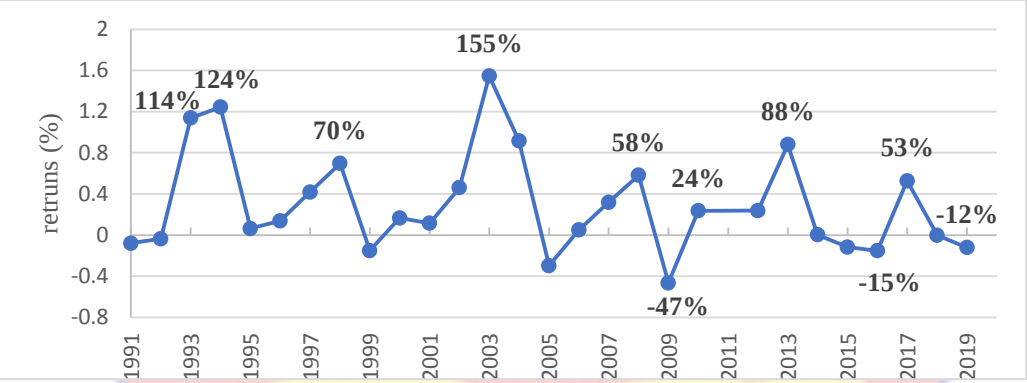

Figure 4: Performance of the GSE 1991 to 2019

Source: Field data (2021)

Demonstrating resilience in 2008, the GSE in the period of the global financial crisis recorded 58% return while most stock markets declined sharply. Consequently, the GSE was rated as a resilient and well-performing stock market in Africa and among the top performers worldwide. However, the GSE recorded its historical losses of 47% in 2009. Some scholars are of the view that the low performance was attributable to the rippling impact of the worldwide financial crisis (Zankawah, 2018). Subsequently, the GSE recovered in 2010 with returns of 24% and had since marginally performed well, as observed in 2013 with returns of 88%. However, there were experiences of some losses in 2016 and 2019.

Overview of the Petroleum Industry of Ghana

After exploration and production, crude oil is found in its raw state, which will have to be refined into its essential products. Consequently, crude oil goes through a value addition process. Ofosu-Peasah and Ackah (2017) regarded this process as the trichotomization of the crude oil value chain. The process is sequentially; upstream, midstream, and downstream activities. Thus, there are

three important units in the petroleum industry, which are the upstream, midstream, and downstream business units.

The upstream business unit entails the actions of oil companies pertaining to the exploration, development, and production of crude oil from land (onshore) or sea (offshore). Key regulatory and commercial institutions in this segment are the Petroleum Commission, Ghana National Petroleum Corporation (GNPC), and the International Oil Companies. GNPC is mandated to explore and produce crude oil in partnerships with domestic or foreign oil companies, the Petroleum Commission is the upstream regulator. However, it is worthy to note that crude oil produced in Ghana is sold in the international market.

The midstream segment also entails the activities of companies linking the upstream and the downstream sectors. Major activities in this sector include the transportation, distribution, and storage of oil and gas through pipelines or vessels for processing (Ofosu-Peasah & Ackah, 2017). The Ghana National Gas Company (GNGC) is the dominant party.

The downstream sector delves into the refining and processing of oil and the ultimate delivery to retail outlets. The Tema Oil Refinery (TOR) currently does not have the capacity to economically and efficiently refine crude oil for Ghana's downstream sector, consequently the Bulk Distribution Companies (BDCs) import petroleum products into Ghana. The Bulk Oil Storage and Transportation (BOST) also functions in enhancing transportation and keeping strategic stocks of petroleum products. There are also many licensed OMCs and

other licensed petroleum products distribution business units in the downstream, with importation, sale, and distribution as their major activities.

Finally, the key institution for petroleum policy formulation, monitoring, and evaluation is the Ministry of Energy. The Ghana Atomic Energy Commission, Environmental Protection Authority, and Petroleum Commission oversee the health, safety, and environment issues. The Maritime Authority, Navy, and other Security services also ensure the security of maritime borders, installations, and oil resources. These institutions may be seen as the auxiliaries with oversight responsibilities for the petroleum industry.

Concept of Deregulation (Subsidy Removal)

Literally, deregulation refers to the elimination of regulation or any market control. Bello (2019) defined deregulation as the course of permitting the market forces to determine products' prices. Deregulation occurs when market liberalisation is encouraged where the fundamentals of demand and supply are permitted to prevail and interact to determine prices. Addae and Ackah (2017) opined that deregulation is initiated when there is a focus on improving the operations of businesses to ensure effectiveness and efficiency through competition. Thus, to remove or curtail restrictions inhibiting market performance. Deregulation allows free trade flow to enhance the forces of demand and supply to determine prices (Yusuf, Turkur & Ibrahim, 2019).

Nonetheless, deregulation emerges from regulation of aspects of an industry where there were restrictions in the interplay between demand and supply to determine prices. Thus, petroleum industry deregulation refers to

removing monopoly rights over certain issues related to the production, distribution, and prices of petroleum products (Monday, 2013). Muthini, Namusonge, Guyo, and Shale (2017) defines downstream petroleum deregulation as reducing the power of a government to liberalise market fundamentals to be the main determining factor of downstream petroleum prices. The deregulation of petroleum products prices is initiated for many reasons, including climatic change and fiscal sustainability reasons in addition to enhancing social welfare of the society.

Regulation of downstream petroleum products prices leads to government's payment of subsidies to ensure OMCs and BDCs do not incur losses due to price control. According to Bello (2019), regulation of the downstream petroleum sector (era of subsidies on petroleum products) is preferred over deregulation by some economies due to poverty levels, depreciation of the value of national currency relative to international currencies, inflation, and corruption in the petroleum industry. Nwosu (2009) asserted that there should be regulation and subsidies to shield economies from turbulence in the international oil markets. However, major literature supports deregulation in the downstream petroleum sector in its major role in eliminating concerns raised by Bello (2019). Thus, Deng, Jiang and Sun (2018) stated that there have been varying thoughts of regulating or deregulating the downstream petroleum sector.

As regulation of the domestic retail petroleum market is tied with subsidy payments, deregulation entails removing subsidies to allow full-passthrough of international oil market prices to the domestic market (Kpodar & Imam, 2020).

Coady *et al.* (2010) articulated that deregulation eliminates the regressive nature of subsidies. That is, regulation through subsidies of the downstream petroleum products cobenefits the rich. On average, over 70% of the total benefits of petroleum products subsidies (petrol, diesel, and LPG) benefit the richest 40% of the household. However, subsidies on kerosene benefited the poor (Coady *et al.*, 2010).

Moreover, Acheampong and Ackah (2015) indicated that deregulation eliminates threats of fiscal sustainability as it halts the continuously increasing amount of petroleum subsidies. The increasing budgetary allocation to subsidise petroleum products deprives the economy of investment in infrastructure and productive ventures required to provide employment and sustain domestic businesses and the economy (CUTS, 2015).

Kpodar and Imam (2020) asserted that petroleum deregulation ensures full pass-through of petroleum products costs from the international oil market to domestic consumers. Moghaddam and Wirl (2018) suggested that deregulation is healthy for an economy because the actual fuel and energy consumption costs are realised, leading to efficiency in the industry and economy. However, there are concerns that deregulation may adversely impact the Ghanaian economy because of the inelastic demand that comes with petroleum products, which is key to sectorial consumption or production (Addae & Ackah, 2017).

Downstream Petroleum Pricing in Ghana

The Government of Ghana, until 2001, made efforts to deregulate the downstream petroleum prices after several years of petroleum products prices

regulation. Following the hikes in the global crude oil prices before 2001 which resulted in TOR accruing debts mainly because of subsidies, prompted the government to deregulate the sector. Consequently, the Automatic Petroleum Product Pricing Formular (APPPF) was adopted to reduce the burden on the government in subsidising petroleum products. However, the pricing mechanism was adjudged to lack transparency and coupled with the eventual hike in petroleum prices in 2002, APPPF was abandoned (CUTS, 2015; Ofori, 2015). The government optimistically reintroduced the APPPF in 2003. Yet public protests led to its abandonment in 2004 due to agitations emanating from a sudden 90 percent surge in ex-pump prices (Crawford, 2012).

The NPA, through an act of the parliament in 2005, was established to regulate the downstream petroleum sector of Ghana. Among the mandates of the NPA Act, 2005 (Act 691) was to establish a Unified Petroleum Price Fund (UPPF). The UPPF pricing guideline for petroleum products depends on the distance between the storage depot of petroleum products and retail outlets to determine the price per litre. This guideline ensured products prices unification throughout the country. The NPA was able to deregulate the downstream petroleum sector officially in June 2015 after a 2-year gradual deregulation process which started in 2013.

The subsidy or pre-deregulation era resulted in government legacy debts to the BDCs which imports petroleum products to Ghana ports. The legacy debts included the foreign loss under recoveries (FLUR), foreign loss under recoveries interest (FLURI), price under recoveries (PUR) and real value factor (RVF)

(Ghana Chamber of Bulk Oil Distributors [CBOD], 2019). The FLUR was the foreign exchange losses as a result of the relatively lower exchange rates applied by the NPA in other to regulate the petroleum products. The FLURI was the financial cost to the government payable to the BDCs for delaying in the payment of the FLUR. The PUR was the actual fuel price subsidy component borne by the government. Finally, the RVF was also the financial cost to the government in the delay of the payment of the fuel price subsidies to the BDCs.

Consequently, the size of the subsidies was rising such that it was threatening fiscal sustainability. The bulky subsidies restricted the Ghanaian government from undertaking important public investment like infrastructure and gravely accelerated budget deficit and growth in the national debt (CUTS, 2015). Because fuel subsidies were targeted at the poor households, they instead benefited the rich. For instance, Cooke, Hague, Tiberti, Cockburn, & Lahga (2016) reported that the affluent Ghanaian households received GHC7.32 and GHC3.4 per year, respectively, for petrol and kerosene as subsidies relative to GHC0.17 and GHC2.05, respectively, received by the poorest quintile. The culmination of these events, coupled with the bid by NPA to fully deregulate the downstream petroleum sector, resulted in the deregulation in June 2015.

The deregulation entailed price liberalisation, which rescinded the NPA's legitimate right to control the prices of petroleum products. Rescinding NPA's mandate regulate prices has allowed BDCs and OMCs to determine the petroleum products' prices. NPA's mandates are relegated to monitoring OMCs and BDCs to provide quality petroleum products and offer fair market prices to household

and industry consumers. The deregulation of prices is also intended to promote competition among OMCs to ensure efficiency and effectiveness in petroleum products pricing. The fundamentals of demand and supply in the retail petroleum market come into play to determine prevailing prices and control the quantity of fuel delivered and consumed (Gasti, 2017). The BDCs and OMCs may adjust their prices to ensure full cost passthrough due to changes from international to the domestic petroleum market. Nonetheless, the government continued to regulate the prices of residual fuel oil and premix fuel within the era of deregulation. Consequently, the Government incurred subsidy debts of GHC 225.4 million for premix fuel and residual fuel oil in 2019 (CBOD, 2019).

Fundamentally, NPA utilizes a two-week inventory window (1st to 16th of every month) to release a price build-up template for BDCs, OMCs, and LPGMCs to compute the respective ex-refinery price and ex-pump price for petroleum products. The basic component of the NPA ex-pump price build-up template, for example as at 1st September 2021 consists of ex-depot price and margins and administrative costs to determine ex-pump price. The ex-depot price is also determined by the ex-refinery price, energy debt recovery levy, price stabilization and recovery levy, sanitation and pollution levy, fuel marking margin, road fund levy, BOST margin, energy sector recovery levy and the special petroleum tax. Whiles the margins and administrative costs is determined by the UPPF, marketers' margin, dealers' margin and distribution margin (See Appendix E).

The trend in the consumption of petroleum products has been relatively stable over time. According to Ofori (2015), consumption of petroleum products

has centred on diesel (majorly consumed by the industrial sector), petrol (transport sector), and LPG (domestic sector and some industries). Figure 5, therefore, shows the consumption pattern of the basic downstream petroleum products.

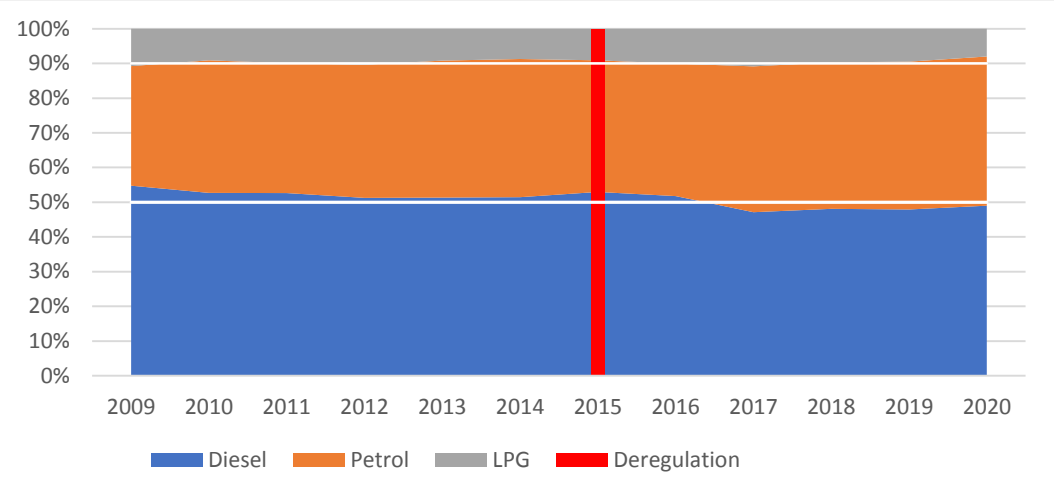

Figure 5: Consumption Pattern of Petroleum Products 1999 to 2020

Source: Field data (2021)

It could be observed in Figure 5 that the consumption of petroleum products in Ghana has majorly been diesel followed by petrol and LPG respectively. Consumption of diesel has marginally declined, losing to petrol while LPG has generally remained stable over in the post-deregulation era relative to the pre-deregulation era. The ratio of 0.5:0.4:0.1 could generally be gleaned from the consumption pattern in petroleum products in Ghana. This ratio was useful in placing weights on the three products in computing the weighted average of the petroleum products' prices.

Related empirical studies

This segment presents related literature describing the nexus between petroleum prices and stock returns, with respect to regulation and deregulation of petroleum products prices.

Lin, Wesseh, and Appiah (2014) investigated the spill-over impact of fluctuations in petroleum prices on Ghana's stock market from a weekly dataset from 2000 to 2010. Using the general autoregressive conditional heteroskedasticity frameworks, the study found transmission of volatilities from petroleum price shocks to the securities market to be significant. Zankawah and Stewart (2020) suggests that international crude oil price spikes influence the stock market through exchange rates pressure resulting from importing petroleum products. Additionally, Addae and Ackah (2017) stated that, through inflation, petroleum products prices affect stock returns due to domestic purchase or usage of petroleum products.

The empirical work of Deng *et al.* (2018) focused on the efficiency in petroleum products pricing by the Chinese government and evaluated the impacts on China's inflation from 2005 to 2009. Using the Phillips curve and the pass-through estimation techniques, Deng *et al.* found that the domestic fuel pricing mechanism in China has a limited and insignificant impact on inflation in China. This affirms the assertion that the government shields the economy or consumers from the petroleum price shocks during a regulatory era.

However, Omotosho (2019) investigating the relationship among petroleum prices, fuel subsidies and Nigeria's macroeconomic stability reported a

contrary view to Deng *et al.* (2018). Applying the Dynamic Stochastic General Equilibrium (DSGE) model with quarterly dataset from 2000 to 2018, Omotosho (2019) revealed that petroleum price surges raised inflationary and exchange rates in presence of fuel subsidies. Whereas in the absence of fuel subsidies, inflation decreases, and exchange rates decline in the short term in reaction to crude oil price surges.

Nonetheless, when the finding of Deng *et al.* (2018) and Omotosho (2019) is juxtaposed with the propositions of Addae and Ackah (2017) that inflation is the main conduit for petroleum prices to affect an economy, then, the effect of downstream petroleum prices on stock market returns becomes inconsequential. As inflation is the main conduit for fluctuations in downstream petroleum prices to adversely affect stock returns, it presupposes that stock returns are only mildly affected during a regulatory era. However, the situation of Ghana could be different. Thus, the exclusivity of economies' economic and political structures and interrelationships among economic variables matter (Hu *et al.*, 2018).

Besides, Wiafe, Barnor, and Quaidoo (2015) analysed the effect of petroleum prices on domestic investment in Ghana. Using dynamic least squares (DOLS) technique on an annual dataset from 1984 to 2012, shocks arising from crude oil prices were observed to significantly affect domestic investment in Ghana, negatively. This result corroborated with that of Tetteh *et al.* (2019) investigating the impact of international crude oil prices on returns of assets in Ghana.

Tetteh *et al.* (2019) applied the fully modified ordinary least squares (FMOLS) and DOLS on a dataset spanning from 2000 to 2016 and ascertained that, fluctuations in international crude oil prices have a negative effect on returns of assets in Ghana in the long run. In contrast, Kuwornu and Nantwi (2011) ascertained no significant impact of international crude oil price volatility returns of stocks in Ghana returns from a monthly dataset spanning 1992 to 2008. This dissension could be a result of the dataset spanned across the regulatory and deregulatory eras and differences in the estimation techniques employed.

Furthermore, considering the short-run dynamics of the nexus between petroleum prices and returns on assets, there have been some disparities in the extant knowledge. Kpanie, Esumanba, and Yakubu (2014) ascertained a positive short-run impact of petroleum price spikes on returns of assets in Ghana, using the vector error correction model (VECM) on a dataset spanning 1995 to 2011. However, Nyarko (2018) applying VECM on a monthly dataset spanning 2003 to 2014, found that petroleum price surges negatively affected Ghana's stock market returns, in the short-run dynamics. These disparities, perhaps, is because of changes in economic conditions in Ghana (Gatsi, Gadzo, Anipa, & Kosipa, 2015).

The downstream petroleum sector in Ghana had undergone pricing reforms which brought about the deregulation. Extant literature focusing on the impacts of the deregulation phenomenon on the economy of Ghana has been scanty. Addae and Ackah (2017) opined that the main conduit for deregulation to impacting an economy and its macroeconomic indicators is through inflation. This is because rises in petroleum products' prices as a result of deregulation

cause inflation (Zankawah & Stewart, 2020). Consequently, a rising inflation is expected to affect stock returns.

Accordingly, Idris (2014) studied the influence of deregulation on firms' profitability in Nigeria. Idris found that when there is subsidies removal (deregulation), firms' cost of operations or productions increases, which negatively affects the firms' performance. However, findings from Rentschler, Kornejew, and Bazillian (2017) suggested that subsidy removal or deregulation either positively or negatively influence firms' performance because of firms' response.

The key findings from Rentschler *et al.*'s (2017) study suggested that firms can respond to deregulation in four major ways. Firms can respond by absorption (profit margins cover rising costs of production). Second, the response can be by substitution (utilising alternative fuel sources). Resource efficiency (cutting unnecessary expenses on fuel, thus operating efficiently) is the third option. Finally, the response from firms can be through pass-on (transferring full raises in costs of production or operation to consumers). In all manners, firms reduce or divert the impact of deregulation on their performance (Rentschler & Kornejew, 2016).

Addae and Ackah (2017), on the other hand, investigated the impacts of the deregulation of Ghana on inflation from 2001 to 2016 using Autoregressive Distributed Lag (ARDL) technique. Using a dummy variable to proxy deregulation, the study revealed that the deregulation did not significantly show as an indicator in affecting inflation in the short and long-run estimations unlike

Bobai's (2012) findings, who also found that changes in the prices of petroleum products drive inflation. However, it is important to note that Addae and Ackah (2017) investigated the impact of deregulation on Ghana's inflation during the first 16 months of the deregulation era.

Maduka, Ihorne, and Anochiwa (2015) also analysed using the ordinary least squares (OLS) to ascertain the impact of deregulation on the downstream petroleum sector on Nigeria's economy using data from 1981 to 2010. The study revealed that fluctuations in petroleum products prices resulted from the deregulation, yet positively affected the economy of Nigeria. In contrast, findings from the empirical work of Monday (2013) disagree with that of Maduka *et al.* (2015). Monday (2013), employing a similar methodology (OLS) on a data span from 1980 to 2011, found that though increases in prices of petroleum products affected Nigeria's economy, the deregulation was not a factor but changes in international crude oil prices.

However, Maduka *et al.* (2015) and Monday (2013) did not analyse the impacts of the regulated relative to the deregulated era on the Nigerian economy to investigate whether the dynamics have same significant levels of impacts. Suppose similar significant levels of impacts exist during regulation era compared to the deregulation era, then the deregulation may not have been effective.

An empirical investigation by Kayalar, Küçüközmen, & Selcuk-Kestel (2017) focused on the impact of international crude oil prices on the financial market using a sample of four developed and six emerging economies with varying levels of oil dependence (net exporter or importer) from 2005 to 2016.

Using the Copula approach, the empirical investigation revealed that stock markets in emerging net oil importer economies are less susceptible to shocks from the international oil market than developed net exporters. However, how does this finding hold for Ghana as a developing economy and a net importer of petroleum products?

Apparently, extant literature seems to have focused on the impacts of the international crude oil prices on various macroeconomic indicators to the neglect of the effects of the domestic retail price of petroleum products (Zankawa & Stewart, 2020; Hu *et al.*, 2018; Chou & Tseng, 2015; and others). Andoh (2019) claimed that estimating the impact of international oil prices on macroeconomic variables miss to portray the full construct of the macroeconomic influence of petroleum price spikes. Thus, the downstream retail petroleum market serves as the main conduit to transmit the shocks of international crude oil prices changes to consumers (firms and households) (Kpodar & Imam, 2020; Deng *et al.*, 2018).

Zankawah and Stewart (2020), applying the GARCH technique, assessed the effects of the instabilities in international crude oil prices on the stock market of Ghana, using monthly data from 1991 to 2015. Zankawah and Stewart found that instabilities in petroleum prices affected the stock market of Ghana when the price is applied as an exogenous element. Zankawah and Stewart focused mainly on the regulatory era of downstream petroleum pricing in Ghana.

Literature investigating the economic impacts of the downstream petroleum reforms or deregulation in Ghana has been scanty (Andoh, 2019; Addae & Ackah, 2017). Though empirical works have intensely scrutinised the

nexus between international crude oil price and returns of stocks, the impact of downstream petroleum prices seem to have been ignored. Andoh (2019) using the ARDL approach, focused on the influence of the 2008 world financial crisis and petroleum prices (proxied with petrol prices) on returns of assets in Ghana between 1990 and 2017. Andoh found that domestic prices do not significantly alter returns of assets in Ghana in both short and long run. In contrast, Nyarko (2018), investigating the impact of petroleum prices on returns of stocks, ascertained that petroleum prices (proxied with petrol prices) had a negative effect on returns of assets, in both the long and short-run dynamics, from a dataset spanning from 2003 to 2014.

Andoh (2019) and Nyarko (2018) seem not to have measured downstream petroleum prices adequately to further establish the nexus between the downstream petroleum prices and returns of assets. The frequent proxy of downstream petroleum prices with petrol prices, which is not adequate (Ofori, 2015). According to Ofori (2015), the consumption of petroleum products has centred on diesel (majorly consumed by the industrial sector), petrol (transport sector), and liquefied petroleum gas (LPG) (domestic sector and some industries).

Therefore, this research is distinguished from existing studies in analysing the pre and post-deregulation eras of the nexus between returns on stocks and downstream petroleum prices, proxied with a weighted average price of petrol, diesel, and LPG.

Conceptual framework

From the foregoing literature reviewed, a conceptual can be developed. Figure 6 shows the relationship between downstream petroleum prices and stock returns.

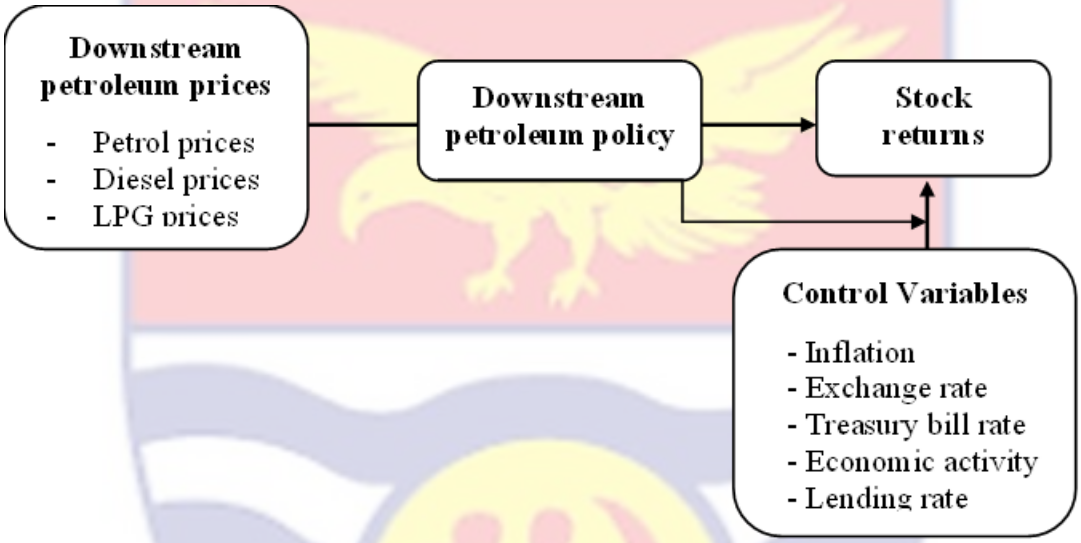

Figure 6: Conceptual framework

Source: Field data (2021)

From the conceptual framework, downstream petroleum price is hypothesised to affect stock returns depending on the downstream petroleum market policy. As informed by the price theory, in a deregulated period, firms on the stock market experience price instabilities due to OMCs instantly adjusting fuel price as a result of rising costs from the international crude oil market; this is unlike a regulated period where OMCs do not adjust prices as it is subsidised by the government. Further, according to the Arbitrage pricing theory, there are systematic risks in the macroeconomic environment that firms cannot diversify.

Though not exhaustive, these systematic risks could include downstream petroleum price risks, inflationary, exchange rate, economic activity, and lending rate risks. These systematic risks could be influenced by the deregulation policy; thus, the behaviour of these systematic risks could differ before and after the implementation of the deregulation policy. This is because, A transition from fuel subsidisation economy to full fuel price passthrough have implications on fiscal savings, inflation, importation and other key macroeconomic indicators. This in turn have cascading effect on various indicators of the economy.

Consequently, in light of the discounted cash flow model, changes in the downstream petroleum prices affect the production costs of firms and eventually thus profitability; thus, the future expected cash flows of firms are altered.

Chapter summary

Drawing insights from the Arbitrage Pricing Theory, Economic theory of regulation, Price theory, and the discounted cash flow model the theories' relevance and implications to the study were discussed. The synopsis of the Ghana stock exchange, the downstream petroleum sector, and the concept of deregulation were reviewed. Through a thorough empirical review, the need for the conduct of this current study was revealed. The dissensions in the nexus between petroleum prices and stock returns could be a result of datasets spanned across a regulatory and deregulatory eras and differences in estimation techniques employed.

CHAPTER THREE

RESEARCH METHODS

Introduction

This research analyses the impact of downstream petroleum product prices on stock returns with respect to the downstream petroleum deregulation in Ghana. The research methods applied the research is discussed in this chapter. The study's design, area, data collection procedures, data processing, and analysis were discussed in this Chapter.

Research Design

Saunders, Lewis, and Thornhill (2019) articulated that the research design encompasses the research paradigm, approach, and method. Research paradigms are the belief systems and mental frames that serve as the contour to the design and conduct of research (Bhattacherjee, 2012). These belief systems form the basis for a researcher's reasoning and observations. Saunders *et al.* (2019) provided an overview of the various research paradigms and suggested that no one research paradigm supersedes the other. Park, Konge, and Artino (2020) suggested that the paradigm of a research is evident from the research inquiries through the hypotheses formulated that a study intends to make.

The stance of the positivism research paradigm is taken to analyse the impact of the downstream petroleum products prices on asset returns with respect to the downstream petroleum deregulation. This paradigm takes the position that concepts should be limited to observable and measurable phenomena by relying exclusively on concepts that can be directly measured and tested (Bhattacherjee,

2012). Positivists have the philosophical stance that social reality can be understood objectively. This indicates that social phenomenon could be measured, quantified and implications made.

Saunders, Lewis, and Thornhill (2007) asserted that the empirical objectives, reveals the research's purpose, being exploratory, descriptive, and explanatory research purposes. The purpose of this study establishes cause and effect relations among the variables of the study. Consequently, this empirical work applied the explanatory research design. The explanatory research design determines cause and effect relations among the variables (Saunders *et al.*, 2007). Therefore, forming conclusions from analysing collected datasets of variables quantitatively in line with theory shares the deductive and quantitative approaches or stances to research.

Examining the impact of the petroleum products prices on asset returns involves quantifying, measuring, and analysing variables and relationships between fuel prices and stock market returns. Thus, translating to the overarching research design or methodological choice suitable for the study. Three major research designs: quantitative, qualitative, and mixed methods research designs are known in research (Creswell & Creswell, 2017). Given the philosophical stance of positivism and the explanatory purpose of this empirical work, the quantitative research design is assumed. Quantitative research design investigates relationships between variables; these variables and relationships are then evaluated using robust statistical techniques (Saunders *et al.*, 2019). The

quantitative research approach entails using numerical datasets of various variables to establish a quantifiable relationship among such variables.

Study Area

Concentrating on Ghana, a Sub-Saharan African economy, the effect of the downstream petroleum products prices on returns of stocks was investigated. As of 2020 Ghana's stock market comprised 37 companies. The downstream petroleum products pricing dynamics have gone through a price regulated era with subsidy payments and deregulated era with emphasis on subsidy removal. Consequently, the impact of domestic petroleum products prices on asset returns before and subsequent to the deregulation era in Ghana was investigated.

Data Collection Procedure

Secondary data on eight variables was utilised, as presented in Table 1. Monthly timeseries data spanning from September 2009 to February 2021 was employed. Data were gathered and refined from the GSE, the Ghana Statistical Service (GSS), Bank of Ghana (BoG), and the National Petroleum Authority (NPA).

Description and Measurement of Variables

Stock returns (SR)

Stock returns (SR) were computed from the GSE market's All-Share Index and Composite Index. Before January 4, 2011, the GSE published the All-Share Index (ASI), whereas, after the period, the Composite Share Index (CSI) replaced the ASI. Both indexes were employed; thus, the GSE-CSI served as the continuation of the GSE-ASI, hence, GSE-ASI/CSI. The GSE indexes track the

financial wellbeing of all firms traded on the stock market. The returns of the GSE stock index reflect the returns of the Ghana's stock market. Stock return is recommended to be computed as $SR_t = ((SI_t / SI_{t-1})-1)*100$ because of the time-series properties (Anokye & Peterson, 2017; Brooks, 2014). Therefore, the monthly data for the stock indexes (SI) was sourced from the GSE by extracting the end day of the month publications of the stock indexes.

Table 1: Summary of Data Characteristics

Variables	Notation	Measurement	Source
Stock returns	SR	Simple returns (Rate)	GSE
Petroleum prices	PP	The weighted average of diesel, petrol and LPG (0.5, 0.4, 0.10) (GHC/lt).	NPA
Exchange rate	EXR	Cedis to a unit of US dollar	BoG
Treasury bill rate	TBR	91-day treasury bill rate	BoG
Lending rate	Lr	Average commercial banks' lending rate	BoG
Economic Activity	EA	BoG's Composite Economic Activity (Real growth)	BoG
Inflation	NF	Consumer Price Index	GSS

Note: *All variables were log transformed except SR and EA due to negative statistics in the timeseries data*.
Source: Field data (2021)

Petroleum Products Prices (PP)

Petroleum products prices represent the weighted average of the ex-pump prices of diesel, petrol, and LPG with the ratio of 0.5:0.4:0.1. The respective weights assigned were based on the petroleum consumption pattern in the

economy. Although, the weights are static in light of the varied monthly consumption patterns of diesel, petrol and LPG, it provides average statistics for analyses. A preliminary analysis indicated weight of 50 percent assigned to diesel, whereas 40 and 10 percent to petrol and LPG respectively. This is affirmed by the NPA (2021) market statistical reports which indicates the monthly consumption mix of petroleum products in Ghana; the reports indicate diesel accounts for approximately 49.6 percent, whereas petrol and LPG accounts for 40.3 and 10.1 percent respectively. Before June 2015, the prices of petroleum products were set by NPA. However, after this regulated era, the petroleum downstream was deregulated allowing the OMCs to price petroleum products. Data for the ex-pump petrol prices before June 2015 was obtained from the NPA's publications of the historical trends of petroleum prices in Ghana. The data for the ex-pump petrol prices after June 2015 was the average indicative prices of the various oil marketing companies published by the NPA.

Exchange Rate (EXR)

Several studies affirm that trends in exchange rate affect stock indices (Mroua & Trabelesi, 2020; Baranidharan & Alex, 2020; and others). There has been a great deal of flow of funds among countries due to the internationalisation of the capital markets (Gatsi *et al.*, 2016). Consequently, foreign and domestic investors have been interested in the fluctuations in economies' exchange rates for cross-border investments. The exchange rate specification was with respect to the US Dollar against the Ghana Cedi. The exchange rate data was retrieved from the

Bank of Ghana's Economic data. The end day of the month exchange rates was used.

Treasury bill rate (TBR)

Empirical literature stablished a connection between treasury bills rate and stock returns (Tetteh *et al.*, 2019; Issahaku, Ustarz, & Domanban, 2013; Kuwornu, 2012; and others). The income of households or firms is either channelled to consumption, savings, or investment. When there are excesses of income after consumption, savings or investments are resorted to. Thus, the channel that provides value for the excess funds is selected. However, investing in treasury bills provides an avenue for an alternative to holding stocks (Issahaku *et al.*, 2013). During periods of rising treasury bill rates, investors are incentivised to channel their funds to purchase treasury bills and vice versa (Frimpong, 2011). The source of monthly data on treasury bill rate is from the Bank of Ghana's Economic data publications.

Lending rate (LR)

The interest rate was proxied using the monthly average commercial bank lending interest rate. Ibrahim (2017), Amarasinghe (2015), and Ngugi (2014) reported a link between lending interest rate and stock returns. Rising lending interest rates results in increased borrowing costs, and firms may stay away from expanding their operations through borrowing (Williams, 2014). This will therefore affect their profits and cash flows and thereby affecting dividends. The monthly data for the lending interest rate was gathered from the Bank of Ghana's Economic data publications.

Economic Activity (EA)

There have been vast researches indicating the link between economic activity and stock returns. However, findings of the nature of the relationship have been mixed. Increases in economic activities result in increases in cash flows, leading to an uprising expectation of large dividends by investors. This then results in an increase in demand for shares resulting in higher prices. Although Khan and Khan (2018) found a cointegrating relationship between returns on assets and economic activity, the influence of economic activity on stock returns was negative and not significant. Smajlbegovic (2019), however, found that a booming economic activity positively predicts stock returns. The monthly data for the economic activity was proxied with the Bank of Ghana's composite index for economic activity. This was sourced from the Economic data publications of the Bank of Ghana.

Inflation (NF)

Literature investigating the link between inflation and stock returns included but not limited to Otieno, Ngugi and Wawire (2017), Ouma and Muriu, (2014), Ahmed and Mustapha (2012), among others). Rising prices of goods and services (inflation) increase costs of living, which diverts funds from savings or investments to consumption (Nketsiah & Ameyibor, 2017). Consequently, this results in a fall in demand for financial instruments. Reduction in demand for financial instruments will also mean that firms are unlikely to raise funds from the

stock market for investment resulting in a decline in share value. Inflation was proxied with the consumer price index. The data for inflation was sourced from the Ghana Statistical Service Economic Bulletins.

Data Processing and Analysis

This section discussed the data estimation instruments and diagnostic checks on the data and the models used for the study. The models for answering the research hypotheses were generated in this section.

Test for Structural Shift

Most financial and macroeconomic variables mimic trends of immediate structural shifts and change over time (Muthuramu, & Maheswari, 2019; Zarei, Ariff, Hook, & Nassir, 2015). These shifts could be due to major economic policy changes, economic booms or recessions, geopolitical developments, and currency devaluations (Ahmed, 2019). Therefore, this study suggests due to the downstream petroleum deregulations in June 2015; there could be a structural shift in modelling the relationship between stock returns and petroleum prices in the presence of control variables. Therefore, the notable Chow test by Chow (1960) was used to investigate whether the downstream petroleum deregulation reform in June 2015 caused a structural shift. According to Muthuramu and Maheswari (2019) the Chow test is used when the supposed breakpoints are known.

Using two simple linear equations, with Z as dependent variable, W as vector of independent variables and ∂ as the coefficient of the variables, of the form:

$Z_t = \partial_1 W_1 + u_1$ ... regression line 1 for the first part of the dataset.

$Z_t = \partial_2 W_2 + u_2$ ... regression line 2 for the second part of the dataset.

On condition that that $\partial_1 = \partial_2$ and $u_1 = u_2$, then they are statistically equal, and a single regression line best represents the dataset. However, if $\partial_1 \neq \partial_2$ and $u_1 \neq u_2$, then two regression lines best explain the relationship among the variables over time. The Chow test has the formula:

$$CHOW = \frac{(RSS_p - (RSS_1 + RSS_2))/k}{(RSS_1 + RSS_2)/(N_1 + N_2 - 2k)},$$

Where;

RSSp implies the residual sum of squares of the pooled regression line.

RSS_1 denotes the residual sum of squares of regression line before break.

RSS_2 denotes the residual sum of squares of regression line after break.

CHOW is the Chow F statistics

N implies the number of observations

K implies the number of parameters

The Chow test was applied to check the significance of the break dates or points of the deregulation reform. To assess the significance the probability value of the Chow F statistics is appraised. The null hypothesis of the Chow tests is that there are no breakpoints: thus, the dataset can be modelled with just one regression line.

Unit root or Stationarity test

Stationarity is important in appraising the time-series properties of a dataset for regression analysis. A time series is stationary when the mean and

variance of the data do not change over time. Unit root test is critical to ascertain the time-series properties of a data set before an appropriate estimation technique could be applied. It, therefore, tests for stationarity in a time series dataset. Unit root occurs when there is no constant mean, variance, and covariance for the lags of variables in a dataset (Anokye & Peterson, 2017). Unit root is simply the cause for non-stationarity in a time series data set.

Consequently, the unit root test was conducted to check the order of integration of the variables. In determining whether the time series data are I (0) or I (1) the data set was subjected to the Augmented Dickey-Fuller (ADF) and Phillip Perron (PhP) tests. Although the ADF test is adequate, both tests are utilised to ensure that unit test results provide sufficient grounds for the choice of an estimation framework (Brooks, 2014). Both tests have the null hypothesis that the time series has a unit root. The rejection of the null hypothesis indicates that the time series is stationary.

Model Specification

The Arbitrage Pricing Theory (APT) asserts that multiple risk factors have the tendency to determine asset returns. These multiple risk factors are systematic risks, including varied macroeconomic indicators such as oil prices, exchange rates, inflation, economic activity, treasury bill rate, lending rate, and others. Applying the concept of discounted cash flows, which holds that asset prices or returns are ascertained by discounting the cash flows of a firm. Consequently, the APT suggests that macroeconomic performance alters asset returns by affecting the firms' expected cash flows. Therefore, the theoretical model is stipulated as;

$$ER = \lambda_0 + \beta_1 RF_1 + \beta_2 RF_2 + \beta_3 RF_3 + \ldots + \beta_n RF_k + e \quad \text{(Eqn. 1)}$$

Where ER is the return on an asset, λ_0 is the riskless rate of return or the constant term of an asset, $RF_{1\text{-}k}$ are the multiple factors of risks (macroeconomic risk factors) that affect the asset, $B_{1\text{-}n}$ are the sensitivities of the factors to the assets and e is the error term of the asset. Consequently, the theoretical model (Eqn.1) is modified for the purposes of this study comprising variables from the literature that has a relationship with stock returns as;

$SR=f(PP, EXR, TBR, LR, EA, NF)$

To allow for a robust functional form of the model the variables are transformed to natural logs except variable with negative statistics in the dataset (Brooks, 2014). This implies Eqn. 2 can be generated as;

$$SR = \lambda_0 + \beta_1 lnPP_t + \beta_2 lnEXR_t + \beta_3 lnTBR_t + \beta_4 lnLR_t + \beta_5 EA_t + \beta_6 lnNF_t + e_t \quad \text{(Eqn.2)}$$

Furthermore, the Autoregressive Distributed Lag (ARDL) model by Peseran, Smith, and Shin (2001) was adopted to analyse the data.

The Autoregressive Distributed Lag (ARDL) Framework

The short and long-run relationship between downstream petroleum prices and stock returns before and after the deregulation policy were assessed using the ARDL model. The ARDL model was adopted because of its numerous advantages over other estimation techniques in assessing long and short-run relationships among variables. The ARDL technique, unlike the Johansen's tests for Cointegration (Johansen, 1991), Vector Autoregression (VAR), Enger-Granger Causality tests (Engel & Granger, 1987), can be used to model

relationships among variables that are integrated of order zero, one or mix orders. The ARDL also simultaneously estimates both short and long-run relationships.

Because most financial time series contain unit root (Muthuramu & Maheswari, 2019), the ARDL estimation technique could be utilised to model variables with varied order of integration, though non-stationary variables with the integration of order two are excluded (Peseran, Shin & Smith, 2001). The model also produces robust estimates when the sample is small (Haq & Larsson, 2016). Given that the sample dataset was split into two small sub-samples (69 observations per sample), the ARDL remained useful. The ARDL technique uses several lags to specify a general to specific model to help adjust for autocorrelation and endogeneity issues (Haq & Larsson, 2016).

Employing the ARDL estimation protocol to model a relationship between *Y*, as an independent variable, and *X*, as a vector of independent variables; the following ARDL (*r*,*z*) can be generated:

$$\Delta Y_t = a_0 + \sum_{j=1}^{r} \phi_1 \Delta Y_{t-j} + \sum_{j=0}^{z} \phi_2 \Delta X_{t-j} + \lambda_1 Y_{t-1} + \lambda_2 X_{t-1} + \mu_t$$

(Eqn.3)

Where α_0 is the trend coefficient, and μ_t is the error term. While *r* and *z* are the r autoregressive term and z distributed lag terms. ϕ_1 and ϕ_2 are the coefficients for the short-run estimation, whereas λ_1 and λ_2 are the coefficients for the long-run estimators. μ_t is the error term while Δ is the first difference operator.

Consequently, from Equations 2 and 3, the ARDL model, which assessed the relationship between petroleum prices (PP) and stock returns (SR) in the presence of control variables, was specified as;

$$\Delta SR_t = a_0 + \sum_{i=1}^{r} \phi_1 \Delta SR_{t-i} + \sum_{j=0}^{z} \phi_2 \Delta lnPP_{t-j} + \lambda_1 SR_{t-1} + \lambda_2 lnPP_{t-1} + \sum_{i=n}^{n} C_n X_t + \mu_t$$

Where C_n is the coefficient of the vector of the control variables repre[illegible] vector *X*.

Lag length selection

After stationarity levels of the dataset were reached, the optimal lag lengths of the variables were estimated and chosen. The lag refers to the number of periods in retrogression in periods of a variable that affects an estimation. The ARDL technique uses number of lags to specify a model from general to specific to also help adjust for autocorrelation and endogeneity issues (Haq & Larsson, 2016). Using the Schwarz Information Criterion (SIC), Akaike's Information Criterion (AIC), Hannan-Quinn information criterion (HQ), and Final Prediction Error (FPE) recommendations, the optimal lag length for the time series was chosen.

Model diagnostics

After the optimal Lag length was chosen, the ARDL model was specified. Diagnostics of the model considered the goodness-of-fit (dependent variable tests) using the adjusted R-squared, AIC, and SIC. For the independent variables' tests, the tests considered the test for explanatory power using the F-statistics and multicollinearity tests using correlation tests. For the error term tests, the Breusch-

Pagan-Godfrey test for Heteroskedasticity and Ramsey's regression specification error test for specification errors were conducted. Again, the Breusch-Godfrey Serial Correlation LM Test and Durbin-Watson statistic were considered to check for no serial correlation in the model. Finally, using the recursive estimation for parameter stability, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) tests for stability were conducted.

Bounds or Cointegration Tests and Long-run Model Estimation

After checking for the robustness of the model, the bounds test was conducted to check whether a long-run relationship exists among the variables. The null hypothesis of no co-integration is that, all the coefficient of the long-run estimate is jointly equal to zero (long-run relationship does not exits; thus, H_o: $\lambda_1 = \lambda_2 = \ldots = \lambda_n = 0$), if otherwise the null hypothesis is rejected in favour of the alternative hypothesis (long-run relationship exits; thus, H_1: $\lambda_1 \neq \lambda_2 \neq \ldots \neq \lambda_n \neq 0$).

Using the recommendation of Peseran *et al.* (2001), the alternative hypothesis of cointegration should be accepted if the estimated F- statistic is more than the upper bound critical value. On the contrary, the null hypothesis of no cointegration should be failed to be rejected to, if the F- statistic is less than the lower bound critical value, which implies that there is no cointegration among the variables.

From the assumptions of equation 3, the long-run levels model could be presented as;

$$SR_t = \lambda_0 + \lambda_1 lnPP + \lambda_2 lnEXR_t + \lambda_3 lnTBR_t + \lambda_4 lnLr_t + \lambda_5 EA_t + \lambda_6 lnNF_t + u_t \quad \text{(Eqn.5)}$$

Where λ_0 is the trend coefficient, and μ_t is the error term. λ_i (i=1…6) are the coefficients for the long-run parameters.

Error Correction Modelling and Short-run model estimation

If there is no cointegration, only the short run model is specified, without the long-run model. On the other hand, when there is cointegration, the long-run model should be specified. For the error correction term to be generated and specified together with the short-run model for an error correction model (ECM). Simply, on condition that the Bounds test provides cointegration among the variables, the next stage is to estimate the long-run levels model and obtain its residuals to generate the error correction term for the Error Correction Model (ECM). The ECM captures the model's convergence towards long-run equilibrium. In culmination, specifying the ECM utilises the short-run dynamics, the first difference of the variables. The significance and negativity of the coefficient of the error correction term signify the existence of a long-run relationship and convergence to equilibrium. Thus, the speed of adjustment towards equilibrium is indicated by the coefficient of the ECM term. The t-statistics of the ECM also capture the number of periods it would take to revert any shock.

This implies, from equation 3, the Error correction model could be estimated as;

$$\Delta lnSR_t = \phi_0 + \sum_{j=1}^{r} \phi_1 \Delta SR_{t-j} + \sum_{j=0}^{z} \phi_2 \Delta lnPP_{t-j} + \sum_{j=0}^{z} \phi_3 \Delta lnEXR_{t-j} + \sum_{j=0}^{z} \phi_4 \Delta lnTBR_{t-j} + \sum_{j=0}^{z} \phi_5 \Delta lnLr_{t-j} + \sum_{j=0}^{z} \phi_6 \Delta EA_{t-j} + \sum_{j=0}^{z} \phi_7 \Delta lnNF_{t-j} + \delta ECT_{t-1} + \mu_t \quad \text{(Eqn.6)}$$

Where $\phi_{0,\ldots,7}$ are the coefficients of the short-run model, and μ_t is the error term. While r is the autoregressive term and z distributed lag terms whereas δ is the coefficient of the error correction term (ECT) and speed of adjustment.

A Priori expectations of the Study

Table 2 indicates the signs expected between the variables of interest of the study, stock returns (SR) and petroleum prices (PP) based on empirical studies.

Table 2: A Priori Expectations of the Study

Variables	Pre-deregulation		Post-deregulation	
	Long-run model	Short-run model	Long-run model	Short-run model
PP → *SR*	+	+	-	-

Source: Field data (2021)

From Table 2, prices of petroleum products are expected to positively affect stock returns in the regulatory era. During the regulatory era with subsidy payments, prices of petroleum products were stable and could be predicted by firms. Shocks from the international oil market were shielded through subsidies. Thus, firms could be able to predict the effect of occasional increases in fuel prices and adjust accordingly.

In the deregulatory era, prices of petroleum products are expected to negatively affect stock returns. During the deregulatory period with subsidy removal, every shock from the international crude oil market will be transferred to domestic consumers of petroleum products. Thus, prices of petroleum products are volatile and unlikely to be predicted by firms. Consequently, firms may be

oblivious with rising costs in production operations, affecting stock returns eventually.

Schema for modelling ARDL

Following the guidelines for estimating the ARDL model by Pesaran *et al.* (2001) and Anokye and Peterson (2014), an ARDL model can be estimated with the following steps or schema:

1. Variables should be of I(0) and I(1), not I(2).
2. An unrestricted ECM is formulated.
3. The optimal lag structure is determined through information criteria.
4. Formulate ARDL(q,p) model
5. Check for auto-correlation, parameter stability, and heterogeneity in the model formulated.
6. Perform Bounds Test for evidence of co-integrating relationship.
7. When there is co-integration among the variables, estimate the long-run levels model and a restricted ECM.
8. The long-run levels model's result and the restricted ECM are utilised to measure the short-run dynamic model, the long-run equilibrating relationship among the variables.
9. Check for parameter stability using CUSUM and CUSUMQ.

Chapter summary

The methodological framework for this empirical work was highlighted in this chapter. The philosophical stance of this empirical work was the positivist research paradigm with a quantitative approach. Variables used included stock

market returns, petroleum prices, treasury bill rate, exchange rate, lending interest rate, economic activity, and inflation. The data spans from September 2009 to February 2021. The ARDL estimation technique was applied to investigate the effect of the downstream petroleum prices on stock market returns in Ghana before and after the deregulation was assessed.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This empirical work's paramount purpose was to assess downstream petroleum prices on asset returns in Ghana with respect to the pre- and post-deregulation era. The Autoregressive distributed lag (ARDL) estimator was applied to analyse the short- and long-run relationships among the variables of interest. The study employed control variables and also undertook diagnostic tests to ensure the estimates were robust. This chapter presents the empirical model results and implications.

Descriptive Statistics of the Dataset

Table 3 presents descriptive statistics on the measures of central tendency, variability, and normality (Jarque-Bera test (JB)) of the variables employed in the study. The observations (obs) and sum and sum of squared deviations (Sum^2 Dev.) were also reported. The variables included stock returns as the dependent variable (SR) and average prices of petroleum products (PP), the exchange rate (EXR), treasury bill rate, lending rate (LR), economic activity (EA), and inflation (NF) as the independent variables. Stock return was computed from stock indexes data collected from the Ghana stock exchange. A weighted average of diesel, petrol, and LPG prices was used as the proxy for the average prices of petroleum products. The exchange rate was expressed as the Ghana cedis to one unit of the US dollar. Lending rate data was also based on the average commercial bank lending interest rates, whereas inflation was the year-on-year change in the

consumer price index. The treasury bill rate was measured with the 91-day treasury bill rate. The BoG's composite index for economic activity (real growth) was used to measure economic activity.

Table 3: Descriptive Statistics of Variables

	SR	lnPP	lnEXR	lnTBR	lnLR	EA	lnNF
Mean	0.692	0.992	1.092	2.831	3.271	6.943	2.453
Median	0.551	1.127	1.326	2.690	3.294	5.500	2.375
Maximum	17.627	1.698	1.751	3.254	3.489	25.220	2.955
Minimum	-15.685	0.052	0.351	2.225	3.042	-10.470	2.028
Std. Dev.	4.922	0.532	0.499	0.299	0.101	6.126	0.270
Skewness	0.329	-0.341	-0.275	-0.010	-0.199	0.423	0.376
Kurtosis	4.856	1.728	1.483	1.658	3.047	3.611	1.784
JB	22.299	11.982	14.981	10.351	0.928	6.265	11.750
Probability	0.000	0.003	0.001	0.006	0.629	0.044	0.003
Sum	95.560	136.96	150.69	390.64	451.38	958.150	338.47
Sum^2 Dev.	3318.78	38.796	34.179	12.282	1.407	5141.76	10.015
Obs.	138	138	138	138	138	138	138

Source: Field data (2021)

From Table 3, all the variables had positive central tendencies. Matching the central tendencies to the respective maximum and minimum statistics, stock returns and economic activity had higher standard deviations. Petroleum prices, exchange rate, treasury bill rate, and lending rate are negatively skewed ($s<0$). The negative skewness recorded for these variables implies there are relatively higher values in the dataset for the respective variables than there are for low values. In other words, petroleum prices, exchange rate, treasury bill rate, and lending rate frequently recorded higher than lower statistics in the trends and vice versa for stock returns, economic activity, and inflation which are positively skewed. However, all variables were moderately skewed ($0 < |s| < 1$).

The distribution of all the variables formed a leptokurtic kurtosis (k>0). This implies that the distribution of the variables has more outliers relative to a normal distribution. The Jarque-Bera (JB) tests match the skewness and kurtosis of data to test if it matches a normal distribution. The null hypothesis for the JB tests indicates the normality of distribution. However, only lending rate matched a normal distribution.

Tests for Structural Shift

The literature has firmly established that most financial and macroeconomic variables mimic trends of immediate structural shifts and changes over time (Muthuramu, & Maheswari, 2019; Zarei, Ariff, Hook, & Nassir, 2015). These shifts could be due to major economic policy changes, economic booms or recessions, geopolitical developments, and currency devaluations (Ahmed, 2019). Consequently, in modelling the relationship between stock returns and petroleum prices in the presence of control variables, structural shifts should be considered. Therefore, this study suggests, due to the downstream petroleum deregulations in June 2015, there could be a structural shift in modelling the relationship between stock returns and petroleum prices in the presence of control variables.

According to Muthuramu and Maheswari (2019), when there are structural shifts or breaks in a model, not with a variable, the regression coefficients differ significantly when the dataset is split. However, the regression coefficients should not significantly differ when a dataset is split in accordance to the assumptions of econometrics modeling. Thus, in linear regression, when there are no structural shifts, the parameters of the regression remain stable over time. Most studies

recommended splitting the dataset upon considering structural shifts, especially as a result of economic reforms (Muthuramu, & Maheswari, 2019; Ahmed, 2019; Haq & Larsson, 2016; Zarei *et al.*, 2015). Therefore, the notable chow test by Chow (1960) was used to investigate whether the downstream petroleum deregulation reform in May 2015 (2015M05) and June 2015 (2015M06) caused a structural shift. According to Muthuramu and Maheswari (2019), the Chow test is used when the supposed breakpoints are known.

The Chow test provided a check on the significance of the structural shift from regulation to deregulation reform. The null hypothesis of the Chow tests is that there are no structural shifts. Table 4 presents the Chow test results.

Table 4: Chow Test Results for Structural Sift

Break date: 2015M05			
F-statistic	4.9488	Prob. F(7,124)	0.000
Log likelihood ratio	33.9986	Prob. Chi-Square(7)	0.000
Wald Statistic	34.6417	Prob. Chi-Square(7)	0.000
Break date: 2015M06			
F-statistic	5.3118	Prob. F(7,124)	0.000
Log likelihood ratio	36.1915	Prob. Chi-Square(7)	0.000
Wald Statistic	37.1828	Prob. Chi-Square(7)	0.000

Source: Field data (2021)

From Table 4, the F-statistics for both break dates were significant, indicating that the null hypothesis of no breakpoint of the Chow test is rejected. Consequently, for econometric analysis, the times series sample of the study was split into two samples, Pre-Deregulation (before June 2015) and Post-Deregulation (After May 2015) periods. Therefore, the Pre-deregulation time

series comprised the data from September 2009 to May 2015, whereas the post-deregulation time series comprised the data from June 2015 to February 2021.

Table 5, comprising the Pre- and Post-Deregulation periods, therefore presents descriptive statistics on the measures of central tendency, variability, and normality of the variables employed in the study.

Table 5: Descriptive Statistics of Variables of Pre and Post deregulation

	SR	lnPP	lnEXR	lnTBR	lnLR	EA	lnNF
Pre-Deregulation							
Mean	1.4877	0.5441	0.6533	2.8806	3.3173	10.0545	2.4432
Maximum	15.6557	1.1575	1.3593	3.2539	3.4889	25.2200	2.9124
Minimum	-15.6851	0.0524	0.3511	2.2246	3.1991	-1.7200	2.1282
Std. Dev.	4.7996	0.3496	0.3020	0.3485	0.0771	6.0730	0.2601
Skewness	-0.1369	0.3028	0.8656	-0.5277	0.9645	0.3331	0.3547
Kurtosis	5.7605	1.9520	2.5016	1.6786	3.1900	2.4657	1.5542
Jarque-Bera	22.1238	4.2117	9.3301	8.2225	10.8019	2.0965	7.4566
Probability	0.0000	0.1217	0.0094	0.0164	0.0045	0.3505	0.0240
Observations	69	69	69	69	69	69	69
Post-Deregulation							
Mean	-0.103	1.441	1.531	2.781	3.225	3.832	2.462
Maximum	17.627	1.698	1.751	3.232	3.375	13.950	2.955
Minimum	-9.681	0.957	1.250	2.492	3.042	-10.470	2.028
Std. Dev.	4.948	0.201	0.144	0.233	0.102	4.369	0.282
Skewness	0.808	-0.744	0.056	0.924	-0.228	-0.541	0.377
Kurtosis	4.846	2.525	1.721	2.200	1.749	5.423	1.913
Jarque-Bera	17.309	7.006	4.739	11.655	5.096	20.254	5.033
Probability	0.000	0.030	0.094	0.003	0.078	0.000	0.081
Observations	69	69	69	69	69	69	69

Source: Field data (2021)

From Table 5, it could be observed the descriptive statistics of the variables noticeably vary from the pre-deregulation periods to the post-deregulation periods.

The skewness makes use of the mean and standard deviation to describe the distribution of the data. Therefore, taking the skewness of the dataset, stock returns and treasury bill rates recorded negative skewness in the pre-deregulation period. This implies that there have mostly been higher than lower values for returns and treasury bill rates in the pre-deregulation period. However, in the post-deregulation periods, as positive skewness is recorded there have mostly been lower than higher values for returns and treasury bill rates. Therefore, stock returns frequently recoded higher returns in the pre-deregulation periods than the post-deregulation periods. The same could be said for treasury bill rates.

Nonetheless, for petroleum prices, exchange rates, and economic activity there have been records of positive skewness in the in the pre-deregulation periods. This indicates that there have mostly been lower than higher statistics for petroleum prices, exchange rates, and economic activity in the pre-deregulation periods, unlike the post-deregulation periods where negative statistics were recorded. Therefore, petroleum prices frequently recoded lower prices in the pre-deregulation periods than the post-deregulation periods where frequent higher prices were recorded. This is just as the same for exchange rates, and economic activity. Inflation on the other hand is positively skewed in both periods.

The distribution of all the variables formed a leptokurtic kurtosis ($k>0$) in both periods. This implies that the distribution of the variables has more outliers

relative to a normal distribution. The Jarque-Bera (JB) tests compares the skewness and kurtosis of data to test if it matches a normal distribution. Petroleum prices and economic activity have normal distributions in the pre-deregulation periods. Also, exchange rates, lending rates and inflation have normal distributions in the post-deregulation periods.

Unit root test for stationarity

Unit root test is critical to ascertain the time-series properties of a data set before an appropriate estimation technique could be applied. It tests for stationarity in the time series dataset. Unit root occurs when there is no constant mean, variance, and covariance for the lags of variables in a dataset (Brooks, 2014). Unit root is simply the cause for non-stationarity in a time series data set.

Table 6 indicates summarised outputs of the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PhP) unit root tests. The null hypothesis (variable has unit root) for both ADF and PP were rejected, and as such, variables were integrated at levels [I(0)] or first difference [I(1)]. All variables were significant at the 5% level of significance. Therefore, an ARDL model can be employed since none of the variables are stationary at the second difference, but I(0) and I(1).

In both Periods, stock returns and economic activity rejected the null hypothesis of unit root tests at levels. However, prices of petroleum products, exchange rate, treasury bill rate, lending rate, and inflation failed to reject the null hypothesis at levels. Nonetheless, these variables then rejected the null hypothesis of having unit root when subjected to unit root tests at first difference.

Table 6: ADF and PhP Unit Root Test Results

	PP				ADF				
	At Level t-Statistic		At 1st Diff. t-Statistic		At Level t-Statistic		At 1st Diff. t-Statistic		Decision
Pre-Deregulation									
SR	-5.987	(0.00)			-5.987	(0.00)			I(0)
lnPP	0.886	(0.99)	-8.817	(0.00)	0.451	(0.98)	-8.759	(0.00)	I(1)
lnEXR	1.362	(0.99)	-9.334	(0.00)	1.178	(0.99)	-3.668	(0.00)	I(1)
lnTBR	-1.405	(0.57)	-3.244	(0.02)	-1.961	(0.30)	-3.146	(0.02)	I(1)
lnLR	-2.088	(0.25)	-6.872	(0.00)	-2.088	(0.25)	-6.868	(0.00)	I(1)
EA	-3.329	(0.01)			-1.914	(0.32)	-4.068	(0.00)	I(1)
lnNF	-1.640	(0.45)	-5.050	(0.00)	-1.970	(0.29)	-4.847	(0.00)	I(1)
Post-Deregulation									
SR	-5.463	(0.00)			-5.450	(0.00)			I(0)
lnPOP	-1.147	(0.69)	-8.929	(0.00)	-1.232	(0.66)	-8.410	(0.00)	I(1)
lnEXR	-0.053	(0.95)	-33.006	(0.00)	-0.533	(0.88)	-6.006	(0.00)	I(1)
lnTBR	-1.786	(0.38)	-4.580	(0.00)	-1.948	(0.31)	-6.288	(0.00)	I(1)
lnLR	0.035	(0.95)	-13.142	(0.00)	-0.311	(0.91)	-13.334	(0.00)	I(1)
EA	-4.213	(0.00)			-4.246	(0.00)			I(0)
lnNF	-1.346	(0.60)	-8.227	(0.00)	-1.335	(0.60)	-8.223	(0.00)	I(1)

(…) indicate Probability values, significant at 5% significance level

Source: Field data (2021)

Lag Structure and Length Determination

The lag refers to the number of periods with retrogression in a variable that affects an estimation. The ARDL technique uses a number of lags to specify a model, from general to specific, which helps to adjust for autocorrelation and endogeneity issues (Haq & Larsson, 2016).

Due to the small sample of data sets representing both periods, the SIC was used to choose the optimal lag structure. According to Haq and Larsson (2016), the SIC provides robust estimates than the AIC in utilising small samples of datasets in the ARDL model. Table 7 presents the lag selection criteria for the variables used for the analysis.

Table 7: Lag selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
Pre-Deregulation						
0	-30.99	NA	8.37E-09	1.27	1.511	1.36
1	353.37	666.24	1.18E-13	-9.91	-7.96*	-9.15*
2	405.20	77.75*	1.15e-13*	-10.01*	-6.34	-8.57
3	453.70	61.43	1.39E-13	-9.99	-4.61	-7.89
Post-Deregulation						
0	-47.38	NA	1.23E-08	1.65	1.88	1.74
1	341.65	683.75	4.14E-13	-8.66	-6.80*	-7.93*
2	395.33	82.967*	3.77e-13*	-8.798*	-5.31	-7.42
3	436.10	54.35	5.50E-13	-8.55	-3.44	-6.53

* indicates lag order selected by the criterion

Source: Field data (2021)

Empirical results

After assessing the diagnostics of the models, there were robust models for making statistical inferences. Therefore, the bounds tests for cointegration and the short-run model estimation were ascertained. Following the guidelines for estimating the ARDL model by Pesaran *et al.* (1998; 2001) and Anokye and Peterson (2017), the ARDL models for this study were generated and diagnosed.

Bounds tests

In estimating the cointegration among the variables, the bounds testing approach by Peseran *et al.* (2001) was employed, with stock returns as the dependent variable. The test found cointegration among the variables in both the pre-and post-deregulation periods, as presented in Table 8. Consequently, the combined significance of lagged variables at levels is tested through the Wald test. The Wald test is carried out with the null hypothesis of no cointegration. Thus, the null hypothesis for the long-run relationship is that all the coefficients of the long-run equation are simultaneously equal to zero.

There is evidence of cointegration where the F test statistic is above the upper bound, I(1), or below the lower bound, I(0), critical values at a given significance level. From Table 8, there was evidence for a cointegrating relationship between stock returns and downstream petroleum prices in the presence of the control variables in both Pre and Post deregulation eras. For the Pre-deregulation era, the F-statistic (*F=6.387862*) was greater than the upper bound critical values at a 1% significance level. Similarly, for the Post-deregulation era, the F-statistics (*F=9.153606*) indicated a long-run relationship among the variables as the F-statistics is greater than the upper bound and significant at 1%.

However, Pesaran et al.'s (2001) critical values for determination of cointegration was contested by Narayan (2005); who contended that critical values reported by Pesaran et al.'s (2001) are representative for 500 to 1000 samples of observations. Thus, Narayan also reported critical values

representative for sample sizes ranging from 30 to 80 observations. Therefore, for robustness, both F statistics were compared to Narayan's (2005) critical values given the 69 observations for each period. Both F-statistics (6.387862 and 9.153606) were higher than the upper bounds ($I(1)$ = 3.921), at the 5 percent level of significance (Narayan, 2005).

Table 8: Bounds Test Results for Cointegration

Test Statistic	Value	Significance Level	I(0)	I(1)
Pre-Deregulation				
F-statistic	6.387862	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.50%	2.75	3.99
		1%	3.15	4.43
Post-Deregulation				
F-statistic	9.153606	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.50%	2.75	3.99
		1%	3.15	4.43

Source: Field data (2021)

These results are in line with that of Phong *et al.* (2019), who found a cointegrating relationship among Vietnam's stock index and some macroeconomic variables such as exchange rates, deposit interest rates, and inflation and money supply. Similarly, Tetteh *et al.* (2019), while employing the FMOLS and DOLS approach, also found a cointegrating relationship among stock returns and inflation, treasury bill interest rate, exchange rate, real GDP, and international oil prices. A recent study by Asravor and Fonu (2021) also affirmed the cointegration between Ghana's stock returns and major economic variables, using the Johansen test for cointegration. In the presence of stock returns, prices

of petroleum products, and other macroeconomic variables, Andoh (2019) also found a linear cointegration relationship.

Consequently, there has been empirical adequacy in the cointegrating relationship between Ghana's stock returns and major macroeconomic variables. Ghana's stock returns had a long-run linear relationship with the prevailing economic indicators regardless of the eras. Hence, this study found a long-run relationship between stock returns and downstream prices of petroleum products, exchange rate, treasury bill rate, lending rate, economic activity, and inflation.

Addressing Hypothesis One and three

Long-run model estimation

After establishing a cointegrating relationship among the variables, the long-run equation can be generated, as presented in Table 9.

Table 9: Long run levels Estimates for Pre and Post Deregulation

Variable	Coeff.	Std. Error	t-Stat.	Prob.	Statistics	
Pre-Deregulation						
C	-6.894	10.880	-0.634	0.529	R^2	0.357
lnPP	-21.240	7.287	-2.915	0.005	Adj. R^2	0.288
lnEXR	15.473	8.367	1.849	0.070	S.E. of reg.	3.765
lnTBR	13.341	2.561	5.209	0.000	SSR	793.608
lnLR	-0.359	0.645	-0.556	0.580	Log like.	-169.197
EA	0.233	0.113	2.052	0.045	F-stat.	5.181
lnNF	-9.557	6.878	-1.390	0.170	Prob(F-stat.)	0.000
					Mean dep. var	1.622
					S.D. dep.var	4.462
					SC	5.832
					DW stat.	1.757
Post-Deregulation						
C	-155.562	67.602	-2.301	0.025	R^2	0.370
lnPP	5.160	7.107	0.726	0.471	Adj. R^2	0.309
lnEXR	20.891	11.538	1.811	0.075	S.E. of reg.	4.112
lnTBR	-15.207	3.948	-3.851	0.000	SSR	1048.438
lnLR	39.501	14.582	2.709	0.009	Log like.	-191.780
EA	0.438	0.117	3.734	0.000	F-statistic	6.077
lnNF	11.784	5.419	2.174	0.034	Prob(F-stat.)	0.000
					Mean dep. var	-0.103
					S.D. dep.var	4.948
					SC	5.988
					DW stat.	1.823

Source: Field data (2021)

It is observed from Table 9 that changes in prices of petroleum products negatively affected Ghana's stock returns at the 5% level of significance in the Pre-deregulation era. Thus, a one percent increase in petroleum products prices results in a 0.21 unit decrease in stock returns in the long run. However, in the post-deregulation era, changes in the prices of petroleum products did not did not significantly affect stock returns at the 5% level of significance. The priori expectation of this research was not met. This implies that the stock returns of listed firms during the pre-deregulation periods were negatively affected by

changes in prices of petroleum products, albeit the government's initiative to protect the sectors of the economy through fuel subsidies during those periods. This indicates that listed firms bore the shocks from petroleum price changes through their costs of inputs, which subsequently affected their profitability and, thereby, stock returns.

Consequently, firms on the stock market either not respond to changes in the prices by adjusting their cost structures to deal with the negative impact of downstream petroleum prices on stock returns in the pre-deregulation periods. However, in the post-deregulation period, though characterised by frequent fluctuations and rising prices of petroleum products, downstream petroleum prices did not affect the returns of firms on the stock market. Nonetheless, in the post-deregulation era, the behaviour of petroleum prices on stock returns was insignificant. Firms on the stock market perhaps adjusted their cost structure to hedge their position against any fluctuations in the prices of petroleum products.

Besides, this revelation is consistent with Rentschler *et al.* (2017) results, which emphasised that deregulation characterised by fuel subsidy removal has significant impacts on the profitability of firms that use petroleum products. However, these firms either absorb the shocks or channel the shocks from changes in downstream petroleum prices to their clients or customers of their products or services (Rentschler *et al.*, 2017). Given the empirical analysis from this study, it seems that listed firm's limit or divert shocks of changes in petroleum products prices from affecting their performance by adjusting their cost of

production or cost structures in the long run during the post-deregulation era (Rentschler *et al.*, 2017).

Furthermore, the impact of petroleum downstream prices on stock returns in Ghana differs between the pre-and post-deregulation era. However, the relationship found is not consistent with the findings of Idris (2014), who found that downstream petroleum deregulation harmed firms in Nigeria. On the contrary, it could be inferred from these current results that the deregulation did not negatively impact listed firms' returns in Ghana.

Contrary evidence from Mokni (2020) revealed that domestic shocks from fuel prices of net oil-importing economies have a negative impact on stock returns of such economies. This evidence was true for Ghana during the pre-deregulation era. On the other hand, Zhu, Li and Li (2014), examining the effect of fuel shocks on Asia-Pacific and the Hong Kong stock market returns partially support the findings of this research. Zhu *et al.* (2014) concluded that the shocks from fuel prices have significant positive effects on the Asia-Pacific stock market returns, unlike the Hong Kong stock market returns. However, this research found an insignificant positive relationship in the deregulation era. Therefore, further literature on the relationship between stock returns and petroleum prices should consider the downstream petroleum regulations of economies before making empirical inferences. Consequently, Zhu *et al.* (2011) asserted that the nature of the stock return-fuel prices nexus is based on the prevailing economic structures peculiar to individual countries

Further, in the pre-deregulation era exchange rate was significant at the 10%, but not 5% level of significance, whereas treasury bill rate and economic activity were significant at 5% level of significance. Lending rate and inflation did not significantly affect stock returns. However, in the post-deregulation era, treasury bill rate, lending rate, economic activity and inflation significantly affected stock returns at a 5% level of significance, whereas at 10% level of significance, exchange rate affected stock returns.

Changes in exchange rates did not significantly affect stock market returns at a 5% significance level in both eras. On the other hand, changes in inflation did not significantly affect stock returns in the pre-deregulation era. However, in the post-deregulation era, changes in inflation significantly affected stock returns at a 5% significance level.

A one percent increase in exchange rates results in 0.15 and 0.20 units increase in stock returns in the pre- and post-deregulation periods, respectively. This indicates that the behaviour of exchange rates towards stock returns has not significantly changed across the eras. This finding corroborates with the findings of Issahaku *et al.* (2013) and Kuwornu (2012), who also found a positive long-run relationship between stock returns and exchange rates. The depreciation of the Ghana cedis to the US dollar increases the exchange rate. Since manufacturing firms also dominate the stock market, a positive relationship is justified because the firms' output becomes cheaper and attractive for exportation. This results in the profitability of the listed firms and investors return increases.

For treasury bill rate, a one percent increase results in stock returns increasing with 0.13 units in the pre-deregulation period. This is consistent with Kuwornu (2012), who found a significant positive relationship between stock returns and treasury bill rate. This could be as a result of firms' floatation of shares on the stock market to attract investment and compete any increase in treasury bill rates. With this approach, firms sell their stocks, expand their operations and returns accrue.

However, in the post-deregulation era, a one percent increase in treasury bill rate results in a 0.15 unit decline in stock returns. This is also justified because treasury bills serve as an alternative risk-free investment avenue for investors. The money market becomes lucrative than the stock market when the treasury bill rate increases. Tetteh *et al.* (2019) also had similar findings of the post-deregulation era, where a significant negative relationship was ascertained between stock returns and treasury bill rates. This implies that investors would opt to buy treasury bills than stocks when the treasury bill rate is high.

This result shares the same findings with Addo and Sunzuoye (2013), which concluded that the treasury bill rate negatively affects stock returns. Haq and Larsson (2016) acclaimed that the relationship among some macroeconomic variables varies with time and periods. Thus, the relationship between some macroeconomic variables may change in several eras, periods or time spans.

The lending interest rate was found to positively and significantly influence the stock market returns. Nevertheless, this was not the case in the pre-deregulation era. In the post-deregulation era, a one percent increase in lending

rate resulted in a 0.40 unit increase in stock returns. However, this is not in line with Amarasinghe (2015) findings, who found that increment in lending interest rate is a disincentive for investors to borrow funds for investment, which should ultimately cause stock returns to decline. Again, on the contrary, one would expect that a decline in lending interest rate would motivate firms to borrow funds for investment to increase their share value, thereby increasing returns on Ghana's stock exchange (Ngugi, 2014). It is worthy to note that as firms stay away from borrowing, commercial banks fail to make profits.

However, as commercial banks and other financial institutions dominate the Ghana stock exchange in terms of numbers and market capitalization, reduction in lending interest rates by the commercial banks reduces their profitability, thereby affecting their stock returns (Williams, 2014). This implies that any decline in the lending interest rate will result in a general decline in the Ghana stock exchange stock returns. Nevertheless, the decrease in the lending interest rate when the monetary policy rate is unfavourable would reduce banks' profitability, affecting returns on the stock exchange. This result is in line with findings by Ibrahim (2017), who found that stock returns of commercial banks are significantly affected by their lending interest rates.

Economic activity was also found to be a significant and positive determinant of stock returns. From the results, a one unit change in economic activity resulted in 0.23 and 0.44 units change in stock returns in the pre and post-deregulation eras, respectively. Increases in economic activities signal favourable economic conditions for firms' operation with investment and expansionary

motives, resulting in increases in cash flows, leading to the uprising expectation of large dividends by investors. This eventually leads to profitability and an increase in demand for shares resulting in higher stock prices. Although Khan and Khan (2018) found a cointegrating relationship between stock returns and economic activity, the impact of economic activity on stock returns was negative and not significant. However, Smajlbegovic (2019) found that economic activity predicts stock returns positively, such that a booming economic activity predicts the performance and earnings of listed firms.

The significance of inflation in determining stock returns was observed only in the post-deregulation periods. In the post-deregulation period, a one percent increase in inflation resulted in a 0.12 unit increase in stock returns. Issahaku *et al.* (2013) and Kuwornu (2012) share similar findings, indicating that inflation has a long run and positive relationship with stock returns. However, although Tetteh *et al.* (2019) found a positive relationship between inflation and stock returns, the relationship was insignificant. The positive and significant relationship indicates that investors are compensated for increases in inflation. This further connotes that, stocks on the GSE cannot be used as a hedge against inflation. Thus, in times of higher inflation, higher stock returns are required (Kuwornu, 2012).

Thus far, the results of this study reject the null hypothesis of no long-run effect of downstream petroleum prices on stock market returns before the deregulation. However, the study fails to reject the null hypothesis of no long-run

effect of downstream petroleum prices on stock market returns after the deregulation.

Addressing Hypotheses Two and Four:

Short-run model estimation

Table 10 presents the short-run estimation of the relationship between prices of petroleum products and stock returns in the presence of control variables. After the establishment of the long-run model, the short-run model is then estimated.

Table 10: Short-run Estimation for Pre and Post deregulation

Variable	Coef.	Std. Error	t-Stat.	Prob.	Diagnostics	
Pre-Deregulation						
C	-0.007	0.590	-0.012	0.991	R^2	0.463
D(lnPP)	-17.397	9.394	-1.852	0.070	Adj. R^2	0.393
D(lnEXR)	14.408	18.268	0.789	0.434	S.E. of reg.	3.733
D(lnTBR)	18.151	7.982	2.274	0.027	SSR	752.439
D(lnLR)	-0.235	0.790	-0.297	0.768	Log like.	-165.356
D(EA)	0.121	0.097	1.241	0.220	F-statistic	6.641
D(lnNF)	-13.831	12.973	-1.066	0.291	Prob(F-statistic)	0.000
ECT(-1)	-0.896	0.138	-6.492	0.000	Mean dep. var	0.016
					S.D. dep.var	4.791
					SC	5.867
					DW stat.	1.922
Post-Deregulation						
C	-0.564	0.572	-0.986	0.328	R^2	0.490
D(lnPP)	18.635	9.982	1.867	0.067	Adj. R^2	0.429
D(lnEXR)	23.199	24.743	0.938	0.352	S.E. of reg.	4.236
D(lnTBR)	-27.021	12.684	-2.130	0.037	SSR	1058.80
D(lnLR)	-15.232	30.694	-0.496	0.622	Log like.	-187.536
D(EA)	0.125	0.134	0.936	0.353	F-statistic	8.093
D(lnNF)	-5.581	9.233	-0.604	0.548	Prob(F-statistic)	0.000
ECT(-1)	-0.731	0.130	-5.641	0.000	Mean dep. var	0.224
					S.D. dep.var	5.608
					SC	6.100
					DW stat.	2.010

Note: ECT implies Error Correction Term
Source: Field data (2021)

From Table 10, changes in the prices of downstream petroleum products had no significant effect on stock returns at the 5% level of significance but were near significance at 7%. However, this relationship differed in the pre- and post-deregulation periods. In the pre-deregulation period, a one percent increase in the downstream petroleum prices resulted in a 0.17 unit decrease in stock returns in the short run. The insignificance of the impact of petroleum prices on stock returns in the short-run dynamics, at the 5 percent significant level, could be

explained by the discounted cash flow approach of equity valuation. The approach suggests prices of petroleum products affect the production costs of listed firms, which is the first impact of shocks in fuel prices on a listed firm within the short term. Consequently, the shock alters profit margins and eventually influences listed firms' stock prices in the long run (Andoh, 2019). Thus, significant relationship in the long-run dynamics.

This indicated that listed firms, possibly, did not adjust the costs of productions to compensate for any changes in the prices of petroleum products. As already asserted, this could be due to the stability in the prices of petroleum products in the pre-deregulation era. Thus, listed firms were oblivious in taking into consideration the effect of petroleum prices on their production costs. The relationship of petroleum prices with stock returns has been fairly established in the literature. The result for the pre-deregulation era conforms with Nyarko (2018), who found a significant and negative relationship between stock returns and downstream prices on a dataset spanning from 2003 to 2014. However, Kpanie *et al.* (2014) found a positive short-run effect of oil price shocks on Ghana's stock returns from a quarterly dataset of 1995 to 2011 while employing the vector error correction model (VECM).

Nevertheless, Haq and Larsson (2016) attested to the changes in relationships between major economic variables due to policy changes. Consequently, in the post-deregulation era, downstream petroleum products' prices positively affected stock returns in the short-run but were not significant at 5% level of significance. For the post-deregulation era, an immediate one percent

increase in the prices of petroleum products in the short-run, at a 7% level of significance, increased stock returns by 0.19 units. In the same direction, Waheed, Wei, Sarwar, & Lv (2018) found that any changes in the prices of petroleum products have positive effects on listed Pakistani firms.

The research finding supports Rentscheler and Kornejew (2016) findings that, when there are subsidies removal or deregulation, any price shocks from petroleum products affect firms. As such, firms that rely on petroleum products respond immediately and pass on the shocks to consumers or clients. Bazilian and Onyeji (2012) found that any price shocks resulting from fuel subsidies removal significantly affect the cost structures of firms and, eventually, their profitability. Consequently, listed firms perhaps respond quickly to these shocks by diverting these increased shocks to their customers.

However, Ayakwa and Mohammed (2014) asserted that any sudden pass on of shocks from firms to consumers leads to consumers also eventually responding by eventually switching to or patronising alternate products or services. This points to the insignificant long-run relationship between stock returns and downstream prices. In the long run, any significant short-term increases in stock returns are corrected or made insignificant by consumers eventually switching to alternative products services. Thus, firms are unable to last the significant return made in the short run.

From the control variables, only treasury bill rate was a significant determinant of stock returns. A one percent increase in the treasury bill rate in the pre-deregulated era increased stock returns by 0.18 units. This agrees with

Issahaku *et al.* (2013) findings, who found a negative relationship between stock returns and treasury bill rates in the short run. However, in the post-deregulation era, a one percent increase in treasury bill rate decreased stock returns by 0.27 units. This therefore translated to the long-run findings. The findings from Kuwornu (2012) also affirms the positive short-run relationship between stock returns and treasury bill rates. Lending rate, economic activity, and inflation did not significantly affect stock returns in the short run for both eras.

The ECT indicate the long-run equation as confirmed by the negative coefficient and its statistical significance. This is evident for both eras. The ECT represents the speed of adjustment to restore to equilibrium any disturbance or disequilibrium in the model. For the pre-deregulation era, the ECM having a coefficient of -0.896 and t-statistic of -6.492 indicate that; about 90% of the deviation from the path to long-run equilibrium following a short run shock or disequilibrium is corrected in each month. This would approximately take six months to restore to the equilibrium path. For the post-deregulation period, about 73% of the deviation from the path to long-run equilibrium following a short-run deviation is corrected in each month which take approximately 6 months to restore to the equilibrium path.

In conclusion, albeit the cointegration relationship between downstream petroleum prices and stock market returns in the presence of control variables, there is no significant short-run effect of the downstream petroleum prices on stock returns in the pre- and post-deregulation periods in Ghana. However, the nature of the relationship differs across eras. Therefore, this research fails to reject

the null hypotheses of no short-run effect of downstream petroleum products' prices on stock returns for both eras.

Diagnostics of Pre and Post-deregulation Models

Model diagnostics such as the serial correlation test, heteroskedasticity test, and parameter stability test were conducted in other to make inferences from robust estimations.

Serial Correlation Test

Serial correlation occurs when the error term for a given period is correlated with that of other periods within a given model. Table 11 presents the test result for serial correlation for both periods. The Breusch-Godfrey Serial Correlation LM Test was utilised to ascertain the serial correlation of the model. From 11able 8, the Breusch-Godfrey Serial Correlation LM Test at 5% level of significance fails to reject the null hypothesis of no serial correlation for both models given the respective F-statistics' (2.833247 and 0.648153) with the respective probability values ($p = 0.0678$ and $0.5268 > 0.05$).

Table 11: Breusch-Godfrey Serial Correlation LM Test

	Pre-Deregulation	Post-Deregulation
F-statistic	2.833247	0.648153
Probability F(2,53)	0.0678	0.5268
Obs*R-squared	6.08506	1.486581
Probability Chi-Square(2)	0.0477	0.4755

Source: Field data (2021)

Heteroskedasticity Test

Results for heteroskedasticity for both models are summarised in Table 12. Heteroskedasticity occurs when the error term's variance is not constant with

a given model. Simply, heteroskedasticity is when there is no equality in the residuals' variances over a range of the measured values (Brooks, 2014). The Breusch-Pagan-Godfery test was employed to ascertain the presence of heteroskedasticity in the models. The test for heteroskedasticity rejected the null hypothesis at a 5% significance level for both models. This is evident by the respective F-statistics' (*1.956445* and *1.836561*) with the probability values (p = *0.078* and *0.0967 > 0.05*).

Table 12: Breusch-Pagan-Godfery Test for Heteroskedasticity

	Pre-Deregulation	Post-Deregulation
F-statistic	1.956445	1.836561
Prob.	0.078	0.0967
Obs*R-squared	12.55973	11.99907
Prob. Chi-Square	0.0836	0.1006
Scaled explained SS	14.2355	22.84994
Prob. Chi-Square	0.0471	0.0018

Source: Field data (2021)

Specification Error Test

Ramsey's regression specification error test was conducted to check for specification errors in the models. There are specification errors or misspecification when the non-linear forms of the fitted values have power in explaining the regressors of a model (Brooks, 2014). When this happens, there is a need to adjust the model to an appropriate functional form. From Table 13, the test results showed that there was no specification error given that the squared

fitted regressors were not significant for both models ($p = 0.9499$ and $0.4785 > 0.05$).

Table 13: Ramsey Regression Specification Error Test

	Pre-Deregulation			Post-Deregulation		
	Value	df	Prob.	Value	df	Prob.
t-statistic	0.063151	54	0.9499	0.713266	54	0.4785
F-statistic	0.003988	(1, 54)	0.9499	0.508748	(1, 54)	0.4785

Source: Field data (2021)

Parameter Stability Test

Muthuramu and Maheswari (2019) emphasised that the long-run multipliers of models should be consistent, which entails testing for stability in the parameters of the error correction model. In appraising the stability of the parameters of models for both periods, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) test were estimated. There is parameter stability when the parameters estimated do not vary over the period. Figure 7 shows the CUSUM and CUSUMQ tests for parameter stability.

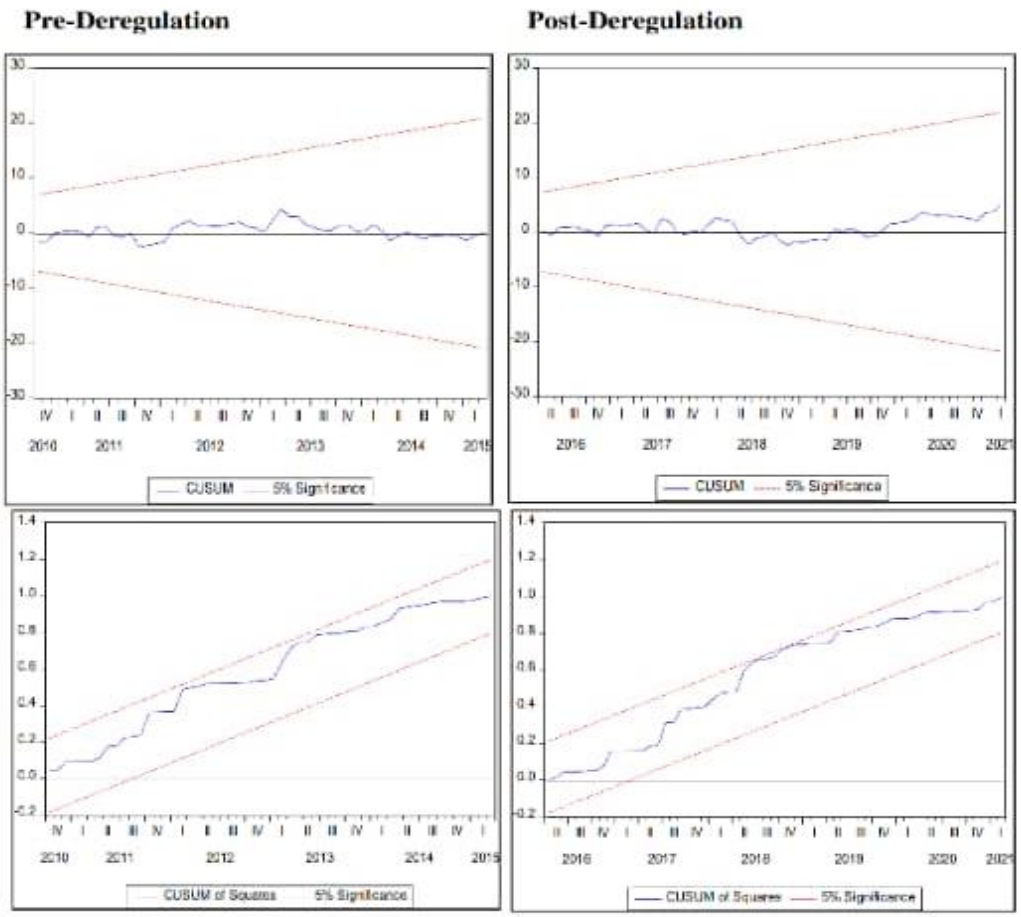

Figure 7: CUSUM and CUSUMQ Stability Test
Source: Field data (2021)

Given that the CUSUM and CUSUMQ of both models do not break the 5% confidence bound, then the parameters are stable. Therefore, inferences could be made on the robust estimations the models provide.

Multicollinearity Test

Preliminary analysis of the relationship among the variables entails that assumptions regarding a robust model must be met. Brooks (2014) asserted that estimation of the problem of multicollinearity occurs when two or more of the regressors in a model are highly correlate with another. Although some level of

correlation among the regressors are allowable very high correlation tends to affect the model. Table 14 presents pairwise correlation analysis among the variables of the study.

Table 14: Correlation Results for Multicollinearity

	SR	lnPP	lnEXR	lnTBR	lnLR	EA	lnNF
Pre-deregulation							
SR	1.00						
lnPP	-0.13	1.00					
lnEXR	-0.10	0.77	1.00				
lnTBR	0.24	0.40	0.44	1.00			
lnLR	-0.03	-0.42	-0.35	0.38	1.00		
EA	-0.02	0.05	-0.05	-0.61	-0.55	1.00	
lnNF	-0.07	0.40	0.50	0.78	0.58	-0.60	1.00
Post-deregulation							
SR	1.00						
lnPP	0.12	1.00					
lnEXR	0.05	0.83	1.00				
lnTBR	-0.28	-0.83	-0.70	1.00			
lnLR	0.03	-0.78	-0.74	0.66	1.00		
EA	0.34	0.17	0.20	-0.12	-0.22	1.00	
lnNF	-0.06	-0.88	-0.83	0.83	0.78	-0.15	1.00

Source: Field data (2021)

It is observed from Table 14 that, economic indicators such as exchange rate is highly correlated downstream petroleum prices in both the regulatory and the deregulatory era. And there are more high correlations among the variables in the post-deregulation era. Nonetheless, all correlations among variables from both eras do not pose the threat of multicollinearity given the recommended correlation threshold of 0.9 (Asterious & Hall, 2016). Asterious and Hall (2016) stated that, beyond the correlation threshold of 0.9, problems can begin to occur in a model. Appendix C comprise correlations among the variables and level of significance.

Chapter Summary

Guided by the Arbitrage Pricing Theoretical Model superimposed in the ARDL model, the results from the analysis were discussed with respect to the research hypotheses. This research revealed that the relationship between shocks from petroleum product prices and stock returns differed across pre and post-deregulation eras. The adverse effect of instabilities in prices of downstream petroleum products on stock returns has been limited in the post-deregulation era. The results indicate a significant negative long-run impact of downstream petroleum prices on asset returns in the pre-deregulation era, unlike in the post-deregulation era where there was a positive relationship, although not significant. Considering the short term, there was an insignificant relationship between asset returns and downstream petroleum products prices in both periods, at 5% level of significance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This empirical work analysed the effect of downstream petroleum price on asset returns in light of the pre- and post-deregulatory eras in Ghana. Guided by the study's main purpose, the long-run and short-run effect of downstream petroleum prices on asset returns in the pre-deregulation era was compared and contrasted against the post-deregulation era. This last section, therefore, convey the summary of the econometric outcomes, the conclusions drawn, and the recommendations proposed by the study. Propositions for further empirical investigations were also highlighted.

Summary

The study's general purpose was to analyse the effect of downstream petroleum prices on stock returns in the pre- and post-deregulatory eras in Ghana. Consequently, four specific research objectives were formulated to compare and contrast the effect of downstream petroleum prices on stock returns in Ghana's pre- and post-deregulatory eras. From the research objectives, suitable research hypotheses were formulated as well.

The Arbitrage Pricing Theory, Theory of Economic Regulation and Price Theory were used to underpin the theoretical bases of the study. The Arbitrage Pricing Theory proposes that asset returns are determined by multiple sources of system risks or risk factors. As such, macroeconomic fundamentals or indicators form major risk factors for determining risk premiums and asset returns.

Consequently, changes in downstream petroleum prices serve as a major macroeconomic risk factor that can drive inflation in an economy and alter firms' cost structures, affecting their profitability and, eventually, stock returns.

On the other hand, the Price Theory emphasises that sellers adjust their prices instantly to new cost conditions as driven by their profit-maximising behaviour or motive in a competitive market. Thus, in a liberalised competitive market without restrictions, the forces of demand and supply determine the ultimate prices of a product. Consequently, in the pre-deregulation era, where downstream petroleum prices were regulated and subsidised by the Government of Ghana, the OMCs sold petroleum products at a subsidised cost. Prices of downstream products were therefore relatively stable in the pre-deregulation era for firms' operations. However, in the post-deregulation era, where the Government of Ghana cut subsidising prices of downstream petroleum products and liberalised the OMCs to set their prices, there have been fluctuations in petroleum products' prices for listed firms' operations.

Extant literature reviewed indicated the proliferation of studies examining the effect of international oil price shocks on the stock market returns of various economies while employing varied econometric models. Studies examining the similar phenomenon and the role of the downstream petroleum deregulation on listed firms in Ghana have been scanty. This served as the motivation to conduct this study.

Employing the ARDL estimation technique, the monthly data set for the study was split into two, 2009M09 to 2015M05 for the pre-deregulation era and

2015M06 to 2021M02 for the post-deregulation periods. This helped in comparing and contrasting the relationship between stock returns and downstream petroleum prices. Aside the variables of interest, stock market returns and downstream petroleum prices, control variables used were exchange rate, treasury bill rate, lending interest rate, economic activity and inflation.

Summary of key findings

The econometric results found a cointegrating relationship among stock returns, downstream petroleum prices, exchange rates, treasury bill rate, lending interest rate, economic activity, and inflation in the pre- and post-deregulation eras. The long-run levels equations were then estimated for both eras. In the long term, it was observed that, in the pre-deregulation periods, approximately 90% of the disequilibrium in the short run was corrected every month to restore the model to equilibrium. However, in the post-deregulation periods, approximately 70% of the disequilibrium in the short run was corrected every month to restore the model to equilibrium.

For the pre-deregulation periods, petroleum price evidently had a significant negative effect on stock returns in the long term, while in the short term, there was an insignificant negative relationship between petroleum prices and stock returns. However, for the post-deregulation era, petroleum prices had an insignificant impact on stock returns in the long run. In contrast, there was a positive, but insignificant effect of petroleum prices on stock returns in the short run, at a 5% level of significance.

Furthermore, exchange rates did not significantly affect stock returns in both the long- and short-term dynamics of both periods. On the other hand, treasury bill rates had a significantly positive impact on stock returns in the pre-deregulation era. Yet, in the post-deregulation era, the treasury bill rate had a significantly negative impact on stock returns. For the pre-deregulation periods, lending interest rates did not impact stock returns significantly, unlike the post-deregulation periods, where lending interest rates had a significantly positive impact on stock returns in the long term. However, in the short-run dynamics, lending interest rate did not significantly affect stock returns in both eras.

Moreover, economic activity was revealed to have a significant and positive effect on stock returns in the long run in both the pre-deregulation and post-deregulation periods. Inflation was observed to have a positive and significant effect on stock returns only in the post-deregulation periods. In the short run, both economic activity and inflation were revealed to not significantly affect stock returns.

Conclusions

The paramount objective of this empirical work was to examine the effect of downstream petroleum price on stock returns in light of Ghana's pre- and post-deregulatory periods. The study applied the ARDL estimation technique after a test of structural break. The study focused on downstream petroleum prices and stock market returns as the main variables of interest, whereas exchange rate, inflation, treasury bill rate, lending rate, and economic activity as control variables.

The key findings from this study provide insights for essential conclusions to be drawn. A cointegrating relationship between stock returns and downstream prices in the presence of control variables suggests the dependence of listed firms on the utilisation of petroleum products in their operations. Any disequilibrium resulting from short-run shock during the pre-deregulation periods was restored faster to the long-term equilibrium, at a rate of approximately 90%, than for the post-deregulation era, which had a speed of adjustment of 73%.

In addition, listed firms' behaviour in responding to changes in petroleum prices has changed following the deregulation in June 2015. As listed firms may have ignored the shocks from downstream petroleum prices in the pre-deregulated era, they eliminated or diverted the shocks from influencing returns on investment in the post-deregulated era. Thus, it could be concluded that the deregulation did not have an adverse effect on investors' returns. However, it could be feared that listed firms may pass on the costs or fuel price shocks to the end-users of their products or services.

This study has shown that the Government of Ghana's fears of shielding the economy by subsidizing petroleum products was a phantom. During the subsidies (pre-deregulation) era, listed firms may have been oblivious to the effect of petroleum price; thus, the negative impact. However, in the absence of subsidies (post-deregulation), there have been fluctuations in petroleum prices, and firms on the GSE may have altered their cost structures to limit the impact of downstream petroleum price shocks on their profitability. Thus, the insignificant impact.

Finally, the relationship among the macroeconomic variables varied before and after the deregulation policy. This indicates that some economic policies relating to the variables used in this research by the government to influence stock performance could be ineffective and may be needed to be reviewed.

Recommendations

The subsequent recommendations are proffered based on the research findings and conclusions.

Pertaining to the cointegrating relationship among stock returns, downstream petroleum prices, and the other major macroeconomic performance indicators, it is recommended that the government develop policies that address economic challenges to stimulate stock performance on the Ghana stock exchange. Especially, since some macroeconomic elements impact stock returns, both in the long and short run, this research recommends the government ensure a stable macroeconomic environment to boost the growth of Ghana's stock market.

Further, investors, firms, and financial experts should take into cognisance the downstream petroleum pricing policies of the economy to accurately analyse and price assets. This is because the link between downstream petroleum prices and stock returns varied before and after the deregulation policy.

In addition, the relationship among asset returns, fuel prices and the other macroeconomic elments (exchange rate, treasury bill rates, lending rates, economic activity, and inflation) has been evident to vary before and after the deregulation periods. Therefore, it is recommended that, policymakers review

policies, affecting fuel prices, exchange rates, treasury bill rates, lending rates, economic activity, and inflation, that influenced stock market returns which were implemented before the deregulation. Thus, the same relationships do not exist before and after the deregulation. Again, it is recommended that the government should not revert the deregulation policy, as the returns on stocks are not affected.

Suggestions for further research

As this empirical work was conducted using listed companies on the GSE, this work could be replicated in other parts of the world to add to the validity and reliability of this study.

Further studies could employ other control variables and different econometric frameworks such as the the Non-linear Auto-regressive Distributed Lag (NARDL), Markov Switching model, and other models to further examine the phenomenon.

Follow-on studies could analyse the implication of the deregulation policy on the market capitalization of the segments of the listed companies like manufacturing firms on the GSE.

Finally, coming studies may employ a broad index of prices on petroleum products aside from the diesel, petrol, and LPG prices used in this study.

REFERENCES

Acheampong, T., & Ackah, I. (2015). Petroleum product pricing, deregulation and subsidies in Ghana: Perspectives on energy security. *Munich Personal RePEc Archive,* 66116, 1-13. Retrieved from: https://mpra.ub.uni-muenchen.de/66116/

Addae, E., & Ackah, I. (2017). Inflation dynamics in pre and post deregulation era in Ghana: Do petroleum prices have any influence? *Munich Personal RePEc Archive,* 77496, 1-55. Retrieved from: https://mpra.ub.uni-muenchen.de/77496/

Addo, A. & Sunzuoye, F. (2013). The impact of treasury bill rate and interest rate on the stock market returns: Case of Ghana stock exchange. *European Journal of Business and Economics, 8*(2), 15-24.

Ahmed, R. & Mustafa, K. (2012). Real stock returns and inflation in Pakistan. *Research Journal of Finance and Accounting, 3*(6), 97-102.

Aliyu, S. U. R. (2012). Does inflation have an impact on stock returns and volatility? Evidence from Nigeria and Ghana. *Applied Financial Economics, 22*(6), 427-435.

Amarasinghe A., (2015). Dynamic relationship between interest rate and stock price: empirical evidence from Colombo Stock *Exchange. International Journal of Business and Social Science, 6* (4), 36-42.

Andoh, E. (2019). *Effect of Petroleum price on Stock Market returns in Ghana*. Unpublished doctoral dissertation, Department of Finance. University of Cape Coast. Cape Coast, Ghana.

Anokye, A. M., & Peterson, O. J. (2017). *Financial modelling: an example-based hand book*. Hauppauge, New York: Nova Science Publishers, Inc.

Asravor, R. K., & Fonu, P. D. D. (2021). Dynamic relation between macroeconomic variable, stock market returns and stock market development in Ghana. *International Journal of Finance & Economics, 26*(2), 2637-2646.

Asteriou, D. & Hall, S. G. (2016). *Applied econometrics* (3rd ed). London, United Kingdom: Palgrave Macmillan.

Ayakwah, A., & Mohammed, J. (2014). Fuel price adjustments and growth of SMEs in the New Juaben Municipality, Ghana. *International Journal of Small Business and Entrepreneurship Research, 2*(3), 13-23.

Bacon, R. W. (1991). Rockets and feathers: the asymmetric speed of adjustment of UK retail gasoline prices to cost changes. *Energy economics, 13*(3), 211-218.

Baranidharan, S., & Alex, A. (2020). Volatility spillover of exchange rate on stock market evidence from South Africa. *Asian Journal of Economics, Finance and Management, 2*(3), 26-34.

Baye, M. R. & Prince, J. (2014). *Managerial economics and business strategy* (8th ed.). New York, USA: McGraw-Hill.

Bazilian, M. & Onyeji, I. (2012). Fossil fuel subsidy removal and inadequate public power supply: Implications for businesses. *Energy Policy 45*, 1–5.

Becker, G. S. (1983). A theory of competition among pressure groups for political influence. *Quarterly Journal of Economics*, *23*, 371-400.

Becker, G. S. (1985). Public policies, pressure groups, and dead weight costs. *Journal of Public Economics, 28*, 329-347.

Bello, T. (2019). Law and economics of deregulation in downstream sector of the Nigerian oil and gas. Retrieved from: https://papers.ssrn.com/sol3/papers .cfm?abstract_id=3474477

Benada, L. (2014). Effect of crude oil on the Prague stock exchange. *Procedia-Social and Behavioral Sciences, 109*, 1316-1321.

Bhattacherjee, A. (2012). Social science research: Principles, methods, and practices. Retrieved from: http://scholarcommons.usf.edu/oa_textbooks/3.

Bobai F. D. (2012). An analysis of the relationship between petroleum prices and inflation in Nigeria. *International Journal of Business and Commerce, 1*(12), 1-7.

Bodie, Z., Kane, A., & Marcus, A. (2010). *Investments*. New York City, USA: McGraw-Hill/Irwin.

Brooks, C. (2014). *Introductory econometrics for finance*. USA: Cambridge University press.

Chamber of Bulk Oil Distributors, Ghana (2019). Petroleum industry report 2019. Retrieved from: https://cbodghana.com/downloads/.

Chou, K. W. & Tseng, Y. H. (2015). Oil prices, exchange rate, and the price asymmetry in the Taiwanese retail gasoline market. *Economic Modelling*, *52*(2015), 733-741.

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica: Journal of the Econometric Society*, 591-605.

Coady, D., Gillingham, R., Ossowski, R., Piotrowski, J., Tareq, S., & Tyson, J. (2010). Petroleum product subsidies: Costly, inequitable, and rising.

Consumer Unity and Trust Society (2015). *Will the deregulation of the petroleum sector result in competition? (No. 1/2015).* Accra, Ghana: CUTS International.

Cooke, E. F. A., Hague, S., Tiberti, L., Cockburn, J., & Lahga, A. (2016). Estimating the impact on poverty of Ghana's fuel subsidy reform and a mitigating response. *Journal of Development Effectiveness, 8*(1), 105-128.

Crawford, G. (2012). *Ghana's fossil-fuel subsidy reform (Case study 09).* Retrieved from: Sussex, UK: Institute of Development Studies.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approach*. Sage publications.

Degiannakis, S., Filis, G., & Arora, V. (2017). *Oil prices and stock markets* (EIA Working Paper No. 20585). Washington, DC: Energy Information Administration.

Deng, C., Jiang, Z., & Sun, C. (2018). Estimating the efficiency and impacts of petroleum product pricing reforms in China. *Sustainability, 10*(4), 1-17.

Engle, R. F. & Granger, C. W. J. (1987). Co-integration and error correction: representation, estimation, and testing. Econometrica: *Journal of the Econometric Society, 55*(2), 251-276.

Frimpong, S. (2011). Speed of adjustment of stock prices to macroeconomic information: Evidence from Ghanaian stock exchange (GSE). *International Business and Management, 2*(1): 151-156.

Gatsi, J. G. (2011). Understanding investment management: The problem of content and definition. *Available at SSRN 1739787*.

Gatsi, J. G. (2017). *Oil and gas management in Ghana*. Bloomington, Indiana: Xlibris Publishing Corporation.

Gatsi, J. G., Appiah, M. O., & Wesseh, P. K. (2016). Exchange rates and stock prices in Ghana. *Journal of Applied Business and Economics, 18*(3), 63-76.

Gatsi, J. G., Gadzo, S. G., Anipa, C. A. A., & Kosipa, S. (2015). Empirical analysis of macroeconomic factors and crude oil prices in Ghana. *International Journal of Economics, Commerce and Management*, *3*(9), 217-235.

Ghana Stock Exchange (2016). *Market report 2016*. Accra, Ghana: Ghana Stock Exchange Commission.

Haq, S. & Larsson, R. (2016). *The dynamics of stock market returns and macroeconomic indicators: An ARDL approach with cointegration.* Unpublished master's thesis. KTH Industrial Engineering and Management Industrial Management. Stockholm, Sweden.

Hertog, J. D. (2010). Review of economic theories of regulation. *Koopmans Research Institute, 10*(18), 1-59.

Hu, C., Liu, X., Pan, B., Chen, B., & Xia, X. (2018). Asymmetric impact of oil price shock on stock market in China: A combination analysis based on SVAR model and NARDL model. *Emerging Markets Finance and Trade*, *54*(8), 1693-1705.

Ibrahim, A. M. (2017). *The effect of lending interest rates on stock returns of commercial banks listed in Nairobi securities exchange in Kenya*. Unpublished master's thesis. University of Nairobi. Nairobi, Kenya.

Issahaku, H., Ustarz, Y., & Domanban, P. B. (2013). Macroeconomic variables and stock market returns in Ghana: Any causal link? *Asian Economic and Financial Review, 3*(8), 1044-1062.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica: *Journal of the Econometric Society, 59*(6), 1551-1580.

Kayalar, D. E., Küçüközmen, C. C., & Selcuk-Kestel, A. S. (2017). The impact of crude oil prices on financial market indicators: copula approach. *Energy Economics, 61*(2017),162-173.

Khan, J., & Khan, I. (2018). The impact of macroeconomic variables on stock prices: A case study of Karachi Stock Exchange. *Journal of Economics and Sustainable Development, 9*(13), 15-25.

Kirchgassner, G., & Kubler, K., (1992). Symmetric or asymmetric price adjustment in the oil market: an empirical analysis of the relations between international and domestic prices in the Federal Republic of Germany 1972–1989. *Energy Economics, 14*(3), 171–185.

Korinek, A. & Kreamer, J. (2013). *The redistributive effect of financial deregulation* (NBER Working Paper No. 19572). Cambridge, Massachusetts: National Bureau of Economic Research.

Kpanie, A. F. & Esumanba, S. V. (2014). Relationship between stock market performance and macroeconomic variables in Ghana. *Journal Issues in Business Management and Economics, 2*(3), 046-053.

Kpodar, K., & Imam, P. A. (2020). *To pass (or not to pass) through international fuel price changes to domestic fuel prices in developing countries: What are the drivers?* (IMF Working Paper No. WP/20/194). Washington, DC: International Monetary Fund.

Kremer, P. J., Talmaciu, A., & Paterlini, S. (2018). Risk minimisation in multi-factor portfolios: What is the best strategy? *Annals of Operations Research, 266*(1), 255-291.

Kuwornu, J. K. M. & Nantwi, O. W (2011). Macroeconomic variables and stock market returns: Full information maximum likelihood estimation. *Research Journal in Finance and Accounting, 2*(4), 49-63.

Kuwornu, J. K. M. (2012). Effect of macroeconomic variables on the Ghanaian stock market returns: A co-integration analysis. *Economics and Informatics, 4*(2), 1-12.

Lin, B., Wesseh Jr, P. K., & Appiah, M. O. (2014). Oil price fluctuation, volatility spill over and the Ghanaian equity market: Implication for portfolio management and hedging effectiveness. *Energy Economics*, *42*, 172-182.

Linter, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics*, *47*(1), 13-37.

Long, S., & Liang, J. (2018). Asymmetric and nonlinear pass-through of global crude oil price to China's PPI and CPI inflation. *Economic research-Ekonomska istraživanja*, *31*(1), 240-251.

Maduka, A., Ihonre, H., & Anochiwa, L. (2015). Impact of deregulation of the downstream oil sector on economic growth in Nigeria. *EPRA International Journal of Economic and Business Review*, *3*(4), 19-30.

Moghaddam, H. & Wirl, F. (2018). Determinants of oil price subsidies in oil and gas exporting countries. *Energy Policy*, *122*(2018), 409-420.

Mohanty, S.K., Nandha, M., Turkistani, A.Q., & Alaitani, M.Y. (2011). Oil price movements and stock market returns: Evidence from Gulf Cooperation Council (GCC) countries. *Glob. Financ. J. 22*(1), 42–55.

Mokni, K. (2020). Time-varying effect of oil price shocks on the stock market returns: Evidence from oil-importing and oil-exporting countries. *Energy Reports*, *6*(2020), 605-619.

Monday, J. U. (2013). Downstream deregulation policy and economic growth: A case of Nigeria. *International Journal of Multidisciplinary Research in Social and Management Sciences*, *1*(4), 1-95.

Mroua, M., & Trabelsi, L. (2020). Causality and dynamic relationships between exchange rate and stock market indices in BRICS countries: Panel/GMM and ARDL analyses. *Journal of Economics, Finance and Administrative Science*, *25*(50), 395-412.

Muthini, J. N., Namusonge, G. S., Guyo, W., & Shale, N. I. (2017). Role of government economic regulations on petroleum supply chain management. *Journal of International Management, 15*(11), 131-139.

Muthuramu, P. & Maheswari, T. U. (2019). Tests for structural breaks in time series analysis: A review of recent development. *Shanlax International Journal of Economics, 7*(4), 66-79.

Narayan, P. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Appl. Econ. 37*(17), 1979–1990.

National Petroleum Authority (NPA) (2021). *Market Statistics.* Retrieved from: www.npa.gov.gh.

Ngugi, E. N. (2014). *Effects of lending interest rates on share price of commercial banks quoted in the NSE evidence from Kenya*. Unpublished Master's thesis. University Of Nairobi. Nairobi, Kenya.

Nketsiah, I. & Ameyibor, J. (2017). Determining the relationship between stock returns and inflation: Evidence from the Ghana Stock Exchange. *Research Journal of Economics & Business Studies, 6*(9), 11-17.

Nwosu, C. P. (2009). Impact of fuel price on inflation: Evidences from Nigeria. *Available at SSRN 1365820*.

Nyarko, S. K. (2018). *Effect of oil price changes on stock prices on the Ghana Stock Exchange*. Unpublished master's thesis. University of Cape Coast. Cape Coast, Ghana.

Ofori, R. O. (2015). *The economic cost of fuel price subsidies in Ghana*. Unpublished master's thesis. Michigan State University. Michigan, USA.

Ofosu-Peasah, G., & Ackah, I. (2017). Modelling gasoline and gasoil consumption and its impact on the environment in Ghana. Available at SSRN 2932293.

Olujobi, O. J. (2021). Deregulation of the downstream petroleum industry: An overview of the legal quandaries and proposal for improvement in Nigeria. *Heliyon 7*(2021), 1-10.

Omotosho, B. S. (2020). Oil price shocks, fuel subsidies and macroeconomic stability in Nigeria. *CBN Journal of Applied Statistics, 10*(2), 1-38.

Otieno, D. A., Ngugi, R W. & Wawire, N. H. W. (2017). Effects of interest rate on stock market returns in Kenya. *International Journal of Economics and Finance*, *9*(8), 40-50.

Ouma, W. N. & Muriu, P. W. (2014). The impact of macroeconomic variables on stock market returns in Kenya. *International Journal of Business and Commerce, 3*(11), 1-31.

Park, Y. S., Konge, L., & Artino, A. R. (2020). The positivism paradigm of research. *Academic Medicine*, *95*(5), 690-694.

Peltzman, S. (1976). Towards a more general theory of regulation. *Journal of Law and Economics, 19,* 211-240.

Peltzman, S. (1989). The economic theory of regulation after a decade of deregulation. *Brookings Papers on Economic Activity: Microeconomics,* 1-41.

Peltzman, S. (2000). Prices rise faster than they fall. *Journal of political economy*, *108*(3), 466-502.

Pesaran, M.H., Shin, Y. & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics,16*(3), 289-326.

Phong, L. H., Van, D. T. B., & Bao, H. H. G. (2019). A nonlinear autoregressive distributed lag (NARDL) analysis on the determinants of Vietnam's stock market. *International Econometric Conference of Vietnam*, 363-376. Springer, Cham.

Pradhan, R. P. (2018). Development of stock market and economic growth: The G-20 evidence. *Eurasian Economic Review, 8*(2), 161-181.

Rentschler, J. & Kornejew, M. (2016). Energy subsidy reforms and the impacts on firms: Transmission channels and response measures. OIES Work.

Rentschler, J., Kornejew, M., & Bazilian, M. (2017). Fossil fuel subsidy reforms and their impacts on firms. *Energy Policy*, *10*(8), 617-623.

Ross, S. A. (1976). The Arbitrage Pricing Theory of capital assets pricing. *Journal of Economic Theory, 13*(27), 341-360.

Saidi, L.O., Adam, P., Rahim, M., Rosnawintang, R. (2019), The effect of crude oil prices on economic growth in South East Sulawesi, Indonesia: An application of autoregressive distributed lag model. *International Journal of Energy Economics and Policy, 9*(2), 194-198.

Sani, I. A. (2014). Impact of petroleum subsidy on SSB performance in Nigeria. *Journal of Economics and Sustainable Development, 5*(22), 55-58.

Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students* (4th ed.). Pearson Education Limited, England.

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson Education Limited, England.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425-442.

Smajlbegovic, E. (2019). Regional economic activity and stock returns. *Journal of Financial and Quantitative Analysis, 54*(3), 1051-1082.

Stigler, G. J. (1971). The theory of economic regulation. *Bell Journal of Economics and Management Science, 2*, 3-21.

Tetteh, J. E., Adenutsi, D. E., & Amoah, A. (2019). The determinants of stock market return in Ghana: FMOLS and DOLS Approaches. *IUP Journal of Applied Finance*, *25*(4), 5-27.

Uddin, A. & Yu, D. (2020). Latent factor model for asset pricing. *Journal of Behavioral and Experimental Finance*, *27*(3), 300-353.

Waheed, R., Wei, C., Sarwar, S., & Lv, Y. (2018). Impact of oil prices on firm stock return: industry-wise analysis. *Empirical Economics*, *55*(2), 765-780.

Wiafe, E. A., Barnor, C., & Quaidoo, C. (2015). Oil price shocks and private investment in Ghana. *Journal of Economics and Sustainable Development, 6* (22), 1-7.

Williams, S. T. (2014). *The causal relationship between stock price and interest rates.* Unpublished master's dissertation. University of Nairobi. Nairobi, Kenya.

Xiao, J., Zhou, M., & Wen, F. (2018). Asymmetric impacts of oil price uncertainty on Chinese stock returns under different market conditions: Evidence from oil volatility index. *Energy Economics*, *74*, 777-786.

Yusuf, A. B., Tukur, M. D., Caleb, A., & Ibrahim, A. (2019). The impact of downstream oil deregulation nexus petroleum gross domestic product: The Nigerian Experience.

Zankawah, M. M. (2018). *Modelling the relationship between oil prices and economic activity: empirical evidence from Ghana*. Unpublished doctoral dissertation, Kingston University.

Zankawah, M. M., & Stewart, C. (2020). Measuring the volatility spill-over effects of crude oil prices on the exchange rate and stock market in Ghana. *The Journal of International Trade & Economic Development*, *29*(4), 420-439.

Zarei, A., Ariff, M., Hook, L., & Nassir, A. (2015). Identifying multiple structural breaks in exchange rate series in finance research. *Pertanika Journals Social Sciences & Humanities*, *23*, 155-166.

Zhu, H. M., Li, L., & Li, S. (2014). Modelling dynamic dependence between crude oil prices and Asia-Pacific stock market returns. *International Review of Economics & Finance 29*, 208–223. doi:10.1016/j.iref.2013.05.015.

Zhu, H. M., Li, S. F. & Yu, K. (2011). Crude oil shocks and stock markets: A panel threshold cointegration approach. *Energy Economics*, *33*(5), 987-994.

Zhu, H. M., Li, S. F., & Yu, K. (2012). Oil prices and stock market in China: A sector analysis using panel cointegration with multiple breaks. *Energy Economics*, *34*(6), 1951-1958.

APPENDICES

APPENDIX A: Pre-deregulation ARDL model output

Dependent Variable: SR
Method: ARDL
Date: 08/31/21 Time: 10:59
Sample (adjusted): 2010M01 2015M03
Included observations: 68 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (1 lag, automatic): LNPP LNEXR LNTBR LNLR EA LNNF
Fixed regressors:
C
Number of models evalulated: 64
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
SR(-1)	0.148217	0.131118	1.130413	0.2632
LNPP	-18.9672	7.54211	-2.51484	0.0149
LNEXR	14.09128	8.435471	1.670479	0.1005
LNTBR	11.54514	3.008226	3.837858	0.0003
LNLR	-0.27662	0.647159	-0.42744	0.6707
EA	0.223208	0.113372	1.968802	0.054
LNNF	-8.24734	6.958235	-1.18526	0.241
C	-7.41613	10.8634	-0.68267	0.4977

R-squared	0.371562	Mean dependent var	1.621591
Adjusted R-squared	0.291579	S.D. dependent var	4.461579
S.E. of regression	3.75521	Akaike info criterion	5.602332
Sum squared resid	775.588	Schwarz criterion	5.874476
Log likelihood	-168.474	Hannan-Quinn criter.	5.709368
F-statistic	4.645519	Durbin-Watson stat	1.942511
Prob(F-statistic)	0.000385		

APPENDIX B: Post-deregulation ARDL model output

Dependent Variable: SR
Method: ARDL
Date: 08/30/21 Time: 13:52
Sample (adjusted): 2015M07 2021M02
Included observations: 68 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (1 lag, automatic): LNPOP LNEXR LNTBR LNLR EA LNNF
Fixed regressors: C
Number of models evalulated: 64
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
SR(-1)	0.135841	0.115271	1.178452	0.2433
LNPOP	5.025604	7.144461	0.703427	0.4845
LNEXR	21.40136	12.51602	1.709918	0.0924
LNTBR	-13.299	4.304105	-3.08983	0.003
LNLR	37.61819	15.89769	2.366268	0.0212
EA	0.411865	0.120143	3.42812	0.0011
LNNF	11.29845	5.478691	2.062254	0.0435
C	-154.039	73.96184	-2.08269	0.0416

R-squared	0.384934	Mean dependent var	-0.09778
Adjusted R-squared	0.313176	S.D. dependent var	4.98498
S.E. of regression	4.131295	Akaike info criterion	5.78519
Sum squared resid	1024.056	Schwarz criterion	6.046308
Log likelihood	-188.697	Hannan-Quinn criter.	5.888653
F-statistic	5.364348	Durbin-Watson stat	2.082439
Prob(F-statistic)	0.000083		

APPENDIX C: Correlations Test Results

*, **, *** indicate 10%, 5% and 1% level of significance respectively

	SR		lnPP		lnEXR		lnTBR		lnLR		EA		lnNF	
Pre-deregulation														
SR	1.00	***												
lnPP	-0.13		1.00	***										
lnEXR	-0.10		0.77	***	1.00	***								
lnTBR	0.24	*	0.40	***	0.44	***	1.00	***						
lnLR	-0.03		-0.42	***	-0.35	***	0.38	***	1.00	***				
EA	-0.02		0.05		-0.05		-0.61	***	-0.55	***	1.00	***		
lnNF	-0.07		0.40	***	0.50	***	0.78	***	0.58	***	-0.60	***	1.00	***
Post-deregulation														
SR	1.00	***												
lnPOP	0.12		1.00	***										
lnEXR	0.05		0.83	***	1.00	***								
lnTBR	-0.28	**	-0.83	***	-0.70	***	1.00	***						
lnLR	0.03		-0.78	***	-0.74	***	0.66		1.00	***				
EA	0.34	***	0.17	***	0.20	*	-0.12		-0.22	*	1.00	***		
lnNF	-0.06		-0.88	***	-0.83	***	0.83	***	0.78	***	-0.15		1.00	***

APPENDIX D: Computation of Consumption Ratios

Year	Petrol	Diesel	L.P G	Total Consumption	Petrol	Diesel	LPG
2009	705,421.52	1,121,276.98	220,602.98	2,047,301.48	34%	55%	11%
2010	743,017.09	1,024,837.30	177,192.31	1,945,046.70	38%	53%	9%
2011	807,007.22	1,135,347.82	214,430.43	2,156,785.47	37%	53%	10%
2012	992,726.20	1,326,126.34	268,486.16	2,587,338.70	38%	51%	10%
2013	1,080,645.72	1,405,683.63	251,759.05	2,738,088.41	39%	51%	9%
2014	1,102,262.53	1,424,560.83	241,548.31	2,768,371.67	40%	51%	9%
2015	1,162,088.28	1,622,733.58	279,019.82	3,063,841.67	38%	53%	9%
2016	1,069,174.88	1,449,844.39	281,474.48	2,800,493.75	38%	52%	10%
2017	1,072,567.10	1,202,588.66	276,702.79	2,551,858.55	42%	47%	11%
2018	1,255,142.54	1,430,256.46	288,328.79	2,973,727.79	42%	48%	10%
2019	1,845,633.18	1,513,257.23	299,574.99	3,658,465.40	50%	41%	8%
Average					40%	50%	10%

Petroleum products consumption pattern (Metric tons)

Source: Field data (2021)

APPENDIX E: Sample Ex-pump Price Build Up Template

EX-PUMP PRICE BUILD-UP FOR OMCs & LPGMCs AS EFFECTIVE 16th to 28th FEBRUARY 2021

EX-REFINERY PRICE	a
ENERGY DEBT RECOVERY LEVY	b
ROAD FUND LEVY	c
ENERGY FUND LEVY	d
PRICE STABILIZATION AND RECOVERY LEVY	e
SPECIAL PETROLEUM TAX	f
PRIMARY DISTRIBUTION MARGIN	g
BOST MARGIN	h
FUEL MARKING MARGIN	i
EX-DEPOT*	j = a+…i
UPPF	k
MARKETERS MARGIN	l
DEALERS (RETAILERS/OPERATORS) MARGIN	m
LPG FILLING PLANT/PREMIX/MGOLOCAL ADMIN COSTS	n
DISTRIBUTION COMPENSATION/PROMOTION MARGIN	o
INDICATIVE MAXIMUM PRICE (EX-PUMP PRICE)**	p = j+…+o

Notes:
NOTE:
1) The Ex-Refinery Price will be inputed by the OMC/LPGMC and is based on the price the OMC procured each product from BDC(s) for each window.
2) The Special Petroleum Tax (SPT) will be computed after the Ex-Refinery Price has been inputed and the Ex-Depot Price determined.
3) The Marketers' Margin will be determined by the Oil Marketing Company or LPG Marketing Company.
4) The Dealers' Margin will be determined by the Oil Marketing Company or LPG Marketing Company.

Source: npa.gov.gh