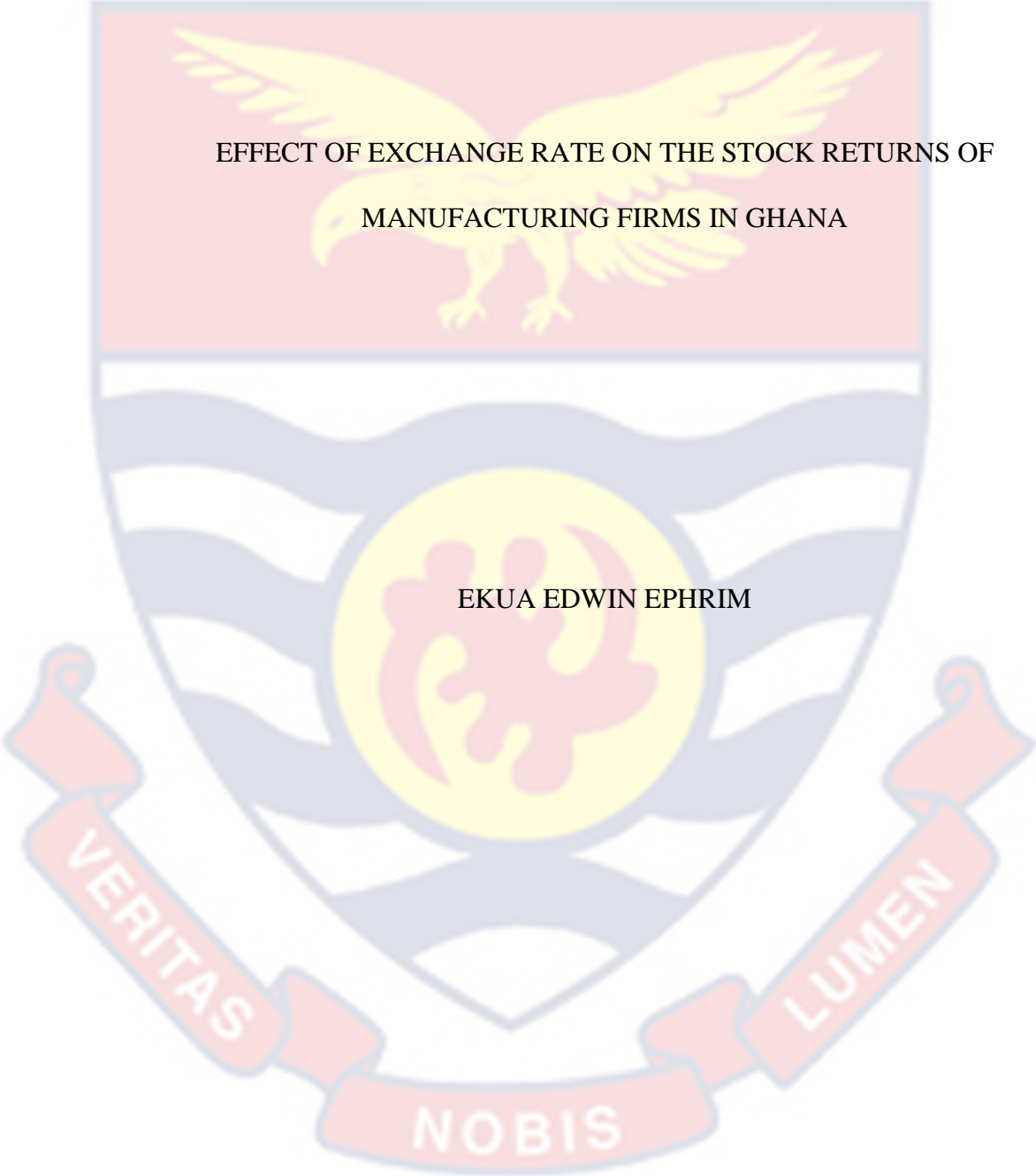UNIVERSITY OF CAPE COAST

EFFECT OF EXCHANGE RATE ON THE STOCK RETURNS OF

MANUFACTURING FIRMS IN GHANA

EKUA EDWIN EPHRIM

2023

UNIVERSITY OF CAPE COAST

EFFECT OF EXCHANGE RATE ON THE STOCK RETURNS OF

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BY

EKUA EDWIN EPHRIM

Dissertation submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirement for the award of Master of Business Administration degree in Finance

JULY 2023

DECLARATION

Candidate's Declaration

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

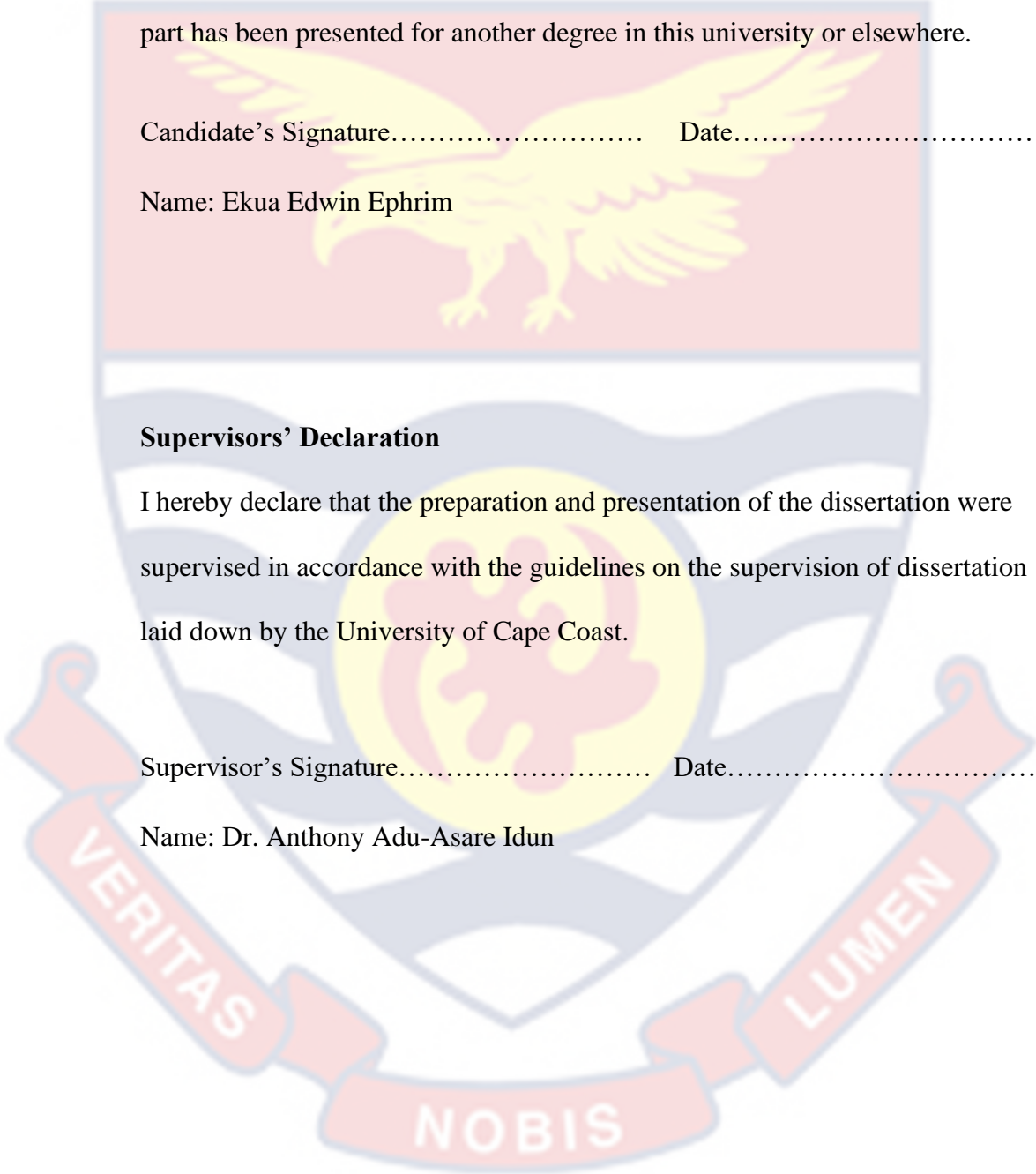Candidate's Signature……………………   Date…………………………….

Name: Ekua Edwin Ephrim

Supervisors' Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on the supervision of dissertation laid down by the University of Cape Coast.

Supervisor's Signature……………………   Date…………………………….

Name: Dr. Anthony Adu-Asare Idun

ABSTRACT

The study examined the effect of exchange rate on the stock returns of manufacturing firms in Ghana. The study aimed to investigate the potential asymmetric impact of exchange rate on the stock returns of manufacturing firms, as well as evaluate the degree of comovement between these two variables. Data from monthly stock returns spanning from January 2008 to December 2020 were collected from the Ghana Stock Exchange (GSE) website. Data on exchange rates (EXR) were also sourced from the website of the Bank of Ghana. A quantitative research method was employed, with the research design being explanatory. The data collected were analyzed using the quantile regression model to analyze the asymmetric effect between the variables in the study. The bi-wavelet technique was also employed to determine the comovement of the variables. Based on the findings, the first objective in general suggests a significant asymmetric effect of exchange rate on the stock returns of the manufacturing firms given different market conditions. In the bearish market condition, exchange rate affected the returns of Benso Oil Palm Plantation (BOPP), Camelot Ghana Limited (CMLT), and Unilever Ghana Limited (UNIL). This was seen also in the normal market where the effect of exchange rate was effectively asymmetric with the returns of BOPP, CMLT, Fan Milk Ghana Limited (FML), and UNIL. The bullish market observed an asymmetric effect on all seven manufacturing firms. The findings from the second objective also show a weak comovement between the two variables in the frequency-time domain, especially in the long term. However, a strong comovement existed in the short and medium terms. The study recommended that investors should pay more attention to changes in exchange rates and channel their investments to firms that yield higher returns when these changes occur. Further, the Bank of Ghana management body, who are responsible for managing the exchange rate ought to introduce exchange rate management strategies that are favorable to improving the stock returns of the manufacturing firms since the study provides evidence to show that the changes in exchange rate led to changes in the stock returns of these manufacturing firms.

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KEYWORDS

Bi-wavelet Technique

Exchange Rate

Ghana

Manufacturing firms

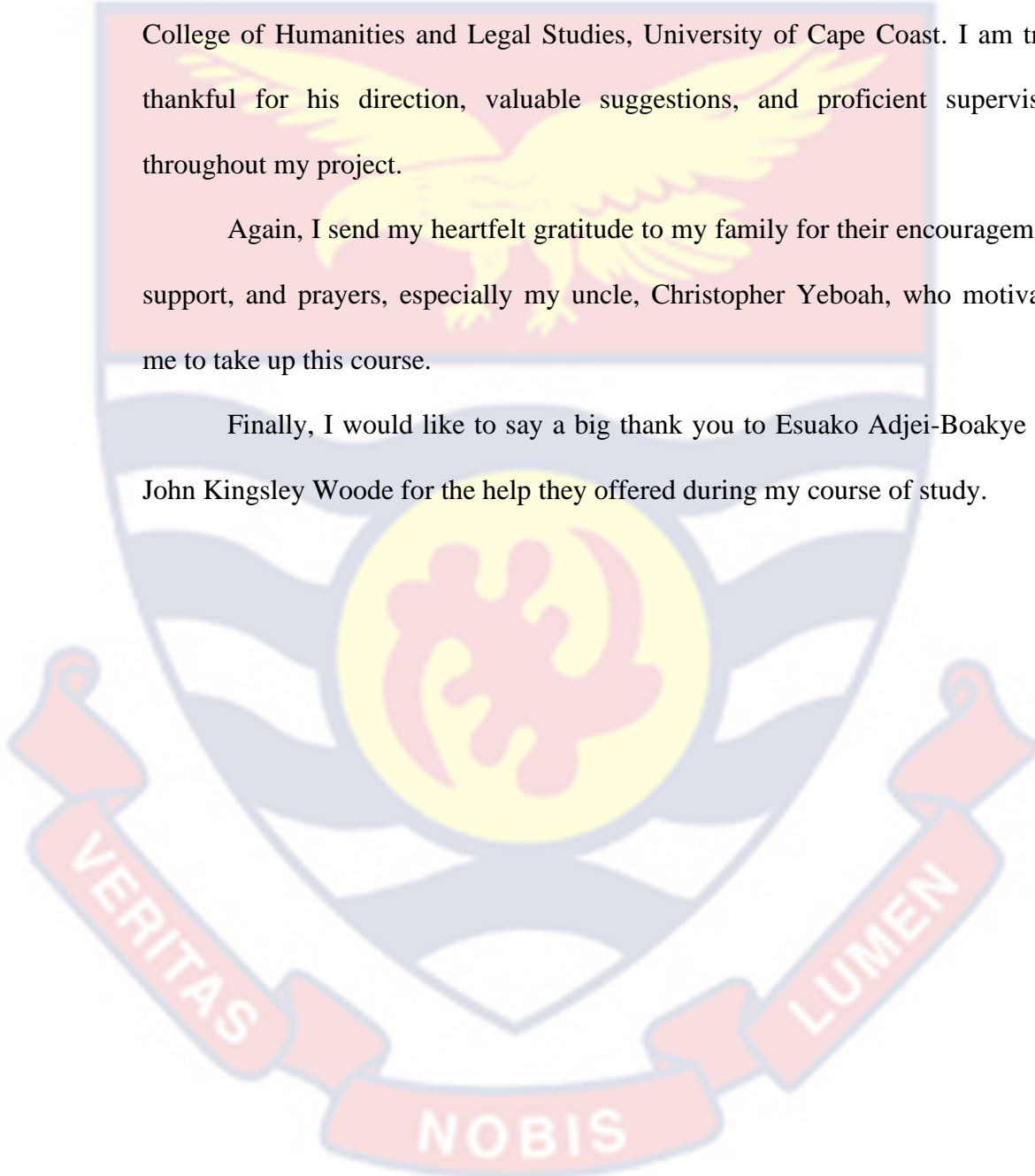Quantile Regression Model

Stock Returns

ACKNOWLEDGEMENTS

I want to convey my heartfelt appreciation to my supervisor, Dr. Anthony Adu-Asare Idun from the Department of Finance at the School of Business, College of Humanities and Legal Studies, University of Cape Coast. I am truly thankful for his direction, valuable suggestions, and proficient supervision throughout my project.

Again, I send my heartfelt gratitude to my family for their encouragement, support, and prayers, especially my uncle, Christopher Yeboah, who motivated me to take up this course.

Finally, I would like to say a big thank you to Esuako Adjei-Boakye and John Kingsley Woode for the help they offered during my course of study.

DEDICATION

To my lovely family.

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
ALW	Aluworks Limited
APT	Arbitrage Pricing Theory
AMH	Adaptive Market Hypothesis
BOPP	Benso Oil Palm Plantation
CPC	Cocoa Processing Company
CMLT	Camelot Ghana Limited
EXR	Exchange Rate
FML	Fan Milk Ghana Limited
GGBL	Guinness Ghana Breweries Limited
GSE	Ghana Stock Exchange
ISIC	International Standard Industrial Classification
OLS	Ordinary Least Square Regression
REER	Real Effective Exchange Rate
SR	Stock Returns
QR	Quantile Regression
UNIL	Unilever Ghana Limited
USD	United States Dollars

CHAPTER ONE

INTRODUCTION

The relationship between exchange rates and stock returns has been the subject of extensive research in the field of finance. In the context of emerging economies like Ghana, how exchange rates influence manufacturing firms' performance is particularly important. Manufacturing sector, which constitute a significant segment of the economy of Ghana, turns to be dependent on foreign raw materials and capital goods to feed its industry and this has been a major challenge facing this sector. The sector which also engages in international trade is exposed to currency risk due to revenue and expense diversity in multiple currencies. This study delves into the effect of exchange rate on the stock returns of manufacturing firms in Ghana to address a critical issue in finance and uses stock returns as a measure of firm performance. The objectives of the study are to determine the asymmetric effect and the comovement between exchange rate and stock returns. While earlier work focused on the relationship on a broader economic framework and in other sectors as well as jurisdictions, this study builds on prior research and narrows the scope to examine the effect of exchange rates on stock returns by focusing on manufacturing in Ghana. The research will contribute to offering valuable insights for investors, policymakers, and corporate decision-makers.

Background to the Study

The stock market has consistently played a crucial role in influencing firm performance and can also reflect and influence public sentiment. A company

characterized by growing stock returns is often perceived as advancing. In fact, the stock market is occasionally viewed as the foremost measure of a nation's economic vitality and progress (Qamri, Haq & Akram, 2015) and hold a paramount relevance in the world of finance. The market represents the financial gains and losses realized by an investor who holds stocks of a company over a specific period. When stock returns are favourable, they serve as a means for companies to secure funds, complementing the debt markets (Luo, Zhang & Zhu, 2011). Moreover, a company's stock performance reflects its overall health and stability and instills confidence in both the market and the general public. This encourages investment and economic activity, creating a positive feedback loop that further strengthens the company and its market position (Fauziah, Moeljadi & Ratnawati, 2015).

Some key macroeconomic factors have been proposed to play a pivotal role in shaping stock prices and, consequently, influencing stock returns (Adam &Tweneboah, 2008). One of such key components that is the exchange rate which explains the value of a country's currency compared to another country's currency or group of currencies and evaluates a nation's level of international competitiveness (Ezenwakwelu, Okolie, Attah, Lawal & Akoh, 2019). It is a crucial economic factor as its appreciation or depreciation has an impact on how well each sector of the economy performs (Odili, 2014). This has been found to be the case since the market has a bearing on the levels of the economic, translation exposure, and transaction exposure of manufacturing firms.

Theoretically, the adaptive market hypothesis introduced by Lo (2004) suggests that exchange rate and the manufacturing sector are deeply rooted in the adaptive behavior of market participants. Investors and manufacturing firms continue to adapt to changing exchange rate conditions, and these adaptations can influence stock market dynamics. This is why the stock market is observed to have fluctuations when there is a change in exchange rates (Ahmed, Rehman & Raoof, 2010) which are dynamic signals that prompt adaptive responses and impact stock returns in the manufacturing sector.

In the past decade, the exchange rate in Ghana has shown a gradual improvement, as the Bank of Ghana continues its mandate to uphold and maintain price and exchange rate stability. Prior to the global health crisis, the Ghanaian currency showed fairly stable dynamics, however, during the past two years, the exchange rate has experienced significant depreciation. For instance, in 2019, Cedi's value decreased against the major trade currency because of rising demand pressures observed with an overall depletion of 6.9%. In March, it appreciated 1.8 percent. However, at the conclusion of the initial six months of the year, the cedi experienced a cumulative depreciation against the US dollar of 8.4%. At the conclusion of the review period, the Cedi had lost value cumulatively against the US dollar by 12.9 percent (Garr, Okoampa-Larbi & Awadzie, 2022). These occurrences greatly affect companies engaged in international trade which manufacturing firms intensively engage in (Engel, 2016).

For firms that engage in international trade, a significant portion of their revenue and costs may be denominated in foreign currencies (Aliber, 2013).

When exchange rates fluctuate, the value of these revenues and costs can be affected, which can have an influence on the profit margins and financial performance. If a firm's costs increase due to exchange rate fluctuations, its profitability may decrease, which can lead to a reduction in the prices of stocks. Moreover, a depreciating currency can lead to the cost of imported raw materials or other inputs increasing, which can have an impact on a firm's cost structure and profitability. This can put downward pressure on stock prices, as investors may perceive the firm's future earnings potential as weaker. On the other hand, a depreciating currency can also make a firm's exports cheaper and enhance competition in the global market. This can lead to an increase in demand for the company's products, which can bring about higher revenues and profits, and a subsequent increase in stock prices, hence returns.

Globally, the stock market is crucial in stimulating a nation's economic expansion. It aids in directing funds from people or businesses without investment prospects to businesses that do, and so increases the nation's economic efficiency. It has a major impact on people, businesses, and the government (Takyi-Danquah, 2015). The Ghanaian stock market has had a mixed performance over the years, with some years experiencing strong growth while others experienced declines or slow growth. The stock market performance is influenced by various factors, including global economic conditions, domestic political and economic developments, investor sentiment, and macroeconomic variables which include exchange rate (Hassan & Nasir, 2008).

A country's relative level of financial health and economic stability can be seen in the foreign exchange market, thus it is crucial to monitor and analyze its movements alongside another equally important indicator, such as stock returns. Considering this, the current research looks at the effect that the exchange rate has on the stock returns of manufacturing companies listed on the Ghana Stock Exchange (GSE).

Statement of the Problem

The recent currency fluctuations in most developing nations, especially in sub-Saharan Africa, have raised varying implications for the manufacturing sector since these fluctuations affect the sector's ability to remain productive (Banerjee, 2020). For instance, across numerous fast-developing countries, the manufacturing sector is the backbone of industrialization, and fostering and developing this sector is important in moving a step closer to inclusive growth (Alhassan, 2021). This sector has proven to be the engine of growth in many countries through its transformational physical, chemical, or mechanical processes (Kalirajan, 2004). Typically, manufacturers operate facilities such as plants, mills, or factories to manufacture goods intended for the general public (Levinson, 2018). However, the manufacturing industry in developing countries currently has several challenges impeding its ability to contribute effectively to development and attract investors.

According to the World Bank (2022), many developing nations have slowed their economic transformation because of the lack of a vibrant manufacturing sector, with Ghana not an exception. Alhassan (2021) discovered

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several challenges the sector faces, including the unavailability of modern technology and inadequate access to initial capital for further production, which adversely affects the performance of these firms. Similarly, in the Ghanaian economy, the manufacturing sector has experienced several setbacks due to the changing nature of the exchange rate, making it less competitive both on the local and global fronts. The reason is that these firms heavily rely on raw materials or capital goods that are imported to undertake its production processes; therefore, any variations in the exchange rate can have a detrimental effect on the sector's growth and performance, among other things.

Consequently, the movement in the exchange rate has caused the collapse of many firms and created uncertainty in the macroeconomic environment. As a result, there has been a reduction in the firm's profit and investment level. The impact of such great changes in the exchange rate is of interest to researchers and policymakers as it has long-term implications on the returns of a firm and for international trade (Boateng, 2019). Accordingly, several global investor decisions hinge on the possibility of earning higher yields since such investments possess varying risks that could only be offset by higher returns.

The exigency of the equity market in the global financial space revolves around its usefulness as a key metric utilised by both domestic and international investors in decision-making. Similarly, emerging equity markets like the Ghana Stock Exchange are attracting world attention as markets of the future and a lot of potential investors (Adu, 2012). Despite the aforementioned suppositions, studies on the stock-exchange rate dynamics within this milieu remain scanty, with no

studies emphasizing manufacturing firms. Furthermore, prior studies (Abdul-Mumuni, 2016; Ayobami, 2019; Mensah, Awunyo-Vitor, & Asare-Menako, 2013) on the nexus between exchange rate and stock returns have rather revealed a mixture of positive and negative outcomes which indicate the existence of varying evidence. In contrast to the aforementioned study, Nyeadi, Atiga, and Atogenzoya (2014) revealed that the exchange rate has no effect on Ghana's exports affirming the earlier supposition on these variations. This indicates the inconclusive nature of the few studies conducted in the sector and demonstrates the need to re-examine the impact, especially against the backdrop of constant currency fluctuation in the region.

Contrary to previous studies that emphasized static models such as linear regression and vector autoregression, among others, the current study employed quantile regression and biwavelet approaches due to these methods' ability to capture the varying market conditions and investor reactions, respectively. For instance, the quantile regression model illustrates the asymmetric influence between the exchange rate and stock returns given different market conditions (bearish, normal, and bullish). Furthermore, the wavelet coherent analysis, unlike other non-frequency-dependent models, captures the nexus between the sample markets through both time and frequency (short, medium, and long-term) while also being able to reveal how the exchange rate fluctuations drive the stock markets. These findings will help stakeholders, including governmental bodies and investors, identify which firms, market conditions, frequency, and time period to invest in in order to yield higher returns with regard to the exchange rate.

In view of this, the present study is significantly different from previous studies as it examines the exchange rate's effect on the manufacturing companies in Ghana using stock returns as a measure of firm performance. Stock returns serve as a metric of firm performance because they reflect the market's assessment of both financial and non-financial factors aspect of the firm and capture the expectation of future cash flows, which are critical for the firm's long-term success. Return on asset and return on equity, also a measure of firms' performance in some literature provides only a snapshot of the firm's performance at a certain time. It is also subject to manipulation through accounting practices such as asset revaluation, depreciation policies, and debt financing which make it difficult to compare performance across different firms or periods. It also does not consider external factors that can affect a firm's performance such as market conditions, competition, or changes in regulatory policies. In this regard, this study finds the use of stock returns as an indicator for the performance of firms appropriate as compared to the previously used measures of firm performance and uses exchange rate monthly data of US dollar- Ghana cedis from 1st January 2008 to 1st December 2020. This study bridged this gap by employing quantile regression and bi-wavelet to examine the asymmetric influence on and assess the time-frequency co-movement between the exchange rate and the returns of manufacturing firms in Ghana respectively.

Purpose of the Study

The goal of this research is to examine how exchange rate affects the stock returns of listed manufacturing firms in Ghana.

Specific Objectives

1. Examine the asymmetric influence of exchange rate on the stock returns of manufacturing firms in Ghana.

2. Assess the time and frequency co-movement between exchange rate and stock returns of manufacturing firms in Ghana.

Research Hypothesis

The research empirically tests the following hypothesis based on the research's primary objective.

1. **H_0:** Exchange rate has no asymmetric influence on the stock returns of manufacturing firms in Ghana.

   H_1: Exchange rate has an asymmetric influence on the stock returns of manufacturing firms in Ghana.

2. **H_0:** There is no time and frequency co-movement between exchange rate and stock returns of manufacturing firms in Ghana.

   H_1: There is time and frequency co-movement between exchange and stock returns of manufacturing firms in Ghana.

Significance of the Study

Investors place great importance on the performance of the stock market and respond to macroeconomic factors that can potentially impact its performance. Exchange rate is one significant macroeconomic factor that affects the market. This research assists investors by presenting empirical findings of exchange rate effect on the stock market, thereby aiding them to make informed decisions. The study also adds to knowledge, inform policymakers, and offer

policy guidance as well as recommendations when dealing with exchange rates. It will also assist policymakers in considering alternative means to control the exchange rate fluctuations and its implications on manufacturing companies in Ghana. For this purpose, this research gathered data on monthly exchange rate and stock returns of seven manufacturing companies on the GSE spanning a thirteen-year period, from 2008 to 2020. Quantile regression and bi-wavelet techniques were the methodologies used for the analysis.

Delimitations of the Study

This research exclusively concentrates on Ghana, and it considers a restricted set of variables within this context. This study investigates how the exchange rate influences the returns of manufacturing companies that are listed on the GSE over a duration of thirteen years; from 2008 to 2020. As a result of available data during the period of study, seven listed manufacturing firms were considered for the research.

Limitations of the Study

The scope of this study is limited to only listed manufacturing firms on the GSE. The study considered a thirteen-year period, spanning from January 2008 to December 2020. Seven manufacturing firms were taken into account. The decision to use this data was primarily to ensure data availability, reliability, and ease of analysis. Due to this, generalizing the study's findings for the entire manufacturing companies in Ghana may be quite inaccurate. Despite the limitations above, the study's findings are still valid.

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Definition of Terms

The study provides clear and specific definitions for the operational terms utilized, which are outlined as follows:

Exchange Rate: Exchange Rate is the rate at which one currency can be traded for another, influencing trade and the movement of financial resources between countries.

Stock Returns: it is the reward an investor gets from investing in an asset. In other words, it is the money made or lost in an investment over some period of time.

Manufacturing Firms: These are firms that transform raw materials into finished or semi-finished goods on a large scale.

Organization of the Study

The remaining portion of the study is structured as follows; Chapter Two reviews the existing body of research on the effect of exchange rate on the returns of manufacturing firms from both a theoretical and an empirical perspective. The research approach that was employed for the analysis is detailed in Chapter Three. Chapter Four presents the findings and related discussions, considering the conclusion in light of the literature. Chapter Five outlines the main conclusions, recommendations, and opportunities for additional research.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter provides theoretical and empirical literature concerning exchange rates and stock returns. The relevant theories for the research work were chosen after reviewing theoretical literature on returns and exchange rates.

Theoretical Review

Arbitrage Pricing Theory (APT) Model

Stephen Ross developed the Arbitrage Pricing Theory (APT) in 1976 as an alternative to the Capital Asset Pricing Model (CAPM). APT is a multi-factor model that posits that the returns of capital assets are determined by a combination set of underlying factors. According to Ross, if equilibrium prices do not provide any arbitrage opportunities, the expected returns on assets can be approximately predicted using a linear combination of factor loadings or beta. In essence, this suggests that the anticipated returns of a financial asset can be mathematically expressed as a linear combination of several macroeconomic variables or market indices. Each factor's impact is captured by a beta coefficient, indicating its sensitivity to changes in those factors. Thus, Ross asserts in a well-known arbitrage pricing (APT) model that both macroeconomic and company-specific factors affect stock returns. The APT model can be represented by:

$Return = \alpha_0 + \beta_1 \ (r \ factor \ 1) + \beta_2 \ (r \ factor \ 2) + ...+ \varepsilon_r$ ....…………. (1) as stated in Brealey et al. (2008).

Equation (1) demonstrates how different macroeconomic variables influence stock returns. Particular economic situations have a greater impact on some stocks than others, thus the model includes provisions to identify those conditions and assess their influence on certain industries. The model also acknowledges the existence of firm-specific factors that influence a particular stock in addition to macroeconomic dynamics. The noise, ε_r, is a representation of these variables. Since the model does not expressly prescribe specific macroeconomic elements, it also provides a flexible platform for a wide range of external influences to affect stock return. The factors may include exchange rates, oil prices, interest rates, unemployment, inflation, political factors, institutional factors, gross domestic product, and so on.

Adaptive Market Hypothesis

The Adaptive Market Hypothesis (AMH) is a theory introduced by economist Lo (2004). It aims to explain the dynamics of financial markets by integrating concepts from Behavioral Finance and the Efficient Market Hypothesis (EMH). While the Efficient Market Hypothesis assumes that markets are always efficient and prices accurately incorporate all relevant information, the AMH recognizes that market efficiency is not a constant and can vary over time. When considering the effect exchange rates has on returns of manufacturing companies in Ghana, the AMH can provide valuable insights. The hypothesis suggests that market participants, including manufacturing firms and investors, adapt their behaviour based on changing market conditions, new information, and

their own experiences. This adaptive behaviour can influence the relationship between exchange rates and stock returns.

As per the AMH, market efficiency can vary depending on the type of information and its availability. Regarding exchange rates, manufacturing firms in Ghana may closely monitor currency fluctuations and incorporate this information into their decision-making processes. Firms that have access to timely and accurate information about exchange rate movements may be better positioned to adjust their strategies and mitigate potential risks, potentially influencing their stock returns.

Moreover, AMH recognizes that individuals may exhibit behavioral biases that can impact their investment decisions. These biases, such as overconfidence or herd mentality, can influence the association between exchange rates and returns on stock. For instance, if manufacturing firms in Ghana collectively perceive an appreciation of the local currency as positive for their business, they may allocate more resources and investments, leading to potentially higher stock returns. However, this behavior may also introduce elements of market inefficiency and subsequent corrections in the long run.

The AMH further suggests that market participants continually adapt to changing market conditions. In the context of exchange rates and manufacturing firms in Ghana, firms may adjust their pricing strategies, sourcing of inputs, or market focus based on exchange rate fluctuations. This adaptation can influence their profitability and ultimately impact stock returns. Additionally, investors who

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recognize these adaptations may adjust their investment strategies, accordingly, further influencing market dynamics.

Flow Oriented and Stock Oriented Models

The link that exists between exchange rate and stock returns can further be explained by two different and conflicting theories; the Flow-oriented and the Stock-oriented models.

In 1980, Dornbusch and Fischer introduced the "Flow Oriented" theory, which posits that movements in currency or exchange rates can impact a company's international competitiveness, subsequently affecting its revenue, cost of funds, output, and ultimately its stock price. This influence aligns with the concepts of transaction and translation exposure, where exchange rate fluctuations can affect corporate transactions involving conversion into another currency, such as exports, imports, and interest income (transaction exposure), as well as the consolidated financial statements of the parent company (translation exposure) (Fauziah, Moeljadi & Ratnawati, 2015).

The model posits that when the local currency depreciates, goods that are produced domestically become more affordable when compared to goods that are imported. This stimulates growth in exports which raises expected future cashflows for exporting firms and consequently raises stock values. In contrast, when the local medium of exchange appreciates, locally produced products become expensive to import, leading to a decline in exports. Thus, the expensive products will be in less demand outside the local market, which will in turn bring about a fall in the prices of stocks in a firm. On the other hand, the increased

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dependence on foreign products by firms causes the depreciation in the local currency (Ghana Cedis) as more imports require more foreign currency (US Dollars) to purchase imported products.

When there is depreciation in the Ghana Cedis, this will affect the Ghanaian manufacturing firms negatively as this industry relies on foreign raw materials, machines, and equipment in their production process. The depreciation will further raise production cost, leading to a decrease in both local and foreign demand for the products produced by these manufacturing firms. A decrease in the demand for internally produced products will result in a decline in firms' profitability which in the end results in a decrease in the stock prices as investors will turn to withdraw their investments from these firms because of a reduction in dividends.

The Stock oriented model points out the function of capital account transactions that was presented by Frankel in 1993. The rise (decrease) in the stock returns will draw capital, which will enhance (diminish) demand for local currency and result in an increase (decrease) in the exchange rate. A country's stock market's price changes for securities are also influenced by how investors perceive the conditions of the capital markets. This view will ultimately have an impact on investment funds entering the country, which will influence the country's economic status, particularly its exchange rate.

The model proves the portfolio balance theory, which suggests that if domestic stock prices rise, investors will be induced to increase their holdings of local assets by trading foreign assets to acquire local currency. The value of the

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indigenous currency will increase as there is more demand for it. On the other hand, rising domestic asset values will raise wealth, which will enhance investors' demand for capital. When this happens, more foreign capital will be drawn in, increasing the want for local currency, and ultimately leading to a rise in the worth of the currency. The exchange rate and stock returns linkage can also be viewed from the perspective of currency exchanges and stock exchanges in the short term. Stocks traded on stock exchanges will experience substitution effects because exchange rate is transacted in currency exchange. For instance, typically, investors will invest in the US Dollar since it is more advantageous when the Cedis depreciates against the US Dollar. Lower rates of return make investing in the stock market less attractive; if not, investors will transfer money to the currency exchange (Mouna & Anis, 2013).

The Concept of Exchange Rate

The exchange rate refers to the value at which one country's currency is exchanged for the currency of another country. The issue of the exchange rate and the risk connected with it in the form of fluctuations is one of the most important considerations considered by governments and international trade organizations (Ho & Iyke, 2017). Exchange rates are usually given in pairs, with the base currency listed first and the quote currency listed second. For example, the exchange rate (currency rate) between the US dollar and the Ghana cedis could be quoted as USD/GH¢ 12, which means that one US dollar can be exchanged for 12 Ghana Cedis.

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To better comprehend the concept of the exchange rate, it is ideal to examine the different regimes and the influence they have on the performance of manufacturing firms. The two major types of currency rates are pegged or fixed exchange rates, and the floating or flexible exchange rate regimes. In a regime of pegged exchange rates, a country's central bank sets its currency to a fixed value against another currency or a selection of currencies. In this system, the country's central bank uses its monetary policy tools to sustain a pegged exchange rate (Nandi, 2019).

A floating or flexible exchange rate regime is one where the market forces of demand and supply influence the exchange rate between two currencies (Kouri, 2019). In this regime, the exchange rate is not fixed by a government or central bank, but instead, it fluctuates in response to various economic factors including changes in inflation rates, capital flows, and interest rates. Under this regime, the exchange rate can appreciate or depreciate based on market conditions, which can be beneficial or harmful to different sectors of the economy.

Exchange Rate Situation in Ghana

Various political regimes have existed in Ghana since 1957, each of which has had an influence on the country's currency rate policies. From the period 1957 to 1992, the Ghana Cedis was pegged to the major convertible currencies, the US Dollar and the British Pound. This was done through a set of decrees and a set of administrative measures, including import licensing, to manage any excessive demand for foreign currency. The aim was to maintain stability in the foreign exchange market and promote economic growth.

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However, the consistent reliance on imported goods with less export has resulted in the depreciation of exchange rate in Ghana (Tankia-Allou, 2021). This causes manufacturing firms' prices of inputs to increase, leading to a reduction in the profit of these firms. When a firm's profit decreases, it has an adverse impact on the dividends of investors of such companies. A decrease in dividends prevents investors from investing leading to a reduction in stock prices. Figure 1 depicts the trends in the exchange rate from 2008 to 2020.
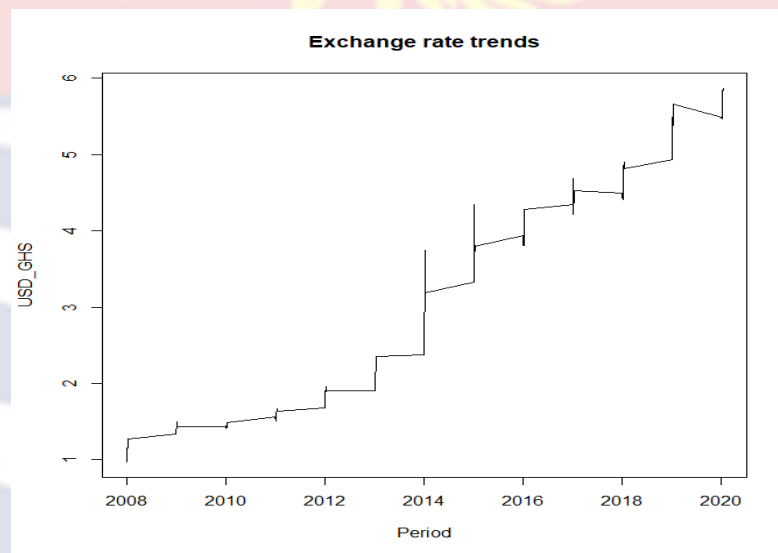
Figure 1: Exchange Rate Trends from 2008 to 2020

Source: Ephrim (2023)

Figure 1 depicts the movement of the Ghana Cedi (GH¢) and the United States dollar (USD) in terms of exchange rate from 2008 to 2020. As of the year 2008, the exchange rate was in favor of the Ghana Cedis; 0.98 Ghana Cedis to a Dollar. From there, the exchange rate seems to have been in constant depreciation. Figure 1 shows there was a depreciation of 17.91% from 2008 to 2009, followed by additional depreciation of 3.5% in 2010. Similarly, from 2014

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to 2015, the GH¢ devalued relative to the Dollar by 19%. From 2018 to 2020, there was a notable decline of 21% in the value of the Ghanaian currency compared to the USD. The figure also reveals during the period under the study, there was no significant appreciation of the Ghana Cedi. This continuous depreciation has been a result of the increased reliance on foreign products, especially raw materials that are used in the further production of goods (Tankia-Allou, 2021). From the figure, the trends show clearly that the Ghana Cedi is likely to depreciate in the subsequent years. It is therefore important to assess how the rise or fall in value of the Cedi against the United States Dollar affects the stock returns of manufacturing firms and the overall economy of Ghana. Since the manufacturing sector is deemed the backbone of the Ghanaian economy (Peters, Sievert & Strupat, 2015), it is imperative to assess to what extent exchange rate dynamics affect these manufacturing firms, to draw salient conclusions about the aforementioned nexus and its implication on the Ghanaian economy.

The Concept of Stock Returns

A securities market is an economic institution, where buying and selling transactions of securities occur based on the principles of supply and demand. It serves as a network connecting various economic actors, enabling the efficient exchange of securities, raising capital through the issuance of new securities, converting tangible assets into financial assets, and offering opportunities for short- or long-term investment to generate profits (Er & Vuran, 2012). Consequently, a stock exchange market plays diverse roles in an economy, such as enabling companies to secure funds for growth by selling shares, sourcing

capital for business operations, aggregating savings for investment purposes, supporting corporate expansion, and providing investment avenues for small-scale investors, among other functions. Investors who buy shares of manufacturing firms on the stock exchange have expectations of generating returns on their investments. Stock returns, which encompass both capital gains (changes in stock prices) and dividends, represent the financial outcomes for these investors.

Stock return is the percentage change in value of an investment in stocks in a financial market over a period. They are typically expressed as a percentage and a measure of the profitability of an investment in a particular stock. The calculation requires several inputs such as the stock price gains or losses, corporate activities like splits, and returns of capital in the form of dividends (Okičić, Remetić-Horvath & Büyükdemir, 2014).

The concept of stock returns is essential in analyzing the performance of a company and assessing the potential risks and rewards of investing in its stock. Investors often use stock returns as a key metric in making investment decisions, as higher returns typically indicate a more profitable investment opportunity. The change in a stock's value (capital gain yield) and any cash dividends distributed during the period are included in the stock return.

Empirical Review

Various writers have used different approaches to examine the topic at hand in both advanced and developing economies. The empirical review encompasses studies that explore the correlation between exchange rate and stock returns.

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Previous research on the correlation between exchange rates and returns have largely centered on emerging and advanced economies, with few studies considering developing and frontier markets. Furthermore, most of these studies have also concentrated on other macroeconomic variables other than the exchange rate in particular. For instance, Hasan and Nasir (2008) carried on a study examining the correlation between stock market prices and various macroeconomic variables, including foreign exchange rate, industrial output index, interest rate, broad money, and inflation. By using cointegration and error correction models, and analyzing monthly time series data, spanning from 1998 to 2008, the research successfully established a strong connection between exchange rate and stock prices.

In 2018, Oktavia and Handayani further investigated the impact of the Dow Jones Index Average (DJIA), the Rupiah exchange rate on the composite stock price index (CSPI) and GDP Growth of the Indonesian stock exchange. The period for the study was from 2012 to 2015. It further used a sample of 48 CSPI data points from the Indonesia Stock Exchange, which were collected through documentation and analyzed using multiple linear regression analysis. The study's result found that the Rupiah currency rate did not significantly affect the CSPI. This is notwithstanding the augmented effect of exchange rate movement on the stock returns of economies that are developing.

Mgammal (2018) carried out a study that investigated the potential association between stock prices and exchange rates in two Gulf countries, specifically Saudi Arabia and the United Arab Emirates (UAE). The study utilized

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quarterly and monthly data spanning from January 2008 to December 2009 to analyze both short-term (temporal or immediate term) and long-term correlations between these variables. The study's findings indicated that in the immediate term, the exchange rate had a positive effect on the stock market price index in the UAE, while no significant association was observed in Saudi Arabia. Moreover, in the long term, the study revealed a negative influence of the exchange rate on the stock market price in the UAE.

Likewise, the results of the study by Er and Vuran (2012) on the factors affecting stock returns for companies listed on the Instabul Stock Exchange Market showed that exchange rates had a positive effect on stock returns while oil prices and interest rates had a negative impact. The positive impact of exchange rates suggested that during the period from 2003 to 2007, firms were relatively insulated from exchange rate risk because exchange rates in this timeframe displayed minimal volatility.

Kutty (2010) also conducted a study that looked at the correlation between exchange rate and stock prices in Mexico from January 1989 to December 2006. The findings from the research indicated that there exists a short-term association between the examined variables, which include exchange rates and stock prices, but no long-term relationship was discovered.

In 2011, Alagidede, Panagiotidis and Zhang also examined the linkage between stock markets and foreign exchange markets for advanced countries such as United Kingdom, Switzerland, Canada, Japan, and Australia by covering the period January 1992 to December 2005. The findings from the cointegration tests

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found no long-term link between the variables. However, based on the results of the Granger causality tests, Switzerland, Canada, and the United Kingdom show that a unidirectional relationship exist between exchange rates and stock prices.

Khan (2019) also examined the association between exchange rates and stock returns from January 2008 to December 2018 on the Shenzhen Stock Exchange. The model used to investigate the immediate- and long-term effects of exchange rates on stock returns was ARDL. The discoveries from the research reveal significant negative impact of exchange rate on the stock returns of the Shenzhen Stock Exchange. Therefore, it is recommended that policymakers at the central bank implement policies to stabilize exchange rates to mitigate the negative impact on the stock market.

Kumar (2010) studied the short- and short-term connections between exchange rates and stock prices in IBSA (India, Brazil, and South Africa). The Linear and Non-linear Granger Causality Tests were used in this study to investigate causal relationships. Additionally, cointegration tests were utilized to identify any long-term relationships among the variables under study. There was a bidirectional relationship between stock prices and exchange rates, according to the outcome of the Granger causality (linear and non-linear) test. The findings of the cointegration test also showed no long-term link between the variables.

Also, Otieno, Ngugi and Muriu (2014), explored how Kenya's stock returns are influenced by macroeconomic factors. Data between the years 2003 and 2013 was used to conduct this study. According to the study's findings, Kenya's inflation rate, exchange rate, and money supply all had a substantial

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effect on stock returns. It was however highlighted that the exchange rate had a detrimental impact on the stock market return.

There are actually limited research in the Ghanaian context, with most of them largely focusing on macroeconomic variables. Adam and Tweneboah (2008) examined the impact of macroeconomic (exchange rate, inflation, interest rates among others) variables on the movement of stock prices in Ghana. The study employed the Johansen multivariate cointegration test and an innovative accounting technique. There was evidence of cointegration between the macroeconomic variables in the long run. In the short run, the results indicated that the exchange rate and inflation matter for share price movement in Ghana in the short run, while interest rates and inflation were found to be less influential in the long run. They also suggested that when there is a depreciation in the Ghana cedi, it becomes difficult for investors in Ghana to invest as depreciation makes shares unattractive.

Adjasi, Harvey, and Agyapong (2008) conducted research in Ghana with the objective of investigating the exchange rate's influence on the stock market. In their study, they encompassed several independent variables: foreign exchange rates, trade deficit, Treasury bill rates, money supply, and inflation, and used Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) to estimate the relationships. Overall, Adjasi et al. found compelling result evidence of a significant correlation between macroeconomic variables, including exchange rates, and stock returns. Their study emphasizes the significance of taking into account macroeconomic factors when assessing the

performance of the stock market, particularly in emerging markets like Ghana. They discovered that in the long run, exchange rate volatility is negatively related to stock market returns.

Furthermore, Kwofie and Ansah (2018) examined the effect of inflation and exchange rates on stock market returns in Ghana. They analyzed monthly data on exchange rate, inflation, and market returns from the Ghana Stock Exchange all-share index between January 2000 and December 2013. To establish the long- and short-run links between GSE market returns, inflation, and exchange rate, the study used the Autoregressive Distributed Lag (ARDL) cointegration technique and the error correction parameterization of the ARDL model. The data show that GSE market returns, and inflation are significantly related in the long-term, but no meaningful short-term relationship. GSE market returns, and the currency rate have a considerable long-term and short-term link. The factors were also examined for long memory, which investors can use because the study establishes a long-term effect of exchange rates and inflation on stock market returns rather than focusing solely on exchange rates and stock returns.

Again, utilizing time series data for analysis, Barnor (2014) used data from 2000 to 2013 to assess macroeconomic variables' effect on Ghana's stock returns. His research discovered that exchange rate had a positive association with stock returns. Similar to Barnor's findings, Laichena et. al. (2015) findings in Nigeria also showed that exchange rate has a positive link with stock returns when she examined exchange rate volatility on stock market behavior. By

employing Johansen's Cointegration and error correction mechanism with quarterly data from 1985 to 2009, it was demonstrated that exchange rate and the stock returns on the Nigerian stock market in both long and short terms are statistically significant.

Adu (2012), investigated on the impact of macroeconomic factors on stock market returns in Ghana, it was found through the utilization of both ordinary least squares and cointegration method of analysis that certain macroeconomic variables, including the exchange rate, held a statistically significant influence over stock returns in Ghana.

Critique of the Literature

The studies mentioned above show evidence of a correlation between exchange rates and stock returns, however they had mixed and inconclusive results. The reason is that most of the existing literature has primarily focused on macroeconomic factors that affect stock returns in different regions or countries. Also, these studies have certain limitations, such as their limited focus on the Ghanaian context and their emphasis on the overall stock market index rather than specific industries like manufacturing firms. Furthermore, these studies employed different methods in analyzing the relationship between the variables but did not consider how exchange rates affect stock returns when given different market conditions or different time and frequency. Given these considerations, the present research aims to investigate the relationship between exchange rates and manufacturing companies listed on the Ghana stock exchange. This study fills the gap in the existing literature in the Ghanaian context, focusing on the period from

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2008 to 2020. Quantile regression and bi-wavelet techniques are employed to analyze the asymmetric influence of exchange rate on the returns of Ghana's manufacturing firms and co-movement between the two variables in Ghana, respectively.

Chapter Summary

This chapter begins by discussing the various theories supporting the relationship between exchange rate and stock returns of Ghana's manufacturing companies and currency exchange rate. These theories include the arbitrage pricing theory, adaptive market hypothesis, and flow and stock-oriented theories. The arbitrage pricing theory explains how changes in macroeconomic variables impact stock market returns, while the adaptive market hypothesis focuses on how market participants adapt their behavior based on changing market conditions and new information. The flow and stock-oriented theories suggest that currency exchange rate movements affect a company's competitiveness, cost of fund, revenue, output, and ultimately stock prices. The chapter also provides an empirical review of related studies conducted by other researchers. The latter part of the chapter presents the critique of the literature which has been reviewed. It is evident from this review that none of these studies have specifically concentrated on the impact of the exchange rate on the returns of Ghana's manufacturing firms. This study, by employing Quantile regression model and Bi-wavelet techniques, examines the asymmetric effect and co-movement between the dependent and independent variable respectively.

CHAPTER THREE

RESEARCH METHODS

Introduction

The purpose of this chapter is to outline the techniques that are appropriate for conducting the research. The methods and models employed in this study are discussed in this chapter. Particularly, this provides a detailed explanation of practical, theoretical, and empirical descriptions of the association that exists between the exchange rate and the stock returns of manufacturing firms in Ghana.

Research Paradigm

The underlying philosophy and scientific approach that are suitable for a particular research work, considering its purpose, context, and focus is referred to as a research paradigm (Hallebone & Priest, 2008). Positivism is a research paradigm that emphasizes the importance of observing and measuring social reality, much like natural and physical scientists (Saunders and Lewis, 2012). The positivism paradigm assumes that social reality is observable and can be measured through variables. This involves collecting data on these variables, using statistical tests to analyze the data, and confirming or disproving hypotheses to make generalizations. Positivist research aims to produce generalizable findings that can be reported in a quantitative manner. It also allows for the potential to make predictions about broader phenomena. The research conducted in this study aligns with the positivist paradigm, which involves collecting data on exchange rate, and stock returns for selected manufacturing firms on the GSE. The data is then analyzed using statistical tests to identify relationships between

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the variables. The study aims to accept or reject hypotheses in order to ascertain the relationship that exist between exchange rate and stock returns of manufacturing firms in Ghana.

Research Design

Quansah (2016) cited Saunders and Lewis in their research conducted in 2012, where they categorized research design into three main types: descriptive, explanatory, or exploratory. In this study, explanatory research design was employed. The explanatory research design helps clarify whether one variable causes change in another or there are confounding factors at play. It also helps provide a structured approach to test the hypothesis and draw conclusions about the relationships of the variables being studied. This research design aims to accomplish the study's objective, thus, examine the effect of exchange rate on the returns of Ghanaian manufacturing firms.

Study Area

The study examined the manufacturing firms listed on the Ghana Stock Exchange (GSE). As of April 2023, the listed firms on the GSE were 31 with manufacturing being one of the dominant sectors. These manufacturing firms were classified under "food and beverages, wood, and paper converters, pharmaceuticals, and traditional" (Quansah, 2016). The reason for the selection of manufacturing firms is because manufacturing firms serve a significant role in the overall economy of a country. It also serves as one of the main contributors to the GDP of the country (Alhassan, Aigbavboa &Thwala, 2021). For example, in 2013, the food and beverages as well as the traditional manufacturing sector of

manufacturing firms collectively contributed GH¢145 million, which accounted for 32% of the total market capitalization (Quansah, 2016). Also, like major economies do, the manufacturing sector in Ghana can benefit massively from the exporting manufacturing products if the right structures and management are put in place. When these firms do well, it attracts foreign direct investment which eventually affects stock prices. Again, previous studies related to the subject were conducted on manufacturing firms (Santosa, 2019). Due to this rationale, the researcher considered manufacturing companies as appropriate subjects for investigation in relation to the problem being studied.

Research Approach

The quantitative, qualitative, and mixed approaches are the three basic types of research methods (Odoom, 2019). To fulfill the research objectives, the quantitative approach to research is adopted. Saunders and Lewis (2012) stated that, for quantitative research, we make use of the positivist research paradigm, so this study adopted the positivist research approach. The quantitative approach concentrates on assembling data and using it to understand a specific event or generalize it across groups of people (Babbie, 2010). The main objective of quantitative research is to examine the connection between variables as well as the cause and effect between them. Also, it emphasizes how one variable affects the other when manipulated. This approach also offers the advantage of replicating the same phenomenon, thereby ensuring a high level of reliability in research findings. Given the study's objective of investigating the effect of

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exchange rates on the returns of manufacturing firms in Ghana, the quantitative approach is considered the most suitable approach.

Data Collection Procedure

The study evaluates and explains the effect exchange rate has on the returns of listed manufacturing firms on the GSE. This was done by analyzing the asymmetric effect and co-movement of exchange rates on the stock returns of these manufacturing firms. For this reason, monthly secondary data was used; the variables, exchange rates data, and stock returns data were collected from Bank of Ghana website and GSE respectively for the thirteen-year period, from 2008 to 2020. Hence, the data collected aligned with the research objectives.

Population

A population refers to the entire group of individuals, entities, or units that are known to share comparable features, and are of interest to the researcher (Lim & Ting, 2012). It is the population from which a sample is selected for analysis. The International Standard Industrial Classification (ISIC) of Economic Activities is a commonly used system of classifying economic activities so that different types of companies can be grouped together according to the type of activity they engage in. According to the ISIC (2008), enterprises that fall under manufacturing include groups involved in the manufacture of food products and beverages, manufacturing of machinery and equipment, electrical equipment, manufacturing of paper and paper products, and manufacturing of plastic products and rubber, manufacturing of basic metals etc. Therefore, the population for the study included all manufacturing firms that met the criteria for manufacturing

enterprises as defined by the United Nations ISIC (2008). Specifically, the population for this study comprised the manufacturing firms listed on the Ghana Stock Exchange. It has employed data on these firms on the GSE covering a period of thirteen (13) years spanning from 2008 to 2020.

Sampling Procedure

Sampling involves selecting a subset of observations from a larger population to draw inferences about the characteristics of the entire population based on the properties of the sample. Due to insufficient data, the study settled only seven manufacturing firms on the GSE whose data was available for the period under study. The table below shows the list of manufacturing firms that were considered in the study.

Table 1: Classification of selected manufacturing firms

NAME OF FIRM	GSE CLASSIFICATION	ISIC CLASSIFICATION
Aluworks (ALW)	Manufacturing	Manufacturing
Fan Milk Ltd (FML)	Food and Beverages	Manufacturing
Benso Oil Palm Plantation (BOPP)	Manufacturing	Manufacturing
Cocoa Processing Company (CPC)	Manufacturing	Manufacturing
Camelot Gh. Ltd (CMLT)	Manufacturing	Manufacturing
Guinness Gh. Breweries Ltd (GGBL)	Food and Beverages	Manufacturing
Unilever Ghana PLC (UNIL)	Manufacturing	Manufacturing

Source: Ephrim (2023)

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Definition and Measurement of variables

The study employed specific variables, including both a dependent and an independent variable. The reason for the choice of measurement is that these measurements are largely used in literature. The stock returns are considered dependent variable, while the independent variable is the exchange rate.

Dependent Variable

Stock Returns

Stock returns refer to the amount of money an investor earns from holding a stock over a given period. These returns can come in the form of capital gains or losses, as well as dividends paid by the company. Positive stock returns can have a positive effect on the manufacturing sector's performance by increasing investment, improving access to capital, and boosting consumer confidence. On the other hand, negative stock returns can have significant negative impacts on firms, including reduced access to capital, decreased investor confidence, declines in market share, cost-cutting measures, and disruptions to supply chains. It's therefore important for manufacturing firms to manage their financial performance and investor relations proactively to minimize the risks associated with negative stock returns. In this study, the stock prices of the seven manufacturing firms were retrieved from the Ghana Stock Exchange and there after the returns of their individual stock prices were calculated.

Independent Variables

Exchange rate

In Ghana, the sector that imports are more than the sector that exports, resulting in a scenario where depreciation of the currency leads to increased production input costs. Consequently, the cashflow of these manufacturing firms, which are mostly import driven, is reduced. The exchange rate serves as a metric for determining the value of one currency relative to others. The Real Effective Exchange rate (REER) is utilized in this research to measure the relative value of the Ghana Cedi in relation to the US Dollar (GH¢/US$). The REER was chosen for the study because it captures the changes in the local currency. In International Trade, the REER quantifies the amount of foreign goods that can be obtained with a fixed quantity of local currency.

Data and Data Sources

The analysis in this study relied solely on secondary data. The collected data encompassed the monthly stock prices of manufacturing firms, which were utilized to estimate their stock returns. The data spanned from the 1st of January 2008 to 1st December 2020. In this study, the simple returns is chosen over the continuously compounded returns for stock prices and exchange rates. This decision aligns with the perspective of Zivot and Wang (2005), who consider simple and continuously compounded returns to be interchangeable. They argue that there is no significant loss in using simple returns, thus supporting the utilization of simple returns in this research. Additionally, the findings of Boako, Omane-Adjepong & Frimpong (2016) suggest that there is no negligible disparity

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between the empirical results obtained from the use of simple returns and those obtained from the use of continuously compounded or log returns. The monthly stock returns data of the manufacturing firms were obtained from the website of Ghana Stock Exchange (GSE). Monthly exchange rate data were also obtained from the Bank of Ghana Website. This study used R to process the data.

Model Specification

The study adopts two models, namely quantile regression and the bi-wavelet technique to examine the relationship between exchange rate on the returns of manufacturing firms in Ghana. The quantile regression captures the asymmetric influence of exchange rate on the returns of manufacturing firms, while the bi-wavelet technique analyzes the co-movement between exchange rate and manufacturing firms' returns in Ghana. The two models have been thoroughly explained below.

Bi-wavelet Analysis

Using a bi-wavelet technique, the study investigates the co-movement in time and frequency between the exchange rate and stock returns of Ghanaian manufacturing firms. The study focuses on the Continuous Wavelet Transform (CWT) due to its superior ability to extract meaningful information. The adoption of CWT in this study is influenced by previous research works that have successfully applied this technique in similar investigations such as studies conducted by Bossman et al. (2022a), among others.

Continuous Wavelet Transform (CWT)

Wavelet analysis is based on two factors: time or location (ἰ) and scale (s), which are expressed below.

$$\psi_{\dot{\imath},s}(t) = \sqrt{s}^{-1}\,\psi\,(t-\dot{\imath})(s^{-1}), \psi(\bullet)$$

$$\in L^2\,(\mathrm{R}) \tag{1}$$

where $\sqrt{s}^{-1}$ is the normalisation factor, ensuring that the unit variance of the wavelet $||\,\psi_{\dot{\imath},s}(t)\,||^2 = 1$; ἰ $||$ is the location factor, providing the precise location of the wavelet; and s is the scale dilation factor, describing the stretched nature of the wavelet. The Morlet wavelet is more precise in Eqn. (2).

$$\varphi^M\,(t) = \pi^{-1/4}e^{i\omega_o t}e^{-t^2/2} \tag{2}$$

where ω_o. denotes the wavelet's dominant frequency. We set ω_o to 6 after Rua and Nunes (2009), and Vacha and Barunik (2012).

A time series x (t) can be decomposed using a selected mother wavelet as follows (Li, Li, Yuan & Yu, 2020):

$$w_x(\dot{\imath},s) = \int_{-\infty}^{\infty}x(t)\,\sqrt{s}^{-1}\,\psi\left(\frac{t-\dot{\imath}}{s}\right)dt \tag{3}$$

By emphasizing the specific wavelet function ψ ($\bullet$) to the given time series, we obtain $w_s(\dot{\imath},s)$. Compatibly, the primary advantage of a CWT is its ability to decompose and recreate the function $x(t) \in L^2(\mathrm{R})$ as

$$(t) = \frac{1}{C_\varphi}\int_0^{\infty}[\int_0^{\infty}W_x(\dot{\imath},s)\,\psi_{\dot{\imath},s}(t)d\dot{\imath}]\frac{ds}{s^2}, s > 0 \tag{4}$$

Wavelet transforms coherence

The squared absolute value of a wavelet cross-spectrum normalization to a single spectrum of wavelet power is well known as the wavelet transform coherence (WTC) (Torrence and Compo, 1998). Hence, the expression for the squared wavelet coefficient can be stated as follows.

$$R^2(x,y)\text{The} = \frac{\left|\rho(s^{-1}W_{xy}(i,s))\right|^2}{\rho(s^{-1}|W_x(i,s)|^2)\rho(s^{-1}\left|W_y(i,s)\right|^2)} \tag{5}$$

where ρ denotes a smoothing factor, which balances resolution and significance, and $0 \leq R^2_{xy}(i,s) \leq 1$. A value close to zero indicates a relationship that is weak, whereas a value close to 1 indicates a strong co-movement. In the time-frequency domain analyzed using wavelet analysis, a high level of co-movement is represented by more intense or fiery colors. Since the theoretical distribution of the cross wavelet transform coefficient is unknown, the statistical significance of the relationship is assessed using Monte Carlo procedure (Torrence and Compo, 1998).

WTC Phase difference

The coherence of the wavelet transforms and observed time series' phase difference indicates the breaks or interruptions in the oscillations concerning the observed time series. The phase difference between the wavelet transforms coherence and the observed time series is indicative of these interruptions. Following Bloomfield et al. (2004), the phase difference between $x(t)$ and $y(t)$ is characterized below.

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$$\emptyset_{xy}(\iota, s) = \tan^{-1}\left(\frac{\Im\{S(s^{-1}W_{xy}(\iota,s))\}}{\Re\{S(s^{-1}W_{xy}(\iota,s))\}}\right) \tag{6}$$

where $\Im$ represent imaginary operators, and $\Re$ represents real operator. The wavelet coherence map's dimensional phase pattern emphasizes the impact of the wavelet coherence difference. Dimensional arrows are used to distinguish various phase patterns.

The Quantile Regression Approach

This paper uses quantile regression (QR) analysis to examine the effect of exchange rates on stock returns of manufacturing firms in Ghana. QR serves as an extension of the conventional Ordinary Least Squares (OLS) regression method, originally propounded by Koenker and Bassett (1978). According to Nusair and Al-Khasaweneh (2023) and Mensi et al. (2014), QR offers more comprehensive analysis of data compared to OLS allowing for deeper understanding of relationships between variables. QR estimates the conditional median of the response variable given different values of the predictor variables. In contrast, the method of least squares estimates the conditional mean of the response variable across values of the predictor variables. When the requirements of linearity are not met, QR is employed as an extension of linear regression. Estimates based on QR are more resistant to outliers in response measurements. Because of its use and robustness, QR is recommended over regular least squares regression (Das, Krzywinski & Altman, 2019). Additionally, this approach provides more detailed understanding of how the independent variables impact the dependent variable (Owusu Junior et al., 2020).

The research employs a standard OLS regression as a reference point to compare with the findings of the QR. The typical OLS regression can be represented as

$$StkR_t = \alpha_0 + \alpha_1 EXR_1 + \varepsilon_t \qquad (1)$$

The variables $StkR_t$ and EXR_1 represent the monthly returns on stocks and the monthly exchange rate respectively. The variable ε refers to the noise term or the random error term. The returns of the stock prices and that of the exchange rate are calculated based on the simple values of the monthly stock price (share indexes) expressed as

$$StkR_t = P_t - P_{t-1} \qquad (2)$$

$$EXR_t = P_t - P_{t-1} \qquad (3)$$

The variables $StkR_t$ and EXR_t represent the continuously compounded monthly stock returns and monthly exchange rate returns, respectively. The variable P_t denotes the monthly stock price of manufacturing firms at the current time period, t, while P_{t-1} indicates the stock price of the same firms in the preceding time period, (t-1).

According to Assifuah-Nunoo et. al. (2022), the conventional OLS model presented in Equation (1) can only address one specific question in this study, which is whether exchange rate movements influence the stock returns of these manufacturing firms. However, the OLS model may not be suitable for answering a crucial question, such as whether exchange rate shocks have different effects on the stock market returns on firms with low returns compared to firms with high returns. Assifuah-Nunoo et. al. (2022) proposed that the use of QR analysis can

provide answers to this important question and can identify any differences in the effects of exchange rate shocks on stock market returns given different market conditions (strong, normal, or bearish).

With QR, a model of the conditional τ^{th} quantile of the explained variable is generated for specified values of $\boldsymbol{\tau} \in (0,1)$. Therefore, the contingent QR model for $Stock_{RT}$ given EXR_t could be represented as

$$Q_{StockR_t}(\tau/EXR) = a^\tau + EXR'_t\beta^\tau \tag{4}$$

where the conditional τ^{th} quantile of the regressand $StockR_t$, the stock returns, is defined by $Q_{StockR_t}(\tau/EXR)$, the intercept is presented as a^τ, and allowed to be subject to τ. A vector of the τth related coefficients is defined as β^τ, and EXR' defines a vector of regressors, which in this study, is restricted to returns on the EXR.

The study examines the quantile correlations to correspond to the conventional OLS model defined in Equation (1) as it examines the effects of the exchange rate movement on stock returns with QR estimations.

$$Q_{stockRt}(\tau/EXR) = \beta_0^\tau + \beta_1^\tau EXR_t \tag{5}$$

By applying the QR model in Equation (4), the study examines the potential stock-exchange rate link across 19 quantiles with $\tau = 0.05, 0.10, 0.15, 0.20, 0.25 \ldots 0.95$, serving as the threshold. Conditions will be attributed to the above-stated quantiles with the median quantile considered a normal market condition and with the quantiles below and above deemed bearish and bullish market conditions respectively.

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Data Analysis

Descriptive analysis was employed to examine the first, second, third and fourth moments of the data. Additionally, quantile regression was utilized to determine the asymmetric effect between exchange rate and the stock returns of manufacturing firms in Ghana. To assess the presence of comovement between the two variables, biwavelet correlation analysis was conducted. The descriptive analyses were performed on a firm-by-firm basis, following the classification of firms on the Ghana Stock Exchange.

Justification of Estimation techniques

The quantile regression analysis is employed to investigate the asymmetric effects of exchange rates on the stock returns of manufacturing firms in Ghana. According to Nusair and Al-Khasawneh (2018), this strategy enables us to thoroughly explore the relationship between the independent variable (exchange rates) and the dependent variable (stock returns). Quantile regression goes beyond traditional methods by providing insights into how the relationship varies across different quantiles of the dependent variable, in this case, stock returns. According to Naifar (2016) and Nusair and Al-Khasawneh (2018), quantile regression, in contrast to other techniques that concentrate on average relationships, enables us to draw conclusions about the relationship between the two variables at various points in the distribution and thus distinguish between various market conditions. Furthermore, Zhu, Duan and Yu (2016) pointed out that quantile regression is considered robust even when dealing with data issues like skewness, non-normality, outliers, and heterogeneity within the dependent variable.

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The study further employed the biwavelet technique to analyze the co-movement between exchange rates and stock returns. One notable contribution of this approach is that it enhances the robustness of the results, as highlighted by Percival and Walden (2000). This increased robustness can be pivotal in achieving the critical mass and empirical consistency needed for theoretical analysis. Wavelet analysis, by estimating the spectral characteristics of a time series over time, reveals how periodic components change with time. It can detect possible breaks in each period and frequency and is suitable for non-stationary data or data with structural breaks.

The ability of wavelet analysis to decompose time scales is advantageous compared to traditional categorizations, such as distinguishing between short and infinitely long-term relationships in cointegration methods. This decomposition into different time scales enhances robustness and the practicality of decision-making, as supported by studies like Almasri and Shukur (2003), Hacker et al. (2014), Percival and Walden (2000), and Ramsey and Lampart (1998).

This approach further assesses the lead-lag relationship between these two variables while preserving both the calendar and intrinsic time dimensions. It's important to note that biwavelet analysis is limited to only two variables.

Chapter Summary

In this chapter, the design and approach were discussed, with explanatory research being the suitable design and quantitative research as the applicable approach for this study. It also outlined and described how quantile regression (QR) techniques and Bi-wavelet technique were used in determining the effect of

exchange rate on the returns of manufacturing firms in Ghana. Further, the study

variables and their time series characteristics were also covered in this chapter.

Lastly, the justification for employing these techniques have been provided in this

chapter.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

The objective of the study was to examine the effect of exchange rate on the stock returns of manufacturing firms listed on the Ghana Stock Exchange from 2008 to 2020. This chapter provides the practical observations and in-depth analysis of the study's outcomes based on the methodology employed in chapter Three. Additionally, using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests the research investigated the time series characteristics of the data to establish the degree of stationarity and integration of the variables. The study also includes explanatory data analysis, descriptive presentation of the results, and comprehensive analysis.

Descriptive Statistics

Knowing the underlying pattern in a data collection would be appropriate before drawing any statistical conclusions from it. Descriptive statistics essentially employ numerical and/or graphical techniques to represent the patterns present in a dataset (Quansah, 2016). An overview of the descriptive statistics for both the dependent and independent variables is given in this section. Table 2 describes the first, second, third, and fourth moments, respectively representing mean, standard deviation, skewness, and the kurtosis characteristics of the stock returns of selected manufacturing firms in Ghana on the stock exchange. The statistics show that all seven manufacturing firms except Benso Oil Palm Plantation (BOPP) and Unilever Ghana Ltd. (UNIL) recorded a negative mean

return. Exchange rate is also seen to exhibit positive mean returns. With reference to skewness, Aluworks Ltd. (ALW), Benso Oil Palm Plantation (BOPP), Cocoa Processing Company (CPC), Camelot Ghana Ltd. (CMLT), and Guinness Ghana Breweries Plc. (GGBL) have returns distribution that is negatively skewed, only Fan Milk Ltd. (FML) and Unilever Ghana Ltd. (UNIL) recorded positive skewness. Also, exchange rate (EXR) recorded skewness that was negative. It is noteworthy that among all the manufacturing firms analyzed, their return deviations were consistently lower than that of BOPP, with CMLT demonstrating the smallest deviation throughout the study period. The result from the Jacque Bera statistics shows a non-normal distribution for the returns of all manufacturing firms and exchange rate.

From Table 2, the study also determined stationarity using Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. The results for both the ADF and PP show all the data at first difference are stationary at 5% significant level. This indicates that the null hypothesis for ADF and PP was rejected and the conclusion for stationarity was achieved for the stock returns for the manufacturing firms at first difference.

Table 2. Descriptive Statistics of Exchange Rate and Stock Returns of manufacturing firms in Ghana

Statistics	EXR	Stock Returns						
		ALW	BOPP	CPC	CMLT	FML	GGBL	UNIL
Mean	0.0116	-0.0039	0.0105	-0.0001	-0.0004	-0.0060	-0.0014	0.0095
Std. Dev.	0.0325	0.0208	0.2890	0.0043	0.0073	0.3010	0.0827	0.0656
Skewness	-0.6115	-1.2423	-0.1701	-0.0645	-1.4423	0.1218	-1.2428	0.0824
Kurtosis	4.5876	5.6435	3.0441	2.4282	20.2479	39.7008	5.4184	3.3435
ADF	-5.556^{**}	-5.869^{**}	-3.7783^{*}	-5.1821^{**}	-5.5831^{**}	-5.5611^{**}	-4.307^{**}	-4.0549^{**}
PP	-152.6^{**}	-148.31^{**}	-89.839^{**}	-201.08^{**}	-123.65^{**}	-187.73^{**}	-102.68^{**}	-92.122^{**}
Jarque Bera	151.69^{***}	254.63^{***}	63.745^{***}	40.439^{***}	2782.4^{***}	10467^{***}	238.04^{***}	75.992^{***}
Obs.	157	157	157	157	157	157	157	157

Notes: EXR, ALW, BOPP, CPC, CMLT, FML, GGBL, and UNIL represent stock market returns with respect to Exchange rate, Aluworks Ghana Ltd., Cocoa Processing Company, Camelot Ltd., Fan milk Ghana Ltd. Guinness Ghana Breweries Ltd and Unilever Ghana Ltd.; Obs represent the number of observations; while ***, **, and * indicate statistical significance at 1%, 5% and 10% level respectively.

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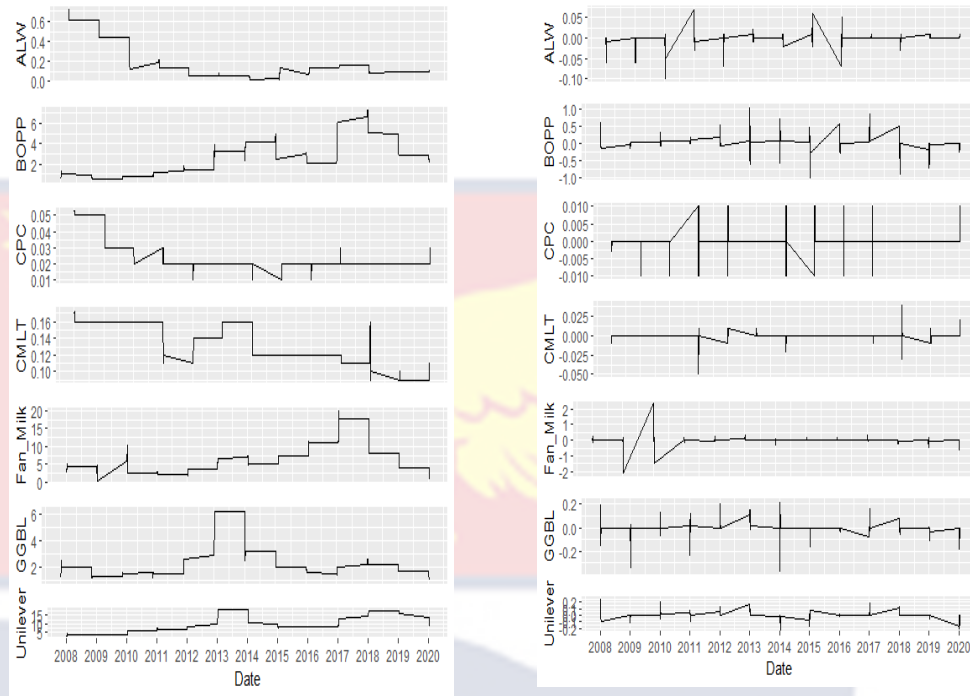
Figure 2: **Graphical depiction of monthly raw series (on the left) and stock return series (on the right).**

Quantile Regression

The study reports the OLS and Quantile Regression (QR) models from Equation (1) and Equation (5) in Tables 3, 4, and 5. Additionally, Figure 1displays the coefficient estimates of the QR model plotted under a 95% confidence interval.

According to the report from the conventional OLS model, there is a notable and significant effect of exchange rate (EXR) on the returns of ALW, CPC, and CMLT. However, it should be noted that the effect of exchange rate on GGBL's returns was also discovered to be negative but insignificant. The report further showed a direct and substantial correlation between exchange rate and the returns of BOPP, FML, and UNIL. The outcome derived from the OLS model aligns with those of Kasman, Vardar and Tunc (2011). Their studies reported that

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exchange rate and stock returns are inversely and positively related respectively. The insignificant relationship between ExR and the SR of GGBL also agrees with the writings of Muhammad, Rasheed, and Husain (2002), who conducted research on the effect of exchange rate on the stock returns of South Asian nations (Pakistan, Bangladesh, Sri Lanka, and India).

However, OLS has a limitation, thus, it only establishes the relationship between variables without factoring in the relationship when there are different market situations. The QR provides robust evidence of the correlation between the dependent variable (stock returns of manufacturing firms in Ghana) and the independent variable (exchange rate) at specific quantiles of the regressand. This methodology offers reliable insights into the connection between these variables under different market scenarios including a bullish (strong) market, a normal (stable) market, or a bearish (weak) market. This is supported by studies conducted by Mensi et al. (2014), Naifar (2016), and Nusair and Al-Khasawneh (2018). QR, which performs more vigorous estimation, is employed in the study also because it can handle issues such as extreme values, heterogeneity, and normality issues as indicated by Zhu, Duan and Yu (2016). Figure 1 presents summarized plots for the QR coefficients, and the approximations obtained from the OLS model.

Stock Returns- ExR Nexus (ALW)   **Stock Returns- ExR Nexus (BOPP)**

Stock Returns- ExR Nexus (CPC)   **Stock Returns- ExR Nexus (CMLT)**

Stock Returns- ExR Nexus (FML)   **Stock Returns- ExR Nexus (GGBL)**
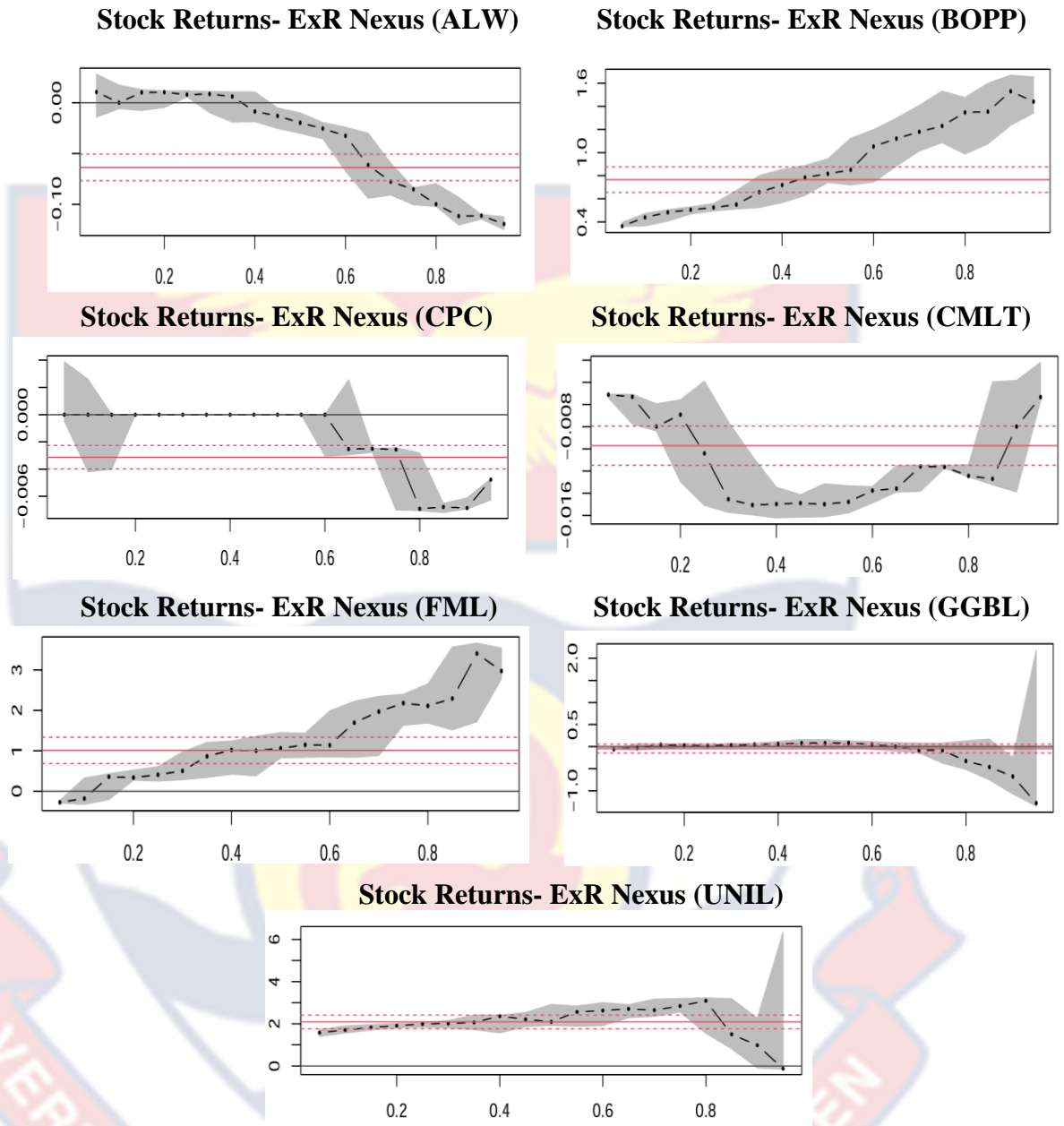
Stock Returns- ExR Nexus (UNIL)

Figure 3: **Estimated exchange rate coefficients under Quantile Regression.**

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Table 3: OLS and QR Coefficients Estimate for Exchange Rate and Stock Returns of the Manufacturing Firms at Lower Quantiles

Manu. firm	Variable	OLS	Lower Quantiles					
			$Q_{0.05}$	$Q_{0.10}$	$Q_{0.15}$	$Q_{0.20}$	$Q_{0.25}$	$Q_{0.30}$
ALW	Intercept	-0.6793	-0.9895	-9.5000	-0.9606	-0.9592	-0.9497	-0.9481
	ExR	-0.064***	0.0104	0.0000	0.0100**	0.0102***	0.0079**	0.0084
BOPP	Intercept	0.0718	-0.6527	-0.6028	-0.5049	-0.4934	-0.4755	-0.4698
	ExR	0.7657***	0.3630***	0.4394***	0.4826***	0.5050***	0.5244***	0.5497***
CPC	Intercept	-0.9694	-0.0900	0.0900	-0.0900	-0.0900	-0.0900	-0.0000
	ExR	-0.0031***	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
CMLT	Intercept	-0.8488	-0.8873	-0.8862	-0.8738	-0.8735	-0.8568	-0.8397
	ExR	-0.0097***	-0.0051**	-0.0053***	-0.008***	-0.0069**	-0.0104***	-0.0145***
FML	Intercept	3.3283	1.3857	1.5068	1.2883	1.5569	1.7127	1.8561
	ExR	1.0110***	-0.2742	-0.1800	0.3584	0.3388**	0.4088	0.5053**
GGBL	Intercept	1.3486	0.2874	0.3318	0.3327	0.4271	0.4954	0.5420
	ExR	-0.0467	-0.0593	-0.0275	0.0404	0.0251	0.0219	0.0298
UNIL	Intercept	4.5364	1.2492	1.5526	1.5964	1.5768	1.5564	1.5859
	ExR	2.0928***	1.5814***	1.7065***	1.8291***	1.9089***	1.9911***	2.0142***

NB: ***, **, and * signifes statistical significance at 1%, 5% and 10% level respectively. ALW, BOPP, CPC, CMLT, FML, GGBL, and UNIL represents stock returns of Aluworks, Benso Oil Palm Plantation, Cocoa Processing Company, Camelot Ghana Ltd, Fan-Milk Ghana Ltd., Guinness Ghana Breweries Plc., and Unilever Ghana Ltd. respectively.

Table 3 provides the estimates of the relationship between exchange rate and the stock returns of manufacturing firms in the lower quantile (0.05, 0.1, 0.15, 0.20, 0.25, and 0.3) or a bearish market condition. The intuition behind the result is that in the bearish market, exchange rate tends to react differently toward the stock returns of each of the manufacturing firms. Significant relationships were observed between exchange rate (ExR) and stock returns (SR) for all firms excluding Cocoa Processing Company (CPC) and Guinness Ghana Breweries Limited (GGBL) which show insignificant quantile regression coefficients. This lack of significance could indicate that other factors or variables may play a more dominant role in determining stock returns in that range of quantiles. It is possible that the influence of the exchange rate may be less pronounced or less consistent within this range of returns.

From the table, exchange rate was positive and significant with stock returns in Benso Oil Palm Plantation (BOPP), and Unilever Ghana Limited (UNIL) which aligns with the work of Er and Vuran, 2012, but negative and significant with CMLT. Where it is significant with negative coefficient, it indicates exchange rate is inversely related with stock returns. That is, as exchange rate increases (decreases), the stock returns of CMLT tend to decrease (increase). This suggests that CMLT may be perceived to be riskier (favorable) for investors when exchange rate appreciates (depreciates). When the exchange rate increases (decrease), the firm's stock returns are likely to lower (raise). This agrees with the study conducted by Rahman, Sidek and Tafri (2009) who investigated the interaction between various macroeconomic variables and Kuala

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Lumpur stock returns in the Malaysian Stock market and discovered EXR has an inverse and significant influence between the exchange rate and stock returns.

The positive coefficient indicates a direct association between the two variables. As exchange rate (ExR) increases, there is a corresponding increase in the returns of BOPP and UNIL. This shows that when ExR appreciates, there is the desire for investors to comprehend more stocks from BOPP and UNIL. The direct relationship that exists between exchange rate and the stock returns of BOPP, and UNIL is commensurate with those of Laichena et. al. (2015) and Barnor (2014) who discovered a direct association with exchange rate and stock returns when they investigated how macroeconomic variables affects stock returns on the Ghana stock market by employing time-series data analysis.

The coefficients obtained in the case of Aluworks Limited (ALW), and Fan Milk Ghana Limited (FML) were found to be statistically significant under different quantiles. The stock returns (SR) for ALW is positively influenced by exchange rate only at the 15%, 20%, and 25% quantiles, while EXR have positive effect on the returns of FML at the 20% and 30% quantiles.

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Table 4. OLS and QR Coefficients Estimate for Exchange Rate and Stock Returns of the Manufacturing Firms at Middle Quantiles

Manu. Firm	Variable	OLS	Middle Quantile					
			$Q_{0.35}$	$Q_{0.40}$	$Q_{0.45}$	$Q_{0.50}$	$Q_{0.55}$	$Q_{0.60}$
ALW	Intercept	-0.6793	-0.9367	-0.8758	-0.8522	-0.8211	-0.7871	-0.7549
	ExR	-0.0637***	0.0060	-0.0087	-0.0130	-0.0198**	-0.0255**	-0.0326
BOPP	Intercept	0.0718	-0.4994	-0.4312	-0.3168	-0.2932	-0.2711	-0.2942
	ExR	0.7657***	0.6575***	0.7185***	0.7843***	0.8165***	0.8509***	1.0524***
CPC	Intercept	-0.9694	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
	ExR	-0.0031***	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
CMLT	Intercept	-0.8488	-0.8376	-0.8376	-0.8363	-0.8341	-0.8337	-0.8340
	ExR	-0.0097***	-0.0150***	-0.0149***	-0.0148***	-0.0149***	-0.0147***	-0.0137***
FML	Intercept	3.3283	1.8605	1.8624	2.4944	2.8258	3.1155	3.1891
	ExR	1.0110***	0.8653***	1.0217***	1.0050***	1.0623***	1.1481***	1.1395***
GGBL	Intercept	1.3486	0.5392	0.5503	0.6157	0.7332	0.7673	0.9876
	ExR	-0.0467	0.0474	0.0564	0.0796	0.0774	0.0830	0.0451
UNIL	Intercept	4.5364	1.6944	1.6724	2.4383	3.6139	3.4555	4.0386
	ExR	2.0928***	2.0660***	2.3631***	2.2123***	2.0972***	2.5631***	2.6307

NB: ***, **, and * signifies statistical significance at 1%, 5% and 10% level respectively. ALW, BOPP, CPC, CMLT, FML, GGBL, and UNIL represent stock returns of Aluworks, Benso Oil Palm Plantation, Cocoa Processing Company, Camelot Ghana Ltd, Fan-Milk Ghana Ltd., Guinness Ghana Breweries Plc., and Unilever Ghana Ltd. respectively.

Table 4 provides the estimates of the relationship between exchange rate and the stock returns of manufacturing firms in the middle quantile (0.35, 0.40, 0.45, 0.50, 0.55, and 0.6) or normal market condition. By examining Table 4, it becomes evident that the coefficients of the variables vary across different quantiles of the exchange rate. Except for Cocoa Processing Company and Guiness Ghana Breweries Limited, all other manufacturing firms exhibit a significant relationship between exchange rate and their stock returns in a normal market environment.

Positive quantile regression is observed between exchange rate and the stock returns of BOPP, FML, and UNIL. It suggests a relationship where increased exchange rate is associated with higher returns for these firms. In other words, during periods where there is a higher exchange rate in a normal market condition, such as the appreciation of the Ghana Cedis, the stock returns of BOPP, FML, and UNIL tend to also rise. This means that the performance of BOPP, FML, and UNIL tend to improve when there is an improvement in the exchange rate. Thus, exchange rate has a direct significant impact on the explanation of the stock returns of these firms, particularly in the middle quantiles.

Regarding Camelot Ghana Limited (CMLT), where there are negative and significant quantile coefficients between the two variables, when the exchange rate of the country is high, it tends to have an adverse effect on the stock returns of CMLT, hence its performance. This suggests that even in a normal market where the economy is said to be stable, and supply and demand factors are in a relatively balanced state, exchange rate have adverse impact on the returns of

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CMLT. This aligns with the findings of Rakhal who conducted his study based on literature available in international and Nepalese context in 2018, and arrived to the same conclusion that exchange rate negatively affects stock market performance.

The results further show a significant but negative relation of the exchange rate in the case of ALW stocks under only the 50th and 55th quantiles ($Q_{0.5}$ and $Q_{0.55}$). This means that the stock returns of ALW are adversely affected by exchange rate at the middle quantile (0.5 and 0.55). Meanwhile, the result for GGBL indicate that there are no asymmetric effects of exchange rate changes on Guinness Ghana Breweries Limited (GGBL) stock returns. Thus, from the findings, changes in exchange rate does not affect the performance of GGBL in a normal market condition.
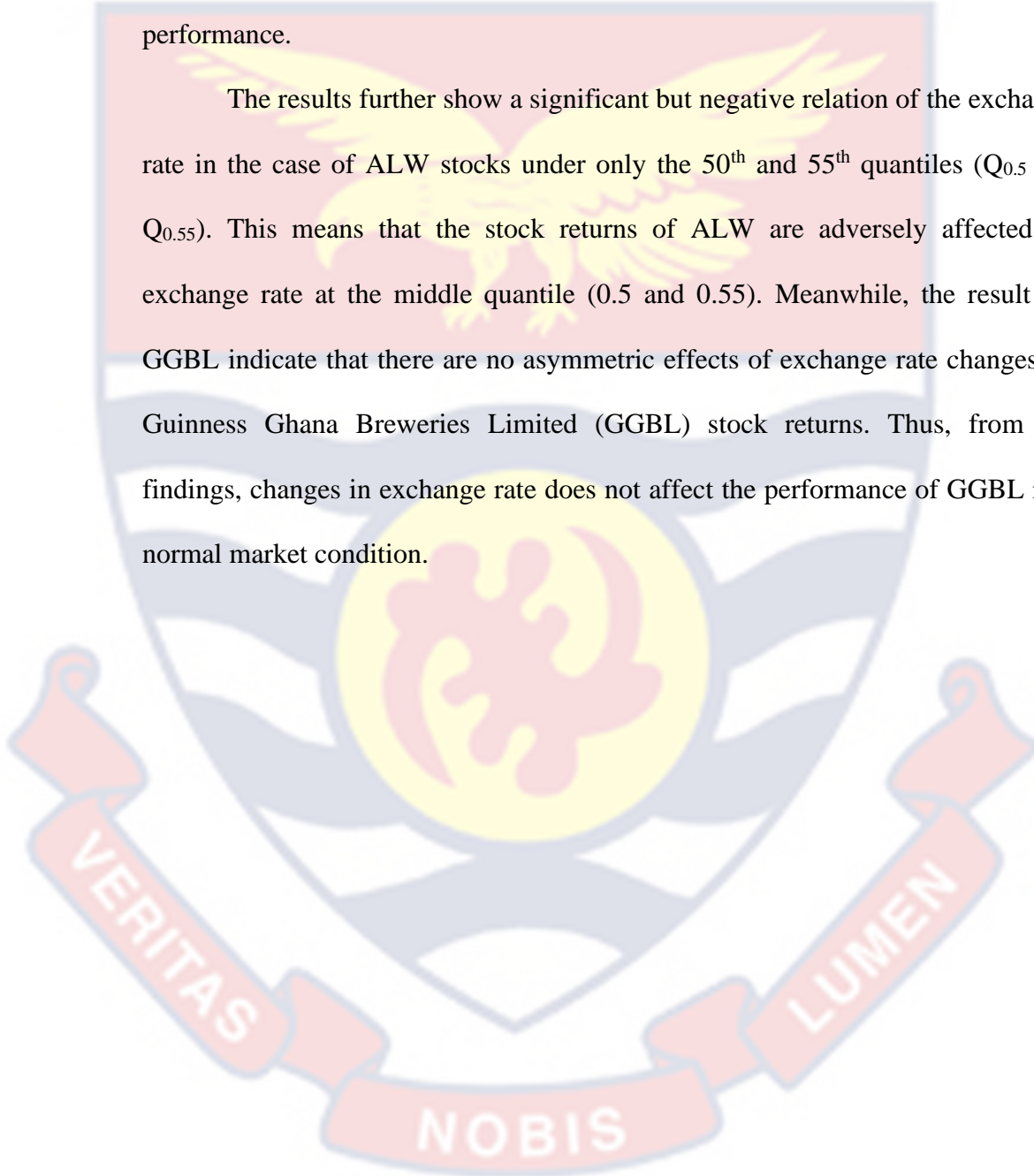
Table 5. OLS and QR Coefficients Estimate for Exchange Rate and Stock Returns of the Manufacturing firms at Upper Quantiles

Manu. firm	Variable	OLS	Upper Quantiles						
			$Q_{0.65}$	$Q_{0.70}$	$Q_{0.75}$	$Q_{0.80}$	$Q_{0.085}$	$Q_{0.90}$	$Q_{0.95}$
ALW	Intercept	-0.6793	-0.6333	-0.5656	-0.5232	-0.4538	-0.3682	-0.3609	-0.3180
	ExR	-0.064***	-0.0613***	-0.0777***	-0.0852***	-0.0998***	-0.1115***	-0.111***	-0.1194***
BOPP	Intercept	0.0718	-0.2762	-0.0656	0.1038	0.0888	0.2680	0.2719	0.9124
	ExR	0.7657***	1.1211***	1.1795***	1.2299***	1.3475***	1.3546***	1.5302***	1.4412***
CPC	Intercept	-0.9694	-0.9689	-0.9689	-0.9685	-0.9489	-0.9476	-0.9471	-0.9471
	ExR	-0.0031***	-0.003**	-0.0025**	-0.003***	-0.0069***	-0.0067***	-0.0068***	-0.005***
CMLT	Intercept	-0.8488	-0.8341	-0.8348	-0.8343	-0.8303	-0.8281	-0.8302	-0.8301
	ExR	-0.0097***	-0.0135***	-0.0115***	-0.0116***	-0.0124***	-0.0127***	-0.0079**	-0.0053**
FML	Intercept	3.3283	3.0373	2.9616	2.9013	3.3489	4.0605	4.6929	6.3066
	ExRR	1.0110***	1.6960***	1.9691***	2.1815***	2.1128***	2.2947***	3.4068***	2.9753***
GGBL	Intercept	1.3486	1.2060	1.5626	1.6940	2.6985	3.2764	4.2197	6.9278
	ExR	-0.0467	-0.0058	-0.0806	-0.0822	-0.3262**	-0.462***	-0.676***	-1.280***
UNIL	Intercept	4.5364	4.5296	4.9347	4.9060	4.9538	11.0392	13.0899	17.2694
	ExR	2.0928***	2.7056***	2.6445***	2.8433***	3.0916***	1.5028**	0.9854	0.1236

NB: ***, **, and * signifies statistical significance at 1%, 5% and 10% level respectively. ALW, BOPP, CPC, CMLT, FML, GGBL, and UNIL represents stock returns of Aluworks, Benso Oil Palm Plantation, Cocoa Processing Company, Camelot Ghana Ltd, Fan-Milk Ghana Ltd., Guinness Ghana Breweries Plc., and Unilever Ghana Ltd. respectively.

Table 5 provides the estimates of the association between exchange rate and the stock returns of manufacturing firms in the upper quantile (0.65, 0.70, 0.75, 0.80, 0.85, 0.9, and 0.95) or a bullish market condition. According to the table, exchange rate has a significant relationship with stock returns for all manufacturing firms. Positive quantile regression coefficient is observed between exchange rate and BOPP, FML and UNIL, while exchange rate has a inverse quantile regression estimate with the stock returns of ALW, CPC, and CMLT.

The positive estimates mean a higher exchange rate causes higher stock returns. In other words, during periods of higher exchange rate (such an appreciation in the Ghana Cedis), the returns of BOPP, FML and UNIL tend to rise and vice versa. These positive estimates will bring more investment confidence to investors leading to improvement in the performance of these firms, but when exchange rate decreases, investors will tend to lose confidence as their returns will decrease. Investors' loss of confidence leads to a decrease in stock prices and trading volumes, and this has several negative consequences for the firm.

The negative relationship suggests that when exchange rate depreciates, investors would rather venture into ALW, CPC, and CMLT as their investment would result in higher returns. Meanwhile, an appreciation of the exchange rate will result in lower returns for ALW, CPC, and CMLT in a bullish market. The negative relationship between exchange rate and the returns between the variables is in line with the findings of Khan (2019) who analyzed the relationship between exchange rate and stock returns on the Shenzhen Stock Exchange using ARDL.

The positive and negative coefficients indicate that exchange rate has a substantial impact on the explanation of stock returns for the manufacturing firms in the upper quantile. The table divulges that exchange rate and the return of GGBL was negative and significant only at some selected quantiles ($Q_{0.80}$, $Q_{0.85}$, $Q_{0.90}$, and $Q_{0.95}$).

Wavelet Analysis

The study's second objective was achieved using the wavelet technique. The bi-wavelet technique was utilized to examine the variables' time and frequency. Since monthly data was used, we set *lj*, j = 1,…4 (Idun, Asafo-Adjei, Adam et. al., 2022), where the components of the wavelets have a conforming relationship to times of 0-4 months indicating short-term (temporal or immediate term), 4-16 months indicating medium term (intermediate term), and 16 months and above indicate long term.

The data used for the analysis consist of monthly stock returns of seven manufacturing firms in Ghana including Aluworks (ALW), Benso Oil Palm Plantation (BOPP), Cocoa Processing Company (CPC), Camelot Ghana Ltd. (CMLT), Fan Milk Ltd. (FML), Guinness Ghana Breweries Plc. (GGBL) and Unilever Ghana Plc. (UNIL) and exchange rate for the period January 2008 to December 2020. The analysis seeks to address the second objective, thus determining whether exchange (EXR) comoves with the stock returns (SR) of manufacturing firms in Ghana.

To ensure clarity and easy interpretation of the data, arrows pointing to the right (→) depict when exchange rate (EXR) and stock returns (SR) move in the

same direction. Conversely, arrows pointing in the left direction (←), on the other hand, indicate EXR and SR are moving in opposite direction. Also, arrows that are pointing right and upwards (↗), or arrows pointing left and downwards (↙) are said to have their first variable lagging while the second variable leads. The opposite is true when there are left-pointing upward arrows (↖) or right-pointing downward arrows (↘) (Idun, Asafo-Adjei, Adam et. al., 2022). According to Nkrumah-Boadu, Owusu Junior, Adam and Asafo-Adjei (2022), the first variable is the variable that leads and first to react to shocks, while the lagging variable reacts subsequently in response.

Time and Frequency Domain

To examine the degree of comovement between two time-frequency variables, the bi-wavelet technique was utilized. The use of this method aids in determining how the two variables move together closely through time and frequency. The horizontal and vertical courses represent the calendar time and frequency domain respectively. Both are combined to represent the time-frequency domain framework (Idun et. al., 2022; Boateng et al., 2022). The program used in analyzing and explaining statistics was adopted from Grouhier et al. (2013). Any outcome outside the cone of influence (COI) is insignificant.
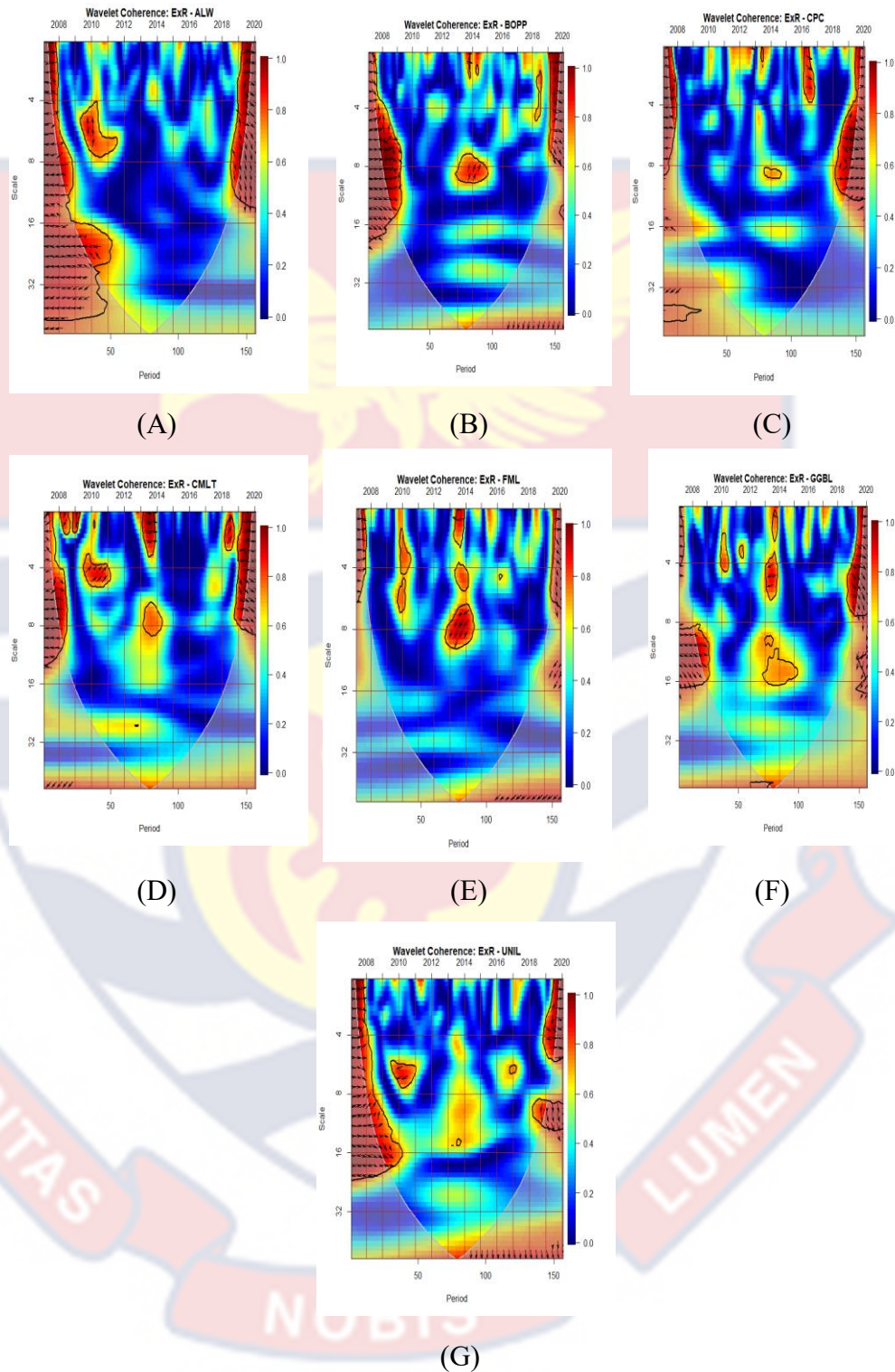
(A)

(B)

(C)

(D)

(E)

(F)

(G)

Figure 4: **Wavelet analysis of exchange rate and stock returns of manufacturing firms.**

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Comovement between exchange rate and the stock returns of manufacturing firm in Ghana

This section presents the results of the comovement between the exchange rate and stock returns of the seven manufacturing firms in Ghana.

Exchange Rate (ExR) and Aluworks (ALW) Stock Returns

Figure A describes the comovement that exists between exchange rate and Aluworks stocks in the time-frequency domain. The presence of red pallets (warm color) in the section of the scalogram demonstrates that the comovement between the two variables is strong. The comovement is seen to spread across all the scales but mostly during the medium term. In the short term, a strong correlation is found in 2019. During the period 2008, 2010 to 2011, and 2018, ExR is seen to interrelate with ALW in the medium term, while in the years 2009 to 2011, comovement is seen during the long term.

In the short and intermediate terms, the two variables seem not to have a clear relationship as the arrows point upwards and downwards without any direction. But in the long term, exchange rate has an adverse relationship with stock returns, this is indicated by the arrows which point leftwards in the red pallets, with a few of them pointing left upwards suggesting that exchange rate is leading, while ALW stock is lagging. This implies that a shock in the exchange rate affects the stock returns of ALW in Ghana. This is consistent with the flow-oriented theory that suggests that changes in the stock returns is influenced by the instability in the exchange rate. The adverse relationship between the two variables indicates that a rise in EXR is associated with a fall in the returns of

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ALW and vice versa in the long term. This negative comovement may be due to the country's currency becoming weaker, and imports becoming expensive, thereby making export favorable for Aluworks in the international market. This enhances the profitability of the company and eventually increases the returns of ALW because investors would rather maintain their stocks in the firm rather than sell them, thereby improving the performance of the firm.

Although there are traces of strong comovement found across all scales, most parts of the scalogram showed a weak comovement between EXR and SR of ALW. This is represented by the blue, green and yellow patches found in the time and frequency domain. It implies that economic shocks on each of the variables do not affect each other.

Exchange Rate (ExR) and Benso Oil Palm Plantation (BOPP) Stock Returns

Figure B depicts the comovement between exchange rate and the Benso Oil Palm Plantation (BOPP) Stock returns in Ghana. Unlike ALW, BOPP documents strong coherence levels in only the temporal and intermediate term, but mostly in the medium term. This is especially observable in the years 2008 to 2009, 2013 to 2015, and a little above 2019. In the short term, there are few traces of red pallets found in the years 2014 and 2018. The red pallet with arrows pointing upward and right in this time-frequency region, especially within the medium frequency (4-16 monthly) region signifies a high positive correlation with ExR lagging while stock returns lead.

Converse to what was observed in ALW, SR leads the ExR in responding as the first variable to external shocks. Thus, the stock return variables could

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positively drive ExR at a specific time and frequency. This makes stock returns a relevant variable that influences exchange rate except in the long term. Further, the right-pointing arrows suggest that exchange rate is directly correlated with stock returns in the medium term, suggesting that an increase (decrease) in exchange rate leads to an increase (decrease) in the stock returns of BOPP. This means that for the years that comovement was depicted, EXR rate and SR of BOPP comoved in one direction. The relationship may be due to BOPP relying heavily on imports even when the currency had depreciated. The depreciation of the currency results in a high cost of import as it takes more of the local currency to purchase the same amount of foreign currency. This leads to lower profit margins and stock prices for the firm as investors in ALW will be concerned about the lower returns and sell off their stocks. Although exchange rate comoved with stock returns in some parts of the time-frequency zone, most of the period experienced a weak comovement indicated by the blue, green and yellow pallets.

Exchange Rate and Cocoa Processing Company (CPC) Stock Returns

The comovement between exchange rate and the stock returns of the Cocoa Processing Company (CPC) in Ghana is depicted in Figure C. Like the observation in BOPP, it could be examined that exchange rate and CPC experienced some level of comovement in the short and medium terms, however, this comovement is not observed in the long term. The few red patches seen indicate the strong comovement between the two variables during the short (0-4 monthly) and medium (4-16 monthly) regions. In the short term, comovement is found between ExR and SR during the year 2016, and in the middle of 2019. This

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finding is consistent with Ayobami's study in 2019. His study discovered exchange rate to be significant with stock returns in the short run but not in the long run. Comovement was depicted from 2018 to the middle of 2019 during the medium term.

The dominant right-downwards pointing arrows located in the red pallet in the short and medium terms indicate exchange rate is leading while the stock return of CPC is lagging. This means alterations in exchange rate typically occur before changes in SR, and the direction of change in EXR can offer insights into future changes in stock returns. The few right-pointing arrows seen during the medium term suggest that exchange rate positively drives the stock returns of CPC. Consequently, an increase in EXR corresponds to an increase in the SR of CPC. This positive relationship may be due to CPC exporting massively during the year 2019, as an increase in exports will benefit the company as they will receive more income in their local currency when they sell their goods abroad. This will enhance the confidence of investors as the returns of the firms increase through the profit gained from exports. The blue and yellow patches in the region are an indication of a weak comovement between the variables during those periods.

Exchange Rate and Camelot Ghana Ltd. (CMLT) Stock Returns

Figure D illustrates the comovement between exchange rate (EXR) and the returns of Camelot Ghana Ltd in Ghana. Figure D indicates the comovements between ExR and SR of CMLT are short-lived. This occurs within the temporal- and intermediate-term timeframes, indicated by the red patches found during

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specific years. In the short term, the comovement is evident in the years 2008, 2014, and 2018, while in the medium term, it is observed from the latter part of 2018 to the middle of 2019. Further, the comovements between ExR and the returns of CMLT are positive, indicating that a rise in exchange rate induces SR of CMLT to rise. This may be because, during those years of strong comovement, CMLT engaged in an increased reliance on imported raw materials which are relatively cheaper when there is an appreciation in the exchange rate, sequentially, leads to an increase in profit and subsequently drives an upward movement in its stock returns.

The arrows pointing to the right and upwards in CMLT in the years 2010 and 2018 during the short term indicate a lead in the stock returns of CMLT while the exchange rate lags. Thus, any shock in the economy will first be reacted by stock returns before exchange rate. There also seem to be few arrows pointing right and downwards in the year 2019, which indicates that stock returns of CMLT lead while EXR lags. This means that movement in the stock prices and investor sentiment during that year drove the stock market before the changes in exchange rate occurred. As observed in the other manufacturing firms, the blue and yellow patches are dominant, indicating a weak correlation between EXR and SR of CMLT.

Exchange Rate (ExR) and Fan-Milk (FML) Stock Returns

Figure E depicts the comovement between EXR and SR of Fan-Milk Ghana Ltd. Similar to what was found in BOPP, CPC, and CMLT, comovement between ExR and Stock Returns occurred only in the temporal- intermediate-term

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timeframes. Traces of the red pallets seen during the years 2010 and 2014 indicate a strong comovement between the two variables in these two timeframes. The left and downward arrows indicate that stock returns lead exchange rate in this time-frequency region, this occurred in the year 2014 in the middle term, thus shocks are first received by the returns of Fan Milk before exchange rate. The blue and yellow pallets in the region indicate a weak comovement between the two variables.

Exchange Rate (EXR) and Guinness Ghana Breweries Ltd. (GGBL) Stock Returns

Figure F illustrates the comovement between EXR and SR of Guinness Ghana Breweries Ltd (GGBL). The figure reveals that EXR exhibits comovement with the returns of GGBL, and this is seen in part of the region indicated by the red pallet in the scalogram. From a time, perspective, that is in 2010 and 2014, EXR correlates with the returns of GGBL in the short to middle term. While co-movement was found in the short term, stronger comovement was found in the middle term. The small red patches also seen in the years 2008 to 2009, in the year 2014 and latter part of 2018 also indicate a strong correlation in the medium term. However, weak comovement was also observed in most parts of the region. The indication of the green, blue, and yellow patches that are seen across the region depicts this weak correlation. The lead-lag relationship shows that exchange rate is leading since the arrow is seen pointing right and downward. Comovements between EXR and GGBL are positive in the short term in the year

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2008, suggesting that a rise in exchange rate will lead to a corresponding increase in the returns of GGBL.

Exchange Rate (ExR) and Unilever Ghana Ltd. (UNIL) Stock Returns

Figure G depicts the comovement between EXR and the SR of Unilever Ghana Ltd. in Ghana using the time-frequency domain. In general, there exists a weak coherence between EXR and the returns of UNIL, this is indicated by the green, yellow, and blue patches that run across the period. Nevertheless, there were periods during which EXR was observed to interrelate with SR. In the short term, except in the year 2019, EXR was seen to have a weak co-movement with the SR of UNIL across a substantial part of the observed region. There are also traces of comovement indicated by the red pallets in the medium term during the years 2008, 2010, and 2018. The arrows pointing to the left direction and the down imply a lead in the stock returns of UNIL. This implies that exchange rate was driven by the stock returns of UNIL during those periods.

In general, the findings from the second objective realized there exists a weak comovement between the two variables, which is indicated by the green, blue, and yellow patches seen in the scalograms, especially in the long term (approximately 16-32 months). This suggests that the long-term exchange rate might not be a reliable indicator of how the Ghanaian stock market would fluctuate in the future. However, there was a strong comovement between the variables in the short to medium terms (from 2008 to 2020) indicated by the red patches found in Figure 2 explains a certain amount of interaction between the two variables. Investors should therefore be vigilant in the changes in the

exchange rate, especially if they own stock in the temporal and intermediate terms in all the manufacturing firms. In this regard, Ghana policymakers should consider the short- to medium-term development of stock markets and prudently adapt regulations to effectively lead long-term investors since exchange rate swings may impede investors' confidence in stock markets.

The alterations in the lead-lag relationship between the two variables agree with two conflicting theories that support this study, which are the Stock Oriented and Flow Oriented Models. In the situation where the exchange rate leads the SR aligns with the Flow oriented theory. When SR is leading the Stock Oriented model supports this. The lead-lag relationship suggests how investors respond to fluctuations in the exchange rate given different time scales.

Chapter Summary

This chapter presented and addressed the study's results and discussions. The chapter first presented the descriptive statistics for the two variables in Table 2. The results from the ADF and PP tests showed all the variables were stationary at first difference. Further, by employing the quantile regression model, Tables 3, 4, and 5 presented the OLS and QR coefficient estimates for exchange rate and stock returns at the Lower, Middle, and Upper quantiles respectively. The Bi-wavelet technique was also employed to show the comovements between the two variables. This is shown in Figure 4. The results from these estimates were reported and discussed.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This chapter provides a comprehensive summary, conclusion, and recommendations based on the study conducted. The findings and conclusion comprise the problem, the objectives, the methodology employed, and the findings derived from the study. The conclusions further present an overview of the general outcomes of the results concerning the specified objectives and hypothesis. In addition, the recommendations section also offers specific and necessary policies for the relevant stakeholders to consider and implement.

Summary of the Study

This study was undertaken to examine the influence exchange rate has on the returns of manufacturing firms in Ghana. Manufacturing firms in Ghana are noted for their increased reliance on imported raw materials to feed the industry. The exchange rate affects the importation of these raw materials, which in turn affects the returns of the firms. The impact of exchange rate on returns has been investigated by several scholars across the globe (See Owusu, 2021; Khan, 2019; Kwofie and Ansah, 2018; Ouma and Miriu, 2014; Barnor, 2014; Adarmola, 2012; Adjasi, Harvey, and Agyapong, 2008). Despite numerous studies conducted on the correlation between exchange rates and returns, there is no unanimity regarding the sector-specific impact. The findings of these studies have been inconclusive, with some researchers reporting insignificant effects, while others identifying positive or negative effects. As a result, there is considerable

uncertainty among scholars about the effectiveness of currency rate policies and stock returns policies in driving transformation within Ghana's manufacturing sector. This lack of clarity poses challenges for policymakers in maintaining investor confidence and improving the productivity of these manufacturing firms. Using seven manufacturing firms on the GSE from the period January 2008 to December 2020, this research sought to analyze the exchange rate's asymmetric effect on the returns of manufacturing firms in Ghana using the quantile regression model. Also, the comovement between exchange rate and the returns of the manufacturing firms was examined using the Bi-wavelet technique.

Summary of Key Findings

It was discovered that from the first objective that, exchange rate has more positive than negative asymmetric effects on the stock returns of the manufacturing firms. Further observation shows that EXR has an asymmetric effect on the stock returns of Benso oil Palm Plantation, Camelot Ghana Limited, and Unilever Ghana Limited in the bearish market condition. In a normal market condition, the returns of BOPP, CMLT, FML, and UNIL had an asymmetric influence on exchange rate while it had an asymmetric effect on the returns of all seven manufacturing firms in a bullish market condition. It is important to note that exchange rate was observed to be asymmetric with three manufacturing firms under all market conditions, namely, BOPP, CMLT, and UNIL. The study further found that no relationship or asymmetric effect was found between EXR and the SR of CPC and GGBL in the bearish and normal market conditions.

In the bearish market conditions, exchange rate directly affected the returns of BOPP and UNIL while it hurt the returns of CMLT. Also, in normal market conditions, exchange rate was identified to have a direct effect on the returns of BOPP, FML, and UNIL, while it had an inverse association with the returns of CMLT. The connection found between exchange rate and the returns of BOPP, FML, and UNIL was positive in a bullish market condition, but negative with the returns of ALW, CPC, CMLT, and GGBL.

The positive effects suggest that exchange rate's appreciation (depreciation) results in higher (lower) stock returns of the manufacturing firms, thereby enhancing (lowering) their performance. On the other hand, the negative effect means that as the currency appreciates (depreciates), the stock returns of such manufacturing firms lower (increase).

The findings from the second objective reveal that the wavelet coherent mostly depicts a weak comovement between exchange rate and stock returns of Ghanaian manufacturing firms, particularly during the long term (approximately 16-32 months). However, strong comovement exists in the temporal and intermediate terms (approximately 0-16 months). Specifically, exchange rate comoves with the returns of ALW, BOPP, CPC, CMLT, FML, and GGBL in the temporal term. This same conclusion is made in the medium term. Only the returns of ALW comoved with exchange rate in the long term.

In the immediate term, SR of BOPP and CMLT positively leads exchange rate while SR lags, but exchange rate positively leads to the returns of Cocoa Processing Company, while the returns of Cocoa Processing Company (CPC) lag

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in the immediate term. The lead-lag association between exchange rate and SR of Benso Oil Palm Plantation (BOPP) and Camelot Ghana Ltd. (CMLT) means investor sentiments drives the returns of BOPP and CMLT positively before changes in exchange rate occur in the immediate term while the lead-lag relationship between exchange rate and the stock returns of Cocoa Processing Company implies that any economic shock that comes with exchange rate will affect the returns of Cocoa Processing Company during the immediate term.

In the intermediate term, the stock returns of Fan Milk Limited are identified as the leading variable while exchange rate lags. It is also identified that exchange rate leads the returns of Guinness Ghana Breweries Ltd. in the medium term. This means that if the exchange rate of the local currency strengthens, the returns of Guinness Ghana Breweries Ltd. will also improve in the medium term. In the long term, exchange rate inversely comoves with the returns of Aluworks, the exchange rate is also found to be leading in this time-frequency region.

Conclusions

The conclusion reached from the first hypothesis suggests that exchange rate has a substantial asymmetric influence on the returns of the manufacturing firms during a bearish, normal, or bullish market condition. The second hypothesis also found a significant comovement between the two variables. However, a weak comovement is found predominantly in the long term. Hence, we do not reject the first and second null hypothesis.

The observed asymmetric influence of exchange rate on the manufacturing firms' returns on stock and the presence of comovement between the two

variables aligns with the theoretical literature discussed in the Second chapter. Thus, the study provided support for the theoretical models; the Arbitrage Pricing Model, the Adaptive Market Hypothesis, and the Flow and Stock oriented Models, thereby reinforcing their relevance in understanding the connection between exchange rate and returns on the stock in the context of the manufacturing sector. The alteration of the lead-lag relationship as observed in the research confirms the Flow and Stock Oriented models and the Adaptive Market Hypothesis, as investors react differently during different time scales. The influence EXR has on the SR of manufacturing firms given different market conditions as indicated in the study also supports Arbitrage Pricing and the Flow Oriented Models.

This study will help both investors by considering consulting with financial advisors, economists, or professionals who specialize in currency markets and stock investments. Their expertise and insights can provide valuable guidance on navigating asymmetric effects and identifying investment opportunities that align with their financial goals and risk tolerance. They must also stay informed about economic trends, central bank policies, and other relevant factors that can impact currency values and stock market. The study holds considerable importance for policymakers as it provides valuable guidance in dealing with exchange rate dynamics and its potential impact on Ghanaian manufacturing firms.

Recommendations

Drawn from the research findings, it is recommended that investors should pay more attention to exchange rate fluctuations and channel their investments to firms that yield higher returns when these changes occur. From the study, investors may consider investing in firms such as BOPP, FML, and UNIL when the Ghanaian currency appreciates. Since the appreciation in the exchange rate is favorable in these firms, thus it yields higher returns when the local currency appreciates. They may also consider investing in firms such as ALW, CPC, and CMLT when the local currency depreciates as there is a higher return when exchange rate decreases.

Further, the Bank of Ghana, which is the body responsible for managing the exchange rate, should analyze and implement policies that are favorable to improving the stock returns of the manufacturing firms since the study provides evidence to show that the changes in the exchange rate led to changes in the stock returns of the manufacturing firms. This is because in all seven firms selected for the study, the exchange rate had a significant effect on them, either positively or negatively. Realistically, imposing strict tariffs would not be able to discourage the over-reliance on imported goods. Therefore, the government must develop policies that would foster an environment and level of confidence among investors that would encourage them to invest in the manufacturing sector.

Again, while the Bank of Ghana implements policies to manage the exchange rate, both the government and private sector should also take proactive measures to ensure effective management of the exchange rate by patronizing the

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use of locally made capital goods by manufacturing firms for their production, especially during times of currency depreciation.

Suggestions to Future Studies

Future research endeavors could explore the influence of exchange rate on the returns of the other sectors within the economy like the financial sector, banking sector, agricultural sector, mineral sector, and health sector.

Also, instead of exchange rate, other studies can investigate the asymmetric effect and comovement between the other macroeconomic variables on the stock returns of the manufacturing sector. Further studies can also employ the Quantile-on-Quantile Regression (QQR) to determine the robustness of the Quantile Regression (QR) on the exchange rate and stock returns.
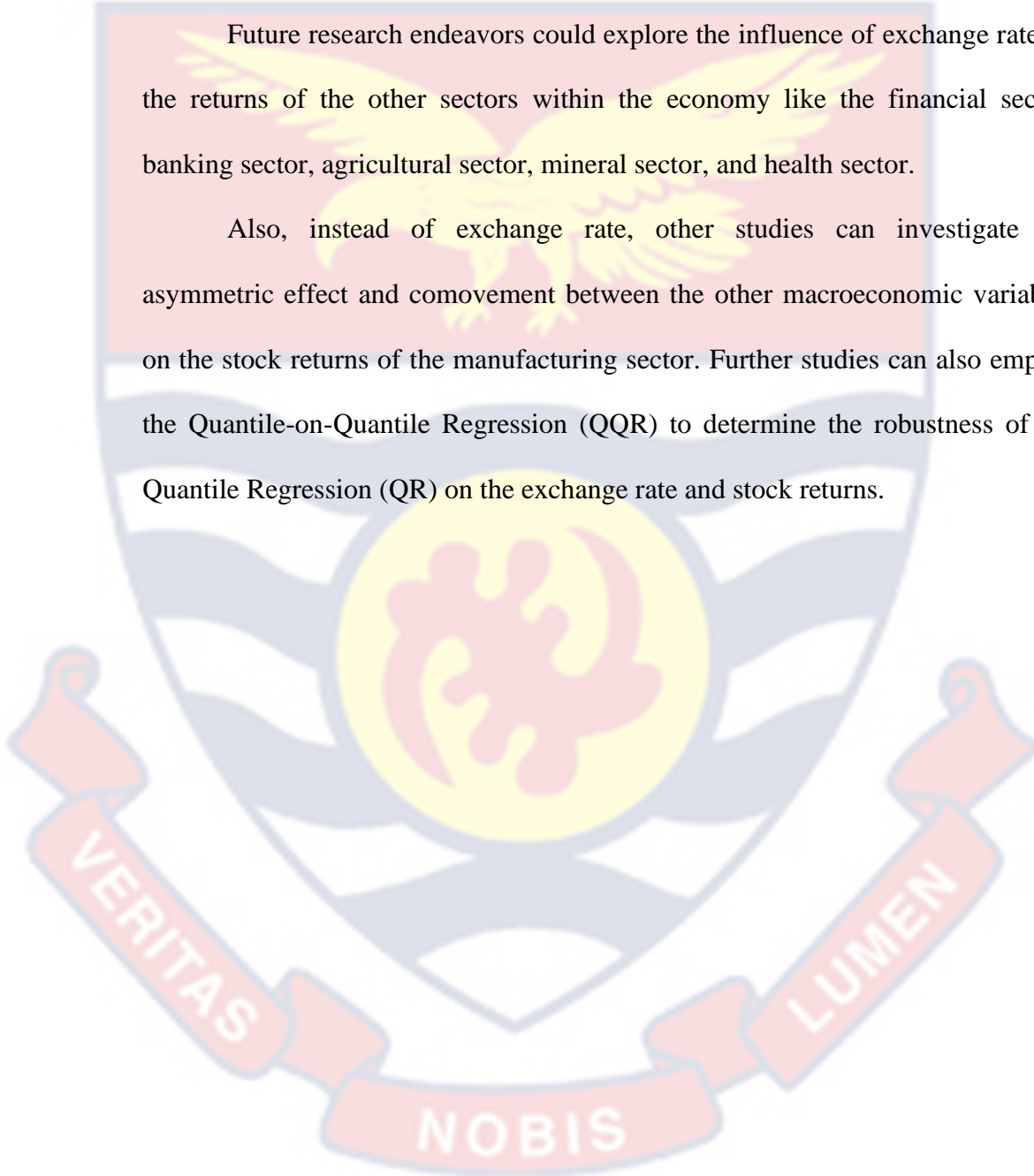
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