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STATISTICAL ANALYSIS OF THE IMPACT OF THE GCNET ON REVENUE PERFORMANCE IN GHANA:

(A CASE STUDY OF TEMA PORT)

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MPHIL STATISTICS DEGREE

SEPTEMBER, 2015

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DECLARATION

Candidate's Declaration

This is to certify that, this thesis is the result of my own research work and that no part of it has been presented for another degree in this University or elsewhere.

SIGNATURE: ……. DATE……..….

EBENEZER ACQUAH-BENTIL

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Supervisors' Declaration

We hereby certify that this thesis was prepared from the candidate's own work and supervised in accordance with guidelines on supervision of thesis laid down by the University of Ghana.

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ABSTRACT

In most economies of the world, import revenue makes up a significant part of total government revenue (Zhu & Kotz, 2010). Since economic development in a nation is largely driven by the amount of revenue mobilized, import revenue makes an impact on how well an economy develops. This study aims at assessing the contribution of Ghana's import revenue mobilization to Gross Domestic Product (GDP) growth and investigate the impact of the implementation of the Ghana Community Network (GCNet) system in import revenue mobilization. The study used both primary and secondary data to draw conclusions on the set objectives. The study administered 150 questionnaires to personnel and staff of Customs, Excise and Preventive Service (CEPS) at Tema port and 135 complete response was attained. The revenue generated from 1999-2013 was collected from Ghana Revenue Authority (GRA) Customers Division at Tema port. Time series model, nonparametric independent samples test and inverse Gaussian generalized linear models were used to analyse and modelled the revenue data. The study shows that, the performance of the GCNet system over the years has been significantly good and not coupled with many challenges. The introduction of GCNet system for revenue mobilization has significantly impact revenue mobilization over the period. Finally, the study revealed that, Gross Domestic Product (GDP) of Ghana is dependent on the four main components of GRA revenue data and inflation rate with a link function of power (-2) through a generalized linear model.

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DEDICATION

I dedicate this thesis to my loving parents and siblings.

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ACKNOWLEDGEMENT

My sincerest thanks go to the Almighty God for His loving blessings bestowed on me during my study period. My utmost gratitude also goes to my supervisors, Prof. Osborne Augustus Yamoah Jackson and Prof. John B. Ofosu for their love, encouragement and support they showed me in making this work a success. To all lecturers of the Department of Mathematical Sciences of Methodist University College Ghana, especially Mr. Christian Akrong Hesse. Also, my profound gratitude goes to Dr. Ezekiel N. N. Nortey and Dr. Felix Okoe Mettle, all of the Statistics Department of University of Ghana, Legon. I am most grateful to Mr. Gabriel Kallah-Dagadu, Assistant Lecturer of the Statistics Department of the University of Ghana, Legon.

My unrivalled appreciations are directed to all institutions, which provided information to make this study a reality, particularly to Officers and Men of Customs Division of Ghana Revenue Authority, Ghana Ports and Harbours Authority, Ghana Shippers Council, Customs House Agents and Freight Forwarders, Ghana Statistical Service and all operatives in the Port of Tema.

My utmost appreciation goes to my loving parents and siblings for their advice, support and encouragement. I say God richly bless you all.

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ABBREVIATION

AIC	Akaike Information Criterion
AIDS	Acquired Immune Deficiency Syndrome
CDF	Cumulative Distribution Function
CEPS	Customs, Excise and Preventive Service
DFH	Development Financial Holdings
EBG	Ecobank Ghana Limited
ECDF	Empirical Cumulative Distribution Function
GCB	Ghana Commercial Bank
GCNet	Ghana Community Network
GDP	Gross Domestic Product
GLMs	Generalized Linear Models
GPHA	Ghana Ports and Harbours Authority
GRA	Ghana Revenue Authority
GSC	Ghana Shippers Council
HIV	Human Immunodeficiency Virus
HR	Human Resource
K-S	Kolmogorov-Smirnov
KIA	Kotoka International Airport
NVTI	National Vocational Training Institute
NX	Balance of Trade
PNDC	Provisional National Defence Council
Q-Q	Quantile-Quantile
RSM	Rotterdam School of Management
SC	Schwarz Criterion
SGS	Societe General de Surveillance
SSCE	Senior Secondary Certificate Examination
WASSCE	West Africa Senior Secondary Certificate Examination

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

In most economies of the world, import revenue makes up a significant part of total government revenue (Zhu & Kotz, 2010). Since economic development in a nation is largely driven by the amount of revenue mobilized, import revenue therefore makes an impact on how well an economy develops. It is in view of this that the concept and procedure of import may be of utmost priority to many governments and individuals. Import is defined as goods and services produced by the foreign sector and purchased by the domestic economy. In other words, imports are goods purchased from other countries. The United States, for example, buys a lot of the stuff produced within the boundaries of other countries, including bananas, coffee, cars, chocolate, computers, and, well, a lot of other products (Economic Glossary, 2007/2008). The individual buying an exotic or foreign goods is called the importer (Lequiller & Blades, 2006). An import is an export to the country where the exotic goods come from (Lequiller & Blades, 2006). An import, like an export, is a means of international trade, which is a current development of human existence.

Historically, imports originated with human civilization, with reference to ancient trades in Egypt (Seyoum, 2009). Imports emerged with international barter systems in ancient Egypt and Greece (Strassner et al., 2009). Though most of its procedures today were not practiced in pre-medieval era, import served as a means of international merchandise that bridged countries economically and commercially. It was through its early procedures that international trade came into being (Strassner et al., 2009).

Imports and exports may have positive impacts on the economy. Imports allow governments or its associated agencies to impose taxes on exotic goods and services (Othieno & Shinyekwa,

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2011), and this could serve as a large source of revenue to governments. In many countries, proceeds of import are channelled into infrastructure development and other developmental projects of the local government (Onogwu & Arene, 2011). In China, about 15% of public revenue is attributed to import and export, on average (Lin & Li, 2011). Ghana is also said to depend largely on import revenues, with import revenue growth extending from the year 2000 to the year 2010 (Asuliwonno, 2011). The potential of import in a country, however, depends on the nature of its trade relations with the international community through international trade.

An import is one of the bases of international trade aside export, on which the concept of "balance of trade" is premised (Li, Greenaway & Hine, 2003). Balance of trade represents a difference in value for import and export for a country (Li et al., 2003). A country has demand for an import when domestic quantity demanded exceeds domestic quantity supplied, or when the price of the goods or services on the world market is less than the price on the domestic market (The Levin Institute, 2014). The balance of trade, usually denoted by NX, is the difference between the values of the goods and/or services a country exports and the value of the goods the country imports (Li et al., 2003). A trade deficit occurs when imports are large relative to exports. Imports are impacted principally by a country's income and its productive resources. As to whether a trade deficit occurs or not depends on the effectiveness and efficiency of a country's import and export procedures and other economic conditions in the nation (Li et al., 2003). Moreover, the country's import potential depends on the effectiveness and efficiency of the agencies responsible for mobilizing import revenues.

In most countries, specific agencies are obligated to mobilize import revenue. Regardless of the mode of these agencies, they are given the responsibility and authority to impose all forms of taxes on all incoming exotic goods and services (Danquah, 2008; Nour, 2011). In most cases, departments of customs are responsible for the mobilization of import revenue, and this

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situation applies to Ghana. Until the year 2011, Customs, Excise and Preventive Service (CEPS) was the sole or independent public institution responsible for the mobilization of import revenue. In the late 2002 however, CEPS and other public organizations partnered Ghana Community Network Services Limited to mobilize import revenue (Asuliwonno, 2011). This partnership is commonly termed the GCNet system.

The primary purpose of the partnership between CEPS, Ghana Community Network Services Limited and the other public institutions, was to improve efficiency and effectiveness of import revenue mobilization, leading to an increased positive impact on Gross Domestic Product (GDP) growth (Asuliwonno, 2011). Rhetorically, what could be the performance of the adoption of the GCNet system, or what could be the result of the partnership between CEPS and Ghana Community Network Services Limited? It is therefore worthwhile to know whether import revenue mobilization has improved after the introduction of the GCNet system.

Knowledge about the current performance of import revenue mobilization in Ghana relative to periods before the introduction of the GCNet system would help to encourage the public to readily pay import taxes and aid stakeholders in possibly maximizing the contribution of import revenue to GDP growth. Currently, there is no suitable and credible research to unfold the impact of the GCNet system on import revenue mobilization. This study shall therefore be undertaken to provide reliable information about the impact of the GCNet system by examining import revenue potential prior to and after its introduction.

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1.2 Statement of the Problem

After about eleven (11) years of its introduction, the potential of GCNet system is not well known at the public and stakeholders level with regard to its impact on GDP growth in Ghana. Indisputably, government adopted the GCNet system following stakeholders concerns with slow and cumbersome port clearance procedures that were expensive and restrictive (Asuliwonno, 2011), with the purpose of improving upon import revenue mobilization in Ghana. Nonetheless, it is quite unfortunate that the performance of this system or its impact on Ghana's GDP is not known by stakeholders and the general public. At the moment, information does not readily exist on the proportion of import revenue mobilized through the GCNet system. Invariably, there is no formal and reliable source of information that reveals whether import revenue has improved after the introduction of the GCNet system or not. After the introduction of the GCNet system, the efficiency and effectiveness of revenue mobilization is expected to be enhanced, leading to an increased positive impact on GDP growth. Yet, there is a lack of information about whether revenue mobilization has improved in terms of efficiency, effectiveness and expected positive impact on GDP growth. This situation would not augur well for Ghana, as it yields a number of limitations to GDP growth in the country.

Moreover, import revenue is paid mainly by Ghanaians or members of the general public and other nationals who import into Ghana. If the public should know the positive performance of the GCNet system, Ghanaian residents or potential importers are likely to be encouraged to pay import taxes imposed on them at any time. In situations of poor performance of the GCNet system, the general public can contribute ideas and strategies for revamping the system. It is in view of this that a lack of public information about the performance of the GCNet system is a problem.

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The absence of reliable information about the performance of import revenue in Ghana after the introduction of the GCNet system is attributable to lack of credible related research work. Thus no reliable research has been done to unfold the efficiency, effectiveness, its general performance and impact of the GCNet system on GDP growth since its introduction in late 2002. Undeniably, some researches, such as those of Asuliwonno (2011), Kogid et al. (2011), Kraev (2005), and Oteng-Abayie and Appiah-Nkrumah (2009) have been carried out on the performance of Ghana's import revenue performance, but none of them were based on the performance of the GCNet system with regard to Ghana's performance in import revenue mobilization prior to and after the introduction of the GCNet system.

1.3 Objective of the Study

This study seeks to assess the contribution of Ghana's import revenue mobilization to GDP growth before and after the implementation of the GCNet system of import revenue mobilization. Invariably, this study involves a multivariate analysis of the performance of major import revenues before and after the implementation of the GCNet system. The specific research objectives of this study are:

1. To investigate the performance of the main import revenues of Ghana after the introduction of the GCNet system.
2. To examine, if there is a significant impact in main import revenues of Ghana after the introduction of the GCNet system.
3. To establish a linear model that expresses the relationship between import revenues collected through GCNet system and Gross Domestic Product (GDP).
4. To examine the factors that hinder operation of GCNet system on import revenue mobilization performance.

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1.4 Significance of the Study

Import revenue is one of the major sources of government revenue in Ghana. It is worth to know whether import revenue plays an important role in the socio-economic development of Ghana. Meanwhile, import revenue has multiple divisions whose performance must be individually known in line with the impact of the GCNet system on import revenue mobilization, purposely to improve the potential of Ghana's import revenue. This study shall therefore be beneficial in:

1. Understanding the extent to which the role of the GCNet system has been fulfilled, as well as its impact on revenue mobilization. This shall make way for reviewing and revamping strategies associated with the core functions of the GCNet system with the aim of maximizing proceeds of import revenue in Ghana.
2. Identifying the basis for resolving challenges associated with current procedures of import revenue mobilization, including those of the GCNet system. This shall help in tailoring result-driven policies of import duty mobilization in Ghana.
3. Serving as a body of knowledge about the performance of Ghana's import revenue mobilization structures and the prospects of import revenue for future economic growth. The study shall also serve as a reference work for further research, precisely those relating to Ghana's import revenues and the impact of the GCNet system.

1.5 Scope of the Study

The scope of this study shall be Ghana Community Network Services Limited and Customs Division of Ghana Revenue Authority (GRA). Thus, the database of the Customs Division of Ghana Revenue Authority and Ghana Community Network Services Limited shall be the sources of information in this study. The fact that Customs Division of GRA and Ghana Community Network Services Limited are responsible for the mobilization of import revenue

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in accordance to the GCNet system makes it the most suitable source of information or data for this study. This study's scope shall cover the Tema Collection of the Customs Division of the Ghana Revenue Authority, since the Tema Collection alone mobilizes or collects at least 75% of the revenue target allocated to the Customs Division of the Ghana Revenue Authority.

1.6 Research Hypothesis

The study seeks to test the following hypotheses for assessing the impact of the GCNet system:

H_{01}: There is no significant difference between import revenues before and after the introduction of the GCNet System.

H_{11}: There is a significant difference between import revenues before and after the introduction of the GCNet System.

H_{02}: There is no linear relationship between import revenue and GDP of Ghana.

H_{12}: There is a linear relationship between import revenue and GDP of Ghana.

1.7 Organisation of the Study

This study shall be organized in five chapters. The first chapter, introduction, shall include background of the study, statement of the problem, objective of the study, significance of the study, scope of the study, research hypotheses and organisation of the study. The second chapter, which is a review of the literature, comprises theoretical and related literature reviews and a framework of this study. The third chapter of this study, methodology, shall be made up of the research designs, population, sample and sampling techniques, data collection procedure and tools and methods of data analysis. The fourth chapter shall constitute results of the study and as well as discussion of findings of the study. Finally, the fifth chapter shall be made up of summary of findings, conclusion, recommendations and limitations of the study.

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CHAPTER TWO

REVIEW OF LITERATURE

2.0 Introduction

This chapter which is a review of literature, comprises theoretical and related studies and framework for this study. Thus the chapter is composed of the overview of CEPS, port operations and economic growth, GCNet system and empirical literature. Empirical literature is composed of related studies that others have carried out, and examines how similarities and gaps in their results pave way for this study to be carried out.

2.1 The Overview of Customs, Excise and Preventive Service (CEPS)

The Ghana Customs, Excise and Preventive Service (CEPS) collects and accounts for revenues from economic functions namely, trade and investment facilitation, as well as provide security at land and sea frontiers (Mensah, 2007). The organisation serves a large clientele in the business and commercial sectors, as well as the general public (Mensah, 2007).

The CEPS was established under the PNDC Law 330, and basically obligated to collect and account for revenue from economic functions namely, trade and investment facilitation, as well as provide security at land and sea frontiers (Mensah, 2007). The CEPS is part of the Public Services of Ghana and the membership of the National Security Council which includes the Commissioner of Customs. The objective of the Customs, Excise and Preventive Service, referred to as "the Service", is to design and implement strategies and programmes for the collection, protection and accounting for all customs and excise duties, taxes, charges, levies, penalties and other assigned tax revenues and for the facilitation of trade and investment (CEPS Management Law,1993).

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The constitutionally assigned functions of CEPS, according to CEPS Management Law (1993) include:

1. To cause to be prepared plans for developing and maintaining an effective, fair and efficient revenue collection system and ensure that the plans are implemented;
2. To effect the restructuring of any of the revenue agencies as and when necessary;
3. To ensure the effective and optimum collection of the taxes, penalties and interest due to the State under the enactments;
4. To direct generally the revenue agencies on revenue related policies;
5. To monitor the performance of the revenue agencies in carrying out their functions;
6. To ensure that all amounts collected by the revenue agencies are paid into the Consolidated Fund unless otherwise provided by an enactment;
7. To recommend to the Minister measures for effective collection of taxes and non-tax revenue;
8. To delimit customs and surveillance zones, approve routes for customs purposes and cause to be built and managed government warehouses for the purposes of revenue collection;
9. To cause systems to be developed and maintained, whether by computer or other means, for coordinating, and supervising the collection, storage and retrieval of information;
10. To arrange for the training and manpower development programmes for employees of the revenue agencies;
11. To establish a system for the exchange of information among the revenue agencies;
12. To initiate and sustain programmes for public education on tax payment;
13. To establish and maintain a financial and accounting system in accordance with prescribed government accounting practice;
14. To draw up a scheme of service for the staff of the revenue agencies; and

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15. To perform such other functions in relation to revenue as the Minister may direct or as may be conferred on it by any other law.

Currently, reforms of taxation in Ghana have made CEPS a division of Ghana Revenue Authority. Thus, the organisation now operates as a subsidiary arm of Ghana Revenue Authority. With regard to the current trends of performance of the CEPS, revenues collected by the organisation have steadily increased since the year 2000. An important achievement of CEPS is that it has been able to increase its revenues collected steadily over the last ten years. The organisation has also been credited for its management ability in the area of finance. The contribution of CEPS to economic growth was favourably articulated by Asuliwonno (2011). The author personally stated that Ghana's revenue from taxation would have been insignificant without the revenues mobilized by CEPS.

Regardless of this performance and achievement, the Service is said to be faced with numerous challenges for which its effectiveness is not being realised (Asuliwonno, 2011). The most serious of such challenges has to do with corruption and lack of accountability on the part of some individual employees of CEPS. In fact, there have been many cases of corruption associated with CEPS in Ghana, with a notable one being the 2010/2011 Tema Harbour Corruption Saga that caught the attention of the late President Evans Atta Mills.

2.2 Port Operations and Economic Growth

Ports play essential roles in the development of developing countries, particularly in times where the focus of economic growth and development is on trade. In landlocked countries, the efficiency or otherwise of transit ports has direct effects on international trade and competitiveness (Asuliwonno, 2011).

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According to the European Commission (1997), ports serve as medium through which countries receive and send goods and services that are imported and exported. This is as a result of the affordability of sea transport in transporting bulky goods and services as compared to other modes of transport. The ports of Ghana handle a greater proportion of the country's exports and imports. The efficiency of ports operations in Ghana has increased over the years and has contributed immensely towards the country's development (Asuliwonno, 2011).

The ports are integral parts of the international transport chain. It is therefore the prime mover of industrial and agricultural development. There is easy movement of capital goods from one country to another for production purposes. Most machines used by countries, particularly in Africa, are imported from the outside world through the seaports. Also, the ports of Ghana contribute to the construction of roads. For instance, the port of Tema constructed a 6km road from the port to the Tema Motorway to enhance transportation within the Tema Township and access to the port (Asuliwonno, 2011).

The successful operations of ports in the world require labour to engineer the operations of the ports. Despite the capital intensive nature of some sea ports in the world, a significant proportion of people are employed by seaports. The intrusion of private sector into ports operations coupled with the openings of new ports over the world. For example, in the last couple of years the Ghana Ports and Harbours Authority (GPHA) has increased the participation of the private sector in the provision of facilities and services to ships and cargo. The authority also seeks to position the ports of Ghana as the trade and investment gateway to the West African sub-region (GPHA, 2014).

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Several governments generate enough revenue from the operations of the seaports. Government augments its revenue through seaports in the form of custom duties from both exporters and importers. The Rotterdam Port, which is the biggest in Europe and one of the biggest in the world, provides jobs for about 145,000 people in both direct and indirect employment (van Den Bosch et al., 2011). The Rotterdam School of Management (RSM) stated that the Rotterdam port also makes an important contribution to Netherlands position in the World Economic forum top ten (van Den Bosch et al., 2011).

In the area of environmental protection, GPHA has been part and supported several projects relating to pollution control and safety week celebrations. For instance, GPHA supported the Marine Pollution Convention and ensures the protection of the ports environs. Also, a week in every year has been set apart for the celebration of safety week during which seminars, symposia and lectures are organised for staff to create safety awareness (GPHA, 2002).

The GPHA contributes to the health sector both in cash and in material resource (GPHA, 2002). The ports have supported several health related exercises and campaigns such as the National HIV/AIDS awareness week to enhance public consciousness on health problems. GPHA also operates hospitals which serve both the workers of the Authority and the wider community (GPHA, 2002).

2.3 GCNet System: Role and Achievement

The GCNet system of import revenue mobilization came into being after the incorporation of the Ghana Community Network Services Limited (GCNet) in the year 2000. Ghana Community Network Services Limited (GCNet) was implemented in a pilot bases in November 2002 at Kotoka international Airport (KIA) and then in June 2003 at Tema as a private-public

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sector partnership, and its shareholders are Customs Excise and Preventive Service (CEPS), Ghana Shippers Council (GSC), Ecobank (Ghana) Limited (EBG), Development Finance Holdings (DFH), a subsidiary of Ghana Commercial Bank (GCB) and Societe General de Surveillance (SGS), (Asuliwonno, 2011). It was fully implemented in the year 2004 at Tema. GCNet has staff strength of 75, who work in eight departments, namely Executive Management, Administration/Human Resource (HR), Finance, Operations, Systems, Network, Logistics, and Security/Quality Assurance.

According to Asuliwonno (2011), the GCNet system serves as information availability and sharing platform where stakeholders can have easy access to information. The system creates a framework where information/data from different sources of customs and ports operations is synchronized without difficulty. The multi-faceted nature of the system also enhances easy communication and clearance of goods at the ports and borders of Ghana. This ensures a holistic growth and management of the ports and customs services and allows for easy tracking of the various stages of the transaction process.

Operationally, the role of GCNet is to serve as an intermediary private organisation that facilitates import processes. It was established to diffuse the rigidity, complexity and unnecessary bureaucracy associated with port clearance procedures (Asuliwonno, 2011). The introduction of GCNet was aimed at creating robustness, flexibility, effectiveness and efficiency in operations relating to import revenue mobilization. With the introduction of GCNet, the Customs Excise and Preventive Services (CEPS) is expected to improve import revenue mobilization by reducing difficulties and challenges associated with initial and traditional methods of import revenue gathering.

Practically, the introduction of the GCNet system has brought a paradigm enhancement in methods of import revenue mobilization. Asuliwonno (2011) stated that the introduction of the

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GCNet system has introduced a steady rise in import revenue from the year of its inception to date. Also, the system gathers much more import revenue relative to years before its introduction. Nonetheless, little is known about the limiting factors of the GCNet system, how it has influenced each element of import revenue and GDP growth.

2.4 Related Studies

With respect to import revenue and its mobilization, studies have been undertaken by some researchers. It is believed that these studies share common features with this research. The first of them has to do with the study of Asuliwonno (2011). The objective of his study was to examine port performance in Ghana. His study was carried out as a case study of Ghana Community Network Services Limited (GCNet). The purposive (non probability) sampling technique was used in selecting eight (8) respondents from eight (8) stakeholder institutions, with a respondent coming from each institution. Here a random sample was not selected but knowledge of the stakeholders was used by the researcher. Data was analyzed using the qualitative approach. Findings of the study revealed that ports operations have been enhanced after the incorporation of GCNet in 2000. This has resulted in higher efficiency and effectiveness in import processes and regulations, and consequently higher import revenue returns. Basically, the study indicated that the GCNet system has caused an increment in import revenue and hence its impact on GDP growth rate.

Impressively, the study by Asuliwonno (2011) has provided a clue about the relative performance of import revenue with respect to periods before and after the introduction of the GCNet system. This is very critical for the success of this study because it establishes a broad basis through which the impact of the GCNet system on GDP growth rate can be examined with regard to each element of import revenue and the periods before and after the introduction of the system. With the study of Asuliwonno (2011) showing that the GCNet system has made

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positive impacts on GDP growth rate, this study would identify the nature of this impact on each element of import revenue with respect to periods before and after the introduction of the GCNet system. In fact, the weakness of the study of Asuliwonno (2011) is that it could not uncover the impact of the GCNet system on the performance of each element of import revenue. Moreover, the study could not bring out precise estimates about the growth in individual import revenues in Ghana based on the presence of GCNet system.

Another related research of this study is the research of Oteng-Abayie and Appiah-Nkrumah (2009). The objective of their study was to estimate an import demand function for Ghana for the period 1970 to 2002, as well as consider the time series properties of the data. The time series behaviour of the data indicated a long term relationship between real exchange rates, GDP, and merchandise import. Their empirical estimates suggest that real income (GDP) is the main factor influencing imports in Ghana. The results also indicate that economic growth (real GDP) and depreciation in the local currency could stimulate increased demand for merchandise imports. Further analysis revealed that shocks to imports, real GDP and real exchange rate are important in explaining various innovations in the error variance of each of these variables at different time horizons and at different magnitudes. Particularly, the evidence shows that at short time periods, about 65%, 95% and 80% of shocks to real exchange rates, merchandise imports and GDP respectively, are attributed to own shocks.

Some information revealed in the study of Oteng-Abayie and Appiah-Nkrumah (2009) is relevant to completing this study. One key objective of this study is to establish a model that linearly relates performance of each element of import revenue to GDP (income) position of Ghana. Therefore, the study of Oteng-Abayie and Appiah-Nkrumah (2009) forms a basis for appraising the nature of the regression of GDP growth on each of the various tax components of import revenues. With their research, this study would be an avenue to examine the

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relationship between the performance of each component of import revenue and income standing of Ghana with respect to years before and after the introduction of GCNet. The study of Oteng-Abayie and Appiah-Nkrumah (2009) however has one limitation in terms of serving as a basis for embarking on such an appraisal. Thus, it comes with only 2 months (i.e. from November 2002 to December 2002) of data on the performance of the GCNet system, since the GCNet system first started in November 2002 at KIA. Hence, using its derived models as precursors and yardsticks in this study would not produce a conclusive information on the performance of the GCNet system.

Another related research of this study is the study of Danquah (2008). This study examined the effects of exchange rates on Ghana's external trade, and this revealed real exchange rate as a key determinant of imports and exports. The study estimated three models, namely imports, exports and trade balance, with all incorporating real exchange rate as a determining factor using annual time series data from 1986 to 2005. Danquah's work confirmed a stable long run relationship between exports, imports and the real exchange rate. The results indicated that the short run elasticities of imports and exports with respect to real exchange rate are inelastic and thus have contractionary effects of depreciation. It was recommended that coordination between the exchange rate and demand management policies should be strengthened and be based in the long run fundamentals of the economy.

The study of Danquah (2008) is similar to that of Oteng-Abayie and Appiah-Nkrumah (2009), but it has brought an added advantage in using findings of Oteng-Abayie and Appiah-Nkrumah (2009). For instance, the study of Danquah (2008) had five (5) years of data covering import revenue activities before and after the introduction of GCNet. It therefore fills the gap of the data deficiency associated with the study of Oteng-Abayie and Appiah-Nkrumah (2009).

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Largely, the studies of Danquah (2008) and Oteng-Abayie and Appiah-Nkrumah (2009) have some differences that would serve as extremes in appraising findings of this study. Regardless of this, it is evident that the study of Danquah (2008) comes with the limitation of not focusing on the performance of each type of import revenue against GDP growth vis-à-vis periods before and after the introduction of the GCNet system.

Sosuh (2011) also undertook a study that indicates the performance of CEPS and its contribution to border security. In effect, the role and achievement of CEPS is partly known. Her study examined the dynamics in border security assurance. She identified among others that the institutional challenges centre around lack of modern border infrastructure and facilities, capacity building of the agents directly involved in border security and those that lend support to apprehend and deal with suspects. Lack of public knowledge on border issues also compounds the problem. Regarding the drawbacks, she suggested that the states commitment to ensuring effective border security must go beyond legislation and be exhibited in the provision of border infrastructure. Other actors involved in the security issues at the borders are also to contribute their quota to enhance the state of security at the borders. Like the initial studies examined, the results of the study of Sosuh (2011) has provided supporting information about challenges faced by the CEPS in Ghana. Also, her study has given important information about the contribution of CEPS to border security and revenue mobilisation at the border level in Ghana. Unfortunately, her study could not produce detailed information about the roles of CEPS, as well as its contributions in the mobilisation of import revenue. Worse of all, it produces no information about the performance of GCNet with respect to the individual aspects of import revenue in Ghana. Considering the limitations of the above related studies, the researcher realized the need to undertake this study to fill the collective gap created by them.

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2.5 Framework of the Study

Much evidence about the relationship between GDP position of a country and import revenue has come from the theoretical and related studies discussed earlier in this chapter. Moreover, a clear-cut scenario has been established about the impact of the GCNet system on revenue growth. From a theoretical viewpoint, GDP growth results from the cost of service of government, the benefit derived by citizens out of public service and the citizen's ability to pay taxes (Atkinson & Stiglitz, 1976; Gruber & Saez, 2002). Practically, these three variables interrelate, and this influences GDP or income position of Ghana. More basically, GDP or national income is influenced by import and export, which determine balance of trade. According to Ahmed et al. (2008), import is often related to export. As a result, GDP positions of countries are based on the collective influence of import and export. A deeper relationship is seen in the impact of each element of import and export revenues on GDP growth and position.

In the context of this study, the regression would be presented in two forms, namely the one representing the position of import revenue before the introduction of GCNet system and the one representing the position of import revenue after the introduction of GCNet system. The next chapter presents the methods of analysing the research data.

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CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter discusses the approach to data collection and methods for data analysis. The study looks at the study population and sources of data, sample size and sampling techniques, research questionnaire, normality tests for the GCNet data and statistical methods for measuring performance over a period of time. Specifically, the statistical methods include time series analysis, generalized linear model and independent samples test.

3.1.0 The Study Population and Source of Data

The research used primary and secondary data for the analysis and the secondary data spans from January 1999 to December 2014 covering the period of before and after the introduction of the GCNet system and quarterly GDP data from Ghana Statistical Service (GSS). The study grouped CEPS revenue into its various tax components over the period. The CEPS revenue data is mainly indirect tax revenue and it was collected from Customs Division of Ghana Revenue Authority (GRA). The primary data was collected through the use of questionnaires from the staff and personnel using the GCNet system for collecting and monitoring revenue. The questionnaire was administered to Customs Division of Ghana Revenue Authority and Agencies using GCNet system for revenue mobilisation at Tema port.

3.1.1 Sample Size and Sampling Techniques

The study considered a sample size of one hundred and fifty respondents from the Customs Division of GRA at Tema port and other agencies working alongside Customs Division in revenue generation at Tema port, since the total population using the GCNet system to monitor revenue performance is about 150. The sampling method employed in this study was simple

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random sampling of the personnel and staff of Customs Division of GRA and other agencies in Tema port using GCNet system.

3.1.2 Questionnaire for the Study

The questionnaire was employed to collect the views of personnel on the challenges facing GCNet system and its performance over the period. Method of data collection used was a self-administered questionnaire. The questionnaire was divided into two sections, namely; Section A: comprising of the demographic information of the respondents and Section B: consisting of the performance and challenges facing GCNet system. A five likert scale was used to measure the responses of personnel on the performance and challenges encumbering the system.

3.2 Normality Tests

The study investigate the before and after revenue data of the introduction of GCNet system of GRA, to determine the impact of GCNet system. To be able to test if there exist a significant impact in revenue mobilization after the introduction of the GCNet system, the data need to satisfied some normality assumptions if the parametric tests to be applied and non-parametric if the data is not normally distributed. The study employed some normality tests to find out whether the data is normally distributed. The following normality tests, quantile-quantile (Q-Q) plots, Kolmogorov-Smirnov (K-S), Anderson-Darling and Shapiro-Wilk tests were used.

3.2.1 Quantile-Quantile (Q-Q) Plot

The quantile-quantile (Q-Q) plot is a diagnostic graph of the input (observed) data values plotted against the theoretical (fitted) distribution quantiles. Both axes of this graph are in units of the input data set. The plotted points should be approximately linear if the specified theoretical distribution is the correct model. The quantile-quantile plot is more sensitive to the

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deviations from the theoretical distribution (normal) in the tails and tends to magnify deviation from the proposed distribution on the tails.

The Q-Q plot is constructed using the theoretical cumulative distribution function, $F(x)$, of the specified theoretical model or distribution. The values in the sample of the data are ordered from the smallest to the largest and are denoted as $X_{(1)}, X_{(2)}, X_{(3)}, \ldots, X_{(n)}$. For $i = 1, 2, 3, \ldots, n$, $X_{(i)}$'s are plotted against the inverse cumulative distribution function; $F^{-1}\left[\frac{i - 1/2}{n}\right]$. The Q-Q plot was used in this study to graphically assess goodness of the Customs Division of GRA data to the normal distribution.

3.2.2 Anderson-Darling Test

The Anderson-Darling procedure is a general test to compare the fit of an observed cumulative distribution function to an expected cumulative distribution function. The Anderson-Darling test is used to test if a sample of data came from a population with a specific distribution. It is a modification of the Kolmogorov-Smirnov (K-S) test and gives more weight to the tails than the K-S test does. The K-S test is distribution free in the sense that the critical values do not depend on the specific distribution being tested but the Anderson-Darling test makes use of the specific distribution in calculating the critical values. This has the advantage of allowing a more sensitive test and the disadvantage that critical values must be calculated for each distribution. The Anderson-Darling tests of the hypothesis:

H_0 : The data follow the specified distribution.

H_1 : The data do not follow the specified distribution.

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The Anderson-Darling test statistic (A^2) is defined as;

$$A^2 = -n - \frac{1}{n}\sum_{i=1}^{n}(2i-1)\left[\ln F(X_i) + \ln(1 - F(X_{n-i+1}))\right] \qquad (3.1)$$

where F is the cumulative distribution function (cdf) of the specified distribution and X_i is the ordered data. The hypothesis regarding the distributional form is rejected at the chosen significance level (α) if the test statistic, A^2, is greater than the critical value obtained from a table. The Anderson-Darling test is used in this study to statistically test for the normal assumption of the Customs Division of GRA data.

3.2.3 Shapiro-Wilk Test

The Shapiro-Wilk test was proposed in 1965 by Shapiro and Wilk, for testing a random sample, $X_1, X_2, ..., X_n$ which comes from (specifically) a normal distribution. The test statistic is denoted as W and small values of W are evidence of departure from normality and percentage points for the W statistic are obtained via Monte Carlo simulations and were reproduced by Pearson and Hartley (1972). The W statistic is defined as follows:

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}, \qquad (3.2)$$

where $x_{(i)}$ are the ordered sample values and a_i's are constants generated from the means, variances and covariances of the order statistics of a sample of size n from a normal distribution. Let $m' = (m_1, m_2, m_3, ..., m_n)$, where $m_i = E(X_{(i)})$ and V is n x n covariance matrix of υ_{ij} where $\upsilon_{ij} = \text{Cov}(X_{(i)}, X_{(j)})$. The vector a of the weights a_i's from eqn. (3.2) is defined as:

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$$a' = m'V^{-1}\left[\left(m'V^{-1}\right)\left(V^{-1}m\right)\right]^{-1/2} \qquad (3.3)$$

The null hypothesis that the random sample comes from the normal distribution is rejected, if the test statistic W is less than or equal to w_α, the critical value for the significance level α; the probability of type I error.

3.2.4 Kolmogorov-Smirnov Goodness-of-Fit Test

The Kolmogorov-Smirnov (K-S) goodness of fit test is a nonparametric test used to assess whether a sample comes from a population with a specified distribution. A hypothesis test involves calculation of a test statistic from the data and the probability of obtaining a value at least as large as a tail area if the correct distribution is chosen. The K-S test is based on the empirical cumulative distribution function (ECDF), it measures the Supremun distance between the cumulative distribution function of the theoretical distribution and the empirical distribution function, over all the sample points. The K-S test is distribution free since its critical values do not depend on the specific distribution being tested. The K-S test is relatively insensitive to differences in the tails but more sensitive to points near the median of the distribution.

Definition 1

Let $X_1, X_2, X_3, \ldots, X_n$ be a random sample. The empirical distribution function $S(x)$ is a function of X, which equals the fraction of $X_i's$ that are less than or equal to X for each $X_i, -\infty < X_i < \infty,$

$$S(x) = \frac{1}{n}\sum_{i=1}^{n} I_{\{x_i \le x\}}, \qquad (3.4)$$

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where $I_{\{x_i \le x\}}(x)$ is an indicator function and

$$I_{\{x_i \le x\}}(x) = \begin{cases} 0, & \text{if } x_i > x \\ 1, & \text{if } x_i \le x \end{cases} \tag{3.5}$$

The empirical distribution function $S(x)$ is useful as an estimator of $F(x)$, the unknown distribution function of the X_i's. We compare the empirical distribution function $S(x)$ with the hypothesized distribution function $F^*(x)$ to investigate if there is a good fit. Conover (1999) states that, Kolmogorov in 1933, suggested the test statistic as the greatest (denoted by "sup" for Supremum) vertical distance between $S(x)$ and $F^*(x)$, and is define as;

$$D = \sup_i \left\| F^*(x_i) - S(x_i) \right\| \tag{3.6}$$

For testing the hypotheses,

$H_0: F(x) = F^*(x)$, for all $-\infty < x < \infty$

$H_1: F(x) \neq F^*(x)$, for at least one value of x,

the Kolmogorov-Smirnov goodness of fit test is used in this study to test the goodness of fit of the CEPS revenue data from January, 1999 to December, 2013 to the Normal distribution.

3.3 Tests for Independent Samples

The study wish to test whether there exist a significant difference in the means of the two set of independent data: before and after the introduction of GCNet system in GRA of Tema port. If the two data set are normally distributed, then independent samples t-test is applied and if otherwise, non-parametric two samples test (Mann-Whitney test) is used.

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3.3.1 Independent Samples t-test

The *t*-test for two independent samples; a parametric test, is employed in a hypothesis testing situation involving two independent samples, where the two samples are normally distributed. Two independent sample t-test is to compare means of two independent normally distributed populations. For large samples, the procedure often performs well even for non-normal populations. The *t*-test for two independent samples is employed with interval/ratio data, and is based on the following assumptions:

a) Each sample has been randomly selected from the population it represents;

b) The distribution of data in the underlying population from which each of the samples is derived is normal; and

c) The third assumption, which is referred to as the homogeneity of variance assumption, states that the variance of the underlying population represented by sample one is equal to the variance of the underlying population represented by sample two (i.e. $\sigma_1^2 = \sigma_2^2$).

The hypothesis used for testing two independent samples, is defined as;

$H_0 : \mu_1 = \mu_2$ (the two population means are equal)

$H_1 : \mu_1 \neq \mu_2$ (the two population means are significantly different)

The test statistic is defined as follows, when equal population variances are assumed;

$$t^* = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_{pool}^2 \left(1/n_1 + 1/n_2 \right)}} \sim t_{n_1+n_2-2} \qquad (3.7)$$

where $S_{pool}^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{(n_1+n_2-2)}$, is known as the pooled variance, s_i^2, $i = 1,2$ are the respective estimates of the variances for samples one and two and (n_1+n_2-2) is the degrees of freedom for the test statistic.

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When unequal population variances is assumed, the test statistic is defined as;

$$t^* = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_1^2/n_1 + s_2^2/n_2}} \qquad (3.8)$$

When H_o is true t^* has the t- distribution with p degrees of freedom, where p is given by,

$$p = \frac{\left(s_1^2/n_1 + s_2^2/n_2\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1 - 1} + \frac{\left(s_2^2/n_2\right)^2}{n_2 - 1}}, \text{ to the nearest integer.}$$

H_0 is rejected at significance level α if the calculated t^* is less than $-t_{\alpha/2}$ (Lower critical value) or greater than $t_{\alpha/2}$ (Upper critical value) for the given tabulated values of the student's t-distribution.

3.3.2 Mann-Whitney Nonparametric test

The Mann–Whitney U test is a nonparametric procedure with ordinal (rank-order) data employed in a hypothesis testing situation involving a design with two independent samples. If the result of the Mann–Whitney U test is significant, it indicates there is a significant difference between the two sample medians, and as a result of the latter the researcher can conclude there is a high likelihood that the samples represent populations with different median values. Mann–Whitney test was developed by Mann and Whitney (1947).

Mann–Whitney *U* test is based on the following assumptions:

a) Each sample has been randomly selected from the population it represents;

b) The two samples are independent of one another;

c) The original variable observed (which is subsequently ranked) is a continuous random variable.

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d) The underlying distributions from which the samples are derived are identical in shape.

The Mann-Whitney test is used for testing the hypothesis;

H_0: The sample medians from the two populations are equal.

H_1: The sample medians from the two populations are significantly different.

To compute the observed value of the test statistic, we combine the two samples and rank all sample observations from the smallest to the largest. Tied observations are assigned the mean of the rank positions they would have occupied had there been no ties. The sum of the ranks of the observations from sample one (n_1) is denoted as T_1.

The test statistic therefore is defined as;

$U = T_1 - \frac{n_1(n_1+1)}{2}$, where n_1 is the sample size of sample one.

Critical values from the Mann-Whitney table are compared with the observed test statistic and a decision is reached whether to reject the null hypothesis or not. H_0 is rejected at significance level α if the calculated U is less than $w_{\alpha/2}$ (Lower critical value) or greater than $w_{1-\alpha/2} = n_1 n_2 - w_{\alpha/2}$ (Upper critical value) for the given tabulated values of the Mann-Whitney table.

3.4 Generalized Linear Models (GLMs)

A random component, specifying the conditional distribution of the response variable, Y_i (for the *i-th* of *n* independently sampled observations), given the values of the explanatory variables in the model is known as Generalized Linear Model. In the initial formulation of GLMs, the

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distribution of Y_i was a member of an exponential family, such as the Gaussian, binomial, Poisson, gamma, or inverse-Gaussian families of distributions.

The goal of generalized linear model is to model the relationship between the explanatory and response variables. To determine whether the GDP growth is dependent on the various groups of GCNet tax revenue, the Inverse Gaussian GLM is used. The generalized linear model analysis is used to estimate the contributions of the independent variables to the dependent variable. It measures the contributions of each explanatory variable in contributing to the response variable (GDP). The Inverse Gaussian GLM is used to determine the most significant components of the GCNet revenue data contributing to GDP and also to forecast four quarters of GDP data.

A generalized linear model (GLM) is made up of a linear predictor,

$$\eta_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_p x_{pi}, \qquad (3.9)$$

and two functions;

1. a link function that describes how the mean, $E(Y_i) = \mu_i$, depends on the linear predictor $g(\mu_i) = \eta_i$
2. a variance function that describes how the variance, $\text{var}(Y_i)$ depends on the mean, $\text{var}(Y_i) = \phi \text{var}(\mu_i)$, where the dispersion parameter ϕ is a constant.

3.4.1 Model Assumptions

The Linear model: $\mu = E(Y) = x\beta$, $x = \begin{bmatrix} x_1 & x_2 & \cdots & x_p \end{bmatrix}$, and

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the generalized linear model: $g(\mu) = g\left[E(Y)\right] = \eta = x\beta,$

where g is called the link function.

In addition, the response Y has a distribution in the exponential family, taking the form;

$$f(y,\theta,\phi) = e^{\left\{\frac{[y\theta - b(\theta)]}{a(\phi)}\right\} + c(y,\phi)}.$$

Intuitively, generalized linear model is the "extension" of the linear model. As the distribution is normal and the link function is the identity function, the generalized linear model reduces to the linear model.

The Inverse Gaussian Distribution

If the response variable, Y is distributed as Inverse Gaussian with mean μ and variance σ^2, i.e. $Y \sim IG\left(\mu, \sigma^2\right)$, then the probability density function of Y is given as follows;

$$f(y,\theta,\phi) = \sqrt{\frac{1}{2\pi\sigma^2 y^3}} \exp\left[\frac{-(y-\mu)^2}{2\mu^2\sigma^2 y}\right]$$

$$= \exp\left[\frac{-\left(y^2 - 2y\mu + \mu^2\right)}{2\mu^2\sigma^2 y} - \frac{1}{2}\log\left(2\pi\sigma^2 y^3\right)\right]$$

$$= \exp\left\{\frac{\left[y\left(\frac{-1}{2\mu^2}\right) + \frac{1}{\mu}\right]}{\sigma^2} - \frac{1}{2\sigma^2 y} - \frac{1}{2}\log\left(2\pi\sigma^2 y^3\right)\right\}$$

$$\Rightarrow \theta = \frac{-1}{2\mu^2},\ \phi = \sigma^2,\ a(\phi) = \sigma^2 = \phi,\ b(\theta) = \frac{-1}{\mu} = -\sqrt{-2\theta},$$

$$c(y,\phi) = \frac{-1}{2}\left[\frac{1}{\sigma^2 y} + \log\left(2\pi\sigma^2 y^3\right)\right] = \frac{-1}{2}\left[\frac{1}{\phi y} + \log\left(2\pi\phi y^3\right)\right]$$

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3.4.2 Properties of Generalized Linear Model

Let the response Y have a distribution in the exponential family, taking the form

$$f(y,\theta,\phi)=e^{\left\{\frac{[y\theta-b(\theta)]}{a(\phi)}\right\}+c(y,\phi)}.$$

Then,

- $E(Y)=\mu=b'(\theta)$
- $Var(Y)=b''(\theta)a(\phi)$

Proof

Let $l(y,\theta,\varphi)=\log\left[f(y,\theta,\varphi)\right]$, be the log-likelihood function.

Then,

$$E\left[\frac{\partial l(y,\theta,\phi)}{\partial\theta}\right]=0, \text{ and}$$
$$-E\left[\frac{\partial^2 l(y,\theta,\phi)}{\partial\theta^2}\right]=E\left[\frac{\partial l(y,\theta,\phi)}{\partial\theta}\right]^2.$$

Thus,

$$\frac{\partial l(y,\theta,\phi)}{\partial\theta}=\frac{y-b'(\theta)}{a(\phi)}$$

$$\Rightarrow E\left[\frac{\partial l(Y,\theta,\phi)}{\partial\theta}\right]=E\left[\frac{Y-b'(\theta)}{a(\phi)}\right]=\frac{E(Y)-b'(\theta)}{a(\phi)}=0$$
$$\Rightarrow E(Y)=b'(\theta)$$

Also,

$$\frac{\partial^2 l(y,\theta,\phi)}{\partial\theta^2}=\frac{-b''(\theta)}{a(\phi)}$$

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$$\Rightarrow \quad -E\left[\frac{\partial^2 l(Y,\theta,\phi)}{\partial\theta^2}\right]=\frac{b''(\theta)}{a(\phi)}=E\left[\frac{\partial l(Y,\theta,\phi)}{\partial\theta}\right]^2$$

$$=E\left[\frac{Y-b'(\theta)}{a(\phi)}\right]^2=\frac{E(Y-\mu)^2}{a^2(\phi)}$$

$$=\frac{Var(Y)}{a^2(\phi)}$$

$$\Rightarrow \quad \frac{b''(\theta)}{a(\phi)}=\frac{Var(Y_i)}{a^2(\phi)} \quad \Rightarrow \quad Var(Y)=b''(\theta)a(\phi).$$

If the response variable, Y is distributed as Inverse Gaussian with mean μ and variance σ^2, i.e. $Y \sim IG\left(\mu,\sigma^2\right)$.

Then,

$$\theta=\frac{-1}{2\mu^2}, \quad \phi=\sigma^2, \quad a(\varphi)=\sigma^2=\phi, \quad b(\theta)=\frac{-1}{\mu}=-\sqrt{-2\theta}$$

$$\Rightarrow \quad E(Y)=b'(\theta)=\frac{1}{\sqrt{-2\theta}}=\mu,$$

$$Var(Y)=b''(\theta)a(\phi)=\frac{-1}{2}\cdot\frac{1}{(-2\theta)^{3/2}}\cdot(-2)\cdot\sigma^2=\frac{1}{(-2\theta)^{3/2}}\cdot\sigma^2=\mu^3\sigma^2.$$

3.4.3 Link Function

Let the response Y has a distribution in the exponential family, taking the form

$$f(y,\theta,\phi)=e^{\left\{\frac{[y\theta-b(\theta)]}{a(\phi)}\right\}+c(y,\phi)},$$

with link function $g(\mu)=g\left[E(Y)\right]=\eta=x\beta$. As $\eta = \theta$, the link function is called canonical link.

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If the response variable, Y is distributed as Inverse Gaussian with mean μ and variance σ^2, i.e. $Y \sim IG\left(\mu, \sigma^2\right)$, then the canonical link is given as; $\eta = g\left(\mu\right) = \frac{-1}{2\mu^2}$.

3.4.4 Hypothesis

To test the utility of the regression model, the following hypotheses are specified;

H_0: The model does not fit the data

H_1:The model fit the data.

Equivalently the null and alternative hypotheses can be stated as follows;

$H_0: \beta_1 = \beta_2 = ... = \beta_p = 0$

$H_1: \beta_i \neq 0$, for at least one $i \{i = 1, 2, ..., k\}$

3.4.5 Test Statistics

The test statistic is computed in accordance with the following rationale. If the null hypothesis is true, none of the p independent or explanatory variables is linearly related to Y, the (response) dependent variable and therefore the model is useless. If at least one of β_i is not equal to zero, the model does have some utility. In assessing the generalized linear model's fit, the Z-test is used to test the coefficients parameters if they are significantly different from zero.

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CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter presents the results of data analysis of the primary and secondary data collected for the study on the performance and challenges of GCNet system of Customs Division of Ghana Revenue Authority (GRA). It provides the descriptive statistics of the results in the form of charts, tables and percentages. We shall use statistical tools such as normality tests, independent t-test and Mann-Whitney test for two independent samples and finally multiple linear regression to draw conclusions on the study objectives.

4.1 Analysis of Field Data

This section presents the analysis of field data collected from the personnel and staff of Customs Division of GRA and other Agencies using GCNet system for mobilization of revenue. This data was collected to examine the challenges and performance of the GCNet system for mobilizing revenue. In the study, we interview one hundred and fifty (150) personnel and staff, using GCNet system at Tema port through a design questionnaire but there were only 135 complete responses which were used for the analysis.

The distribution of respondents by gender is displayed in the pie chart in Figure 4.1, on the next page. It is observed that, 84 males representing 62% of the respondents responded to the questionnaire and 51 females representing 38% responded to the survey questionnaire. This shows that there were more males than females who took part in the interview.

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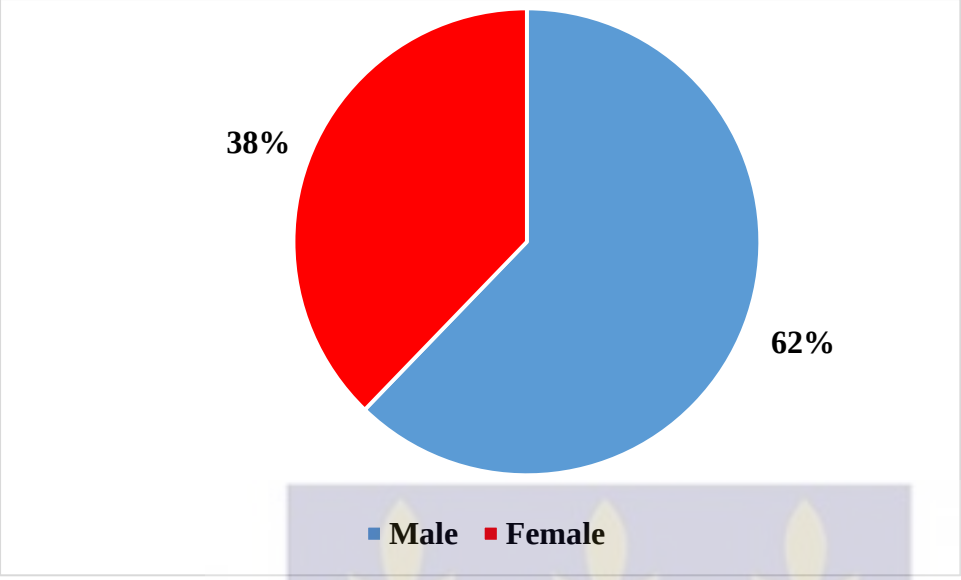

Figure 4.1: Distribution of respondents by Gender

The qualifications of personnel and staff is a key to the effective use of the GCNet system in the revenue generation. Table 4.1 displays the respondents' educational qualifications and it ranges from the secondary level to the postgraduate level. It is observed that out of 135 respondents, 34.8% have a degree, 33.3% have the diploma, 21.5% have the SSCE/ WASSCE and the remaining 10.4% had a master's degree. These show that the personnel using the GCNet system have a good educational qualification and have the required skills and competence to effectively use the system to collect revenue.

Table 4. 1: Qualification of respondents

Qualification	Frequency	Percent
SSCE/WASSCE/NVTI	29	21.5
Diploma	45	33.3
Degree	47	34.8
Masters	14	10.4
Total	135	100.0

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The study set an objective to investigate the performance of the Customs' revenue after the introduction of the GCNet system. The personnel were asked to rank the performance of GCNet system since its introduction in a likert scale of five (very poor, poor, fairly good, good and very good). Table 4.2 shows the responses of the personnel on performance of GCNet System. It is observed that 84 respondents representing 62.2% ranked the performance of the GCNet System as very good, 35 respondents representing 25.9% ranked the performance as good, 6.7% of the respondents ranked the performance as fairly good and the remaining 5.2% of the respondents ranked the performance of the GCNet system as poor. There was no response for very poor performance, but despite the system performing well, it also has some challenges. It is good to note that, majority of the respondents ranked the performance of the GCNet System as very good.

Table 4. 2: Performance of GCNet System

Response	Frequency	Percent
Poor	7	5.2
Fairly Good	9	6.7
Good	35	25.9
Very Good	84	62.2
Total	135	100.0

To examine the factors that hinder the operation of the GCNet system in the performance of revenue mobilization, the personnel were asked questions on eight common challenges the system may encounter. The common challenges enumerated are as follows: stable supply of power, frequent system failure or breakdown, adequate human resource, qualified personnel, logistics, processing time, break in information flow and middle men or "goro" boys. The personnel were asked to rank the degree of challenge in a five likert scale.

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Table 4.3a presents the summary of the eight possible challenging areas hindering the performance of the GCNet System. On average, 31.67% of the respondents said they were neutral on the level of challenges of the GCNet system, 29.35% said the GCNet System is completely not challenging, 27.50% said the GCNet system is not challenging, 10.65% said the GCNet system is challenging and the remaining 0.83% said the GCNetsystem is highly challenging. This shows that system faces some challenges making it not to perform efficiently.

Table 4.3a: Level of Challenging of GCNet System

Response	Average Percent
Completely not challenging	29.35
Not challenging	27.50
Neutral	31.67
Challenging	10.65
Highly challenging	0.83
Total	100.00

Table 4.3b, on the next page, shows the detailed response of the factors hindering the efficient performance of the GCNet system. It can be observed that, about 18.6 percent of the respondent personnel ranked the system failure as the major challenge GCNet system is facing. Provision of adequate logistics, stable power supply and break in information flow between the sectors/departments were considered as also factors affecting the efficient performance of the system for revenue generation (Table 4.3b). The rest are also in a way affecting the performance of GCNet system in revenue generation but they are minimal as compared with the early factors discussed above.

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Table 4.3b: Detailed degree of challenges of the respondents on the performance of GCNet system (Percent)

Challenges	Completely Not Challenging	Not Challenging	Neutral	Challenging	Highly Challenging
Stable supply of power	36.3	11.9	37.8	13.3	0.7
System failure or breakdown	24.4	16.3	40.7	15.6	3.0
Adequate human resource or personnel	27.4	48.1	14.1	10.4	0.0
Qualified human resource or personnel	14.8	51.1	31.1	3.0	0.0
Adequate logistics supply	15.6	37.0	33.3	14.1	0.0
Long processing time	39.3	17.0	33.3	10.4	0.0
Break in information flow	28.9	17.8	40.7	9.6	3.0
Middle men or Goro boys	48.1	20.7	22.2	8.9	0.0

4.2 Performance of Revenue over the Period

The study employed a time series plot to illustrate the performance of CEPS revenue collected over the fifteen years period (January 1999-December 2013). Figure 4.2 displays the time series plot of the raw revenue data and the exponential smoothed revenue data. It is observed from Figure 4.2 that, there was a constant growth in revenue from 1999-2002 and then a gentle increase in revenue between 2002 and 2004. The graph shows a steep decrease in revenue in 2004 and then a gentle increase till 2008 December. The revenue starts increasing again after the first half of 2009 and with high fluctuations between January 2012 and December 2013. The time series graph shows an upward trend over the fifteen years period and the break in 2004, may be attribute to the introduction of the GCNet system. Also the steep increase recorded in 2009 may be due to government policies and programmes put in place to increase revenue generation and this can been seen in the continuous increasing till December, 2013.

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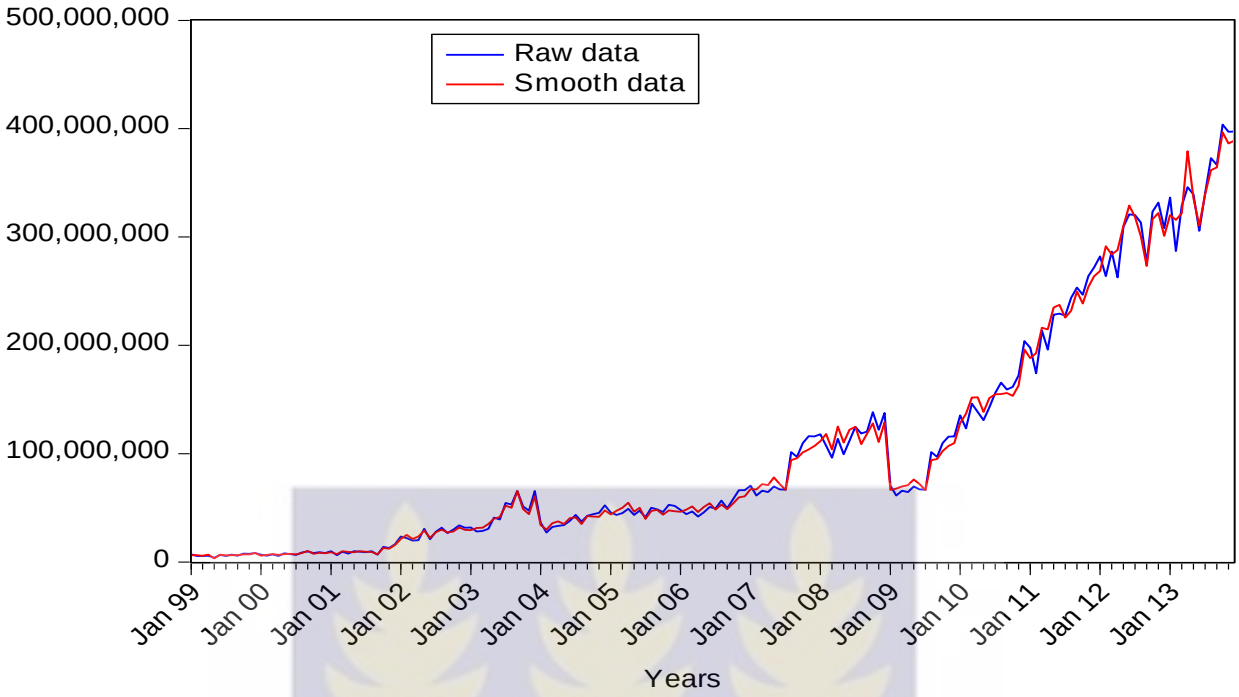

Figure 4.2: Time series graph showing performance of revenue; 1999-2013

Table 4.4 shows the statistics of the single exponential smoothing model displayed in Figure 4.2. The parameter alpha is 0.714 and the root mean squared error is 13973636. The single exponential smoothing model is given as follows from table 4.4:

$$forecast_t = 0.714\ revenue_t + 0.286\ forecast_{t-1}$$

Table 4.4: Estimates of exponential smoothing

Parameters:	Alpha	0.714
Sum of Squared Residuals		3.51E+16
Root Mean Squared Error		13973636
End of Period Levels:	Mean	3.97E+08

4.3 Normality Test of Revenue Data

This section presents the normality test for the revenue data collected from 1999 to 2013. The study used histogram and Q-Q plot to graphically test the normality of the data set whilst three

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statistical tests for normality were also employed to statistically test if the revenue collected over the period follows the normal distribution.

Figure 4.3 displays the histogram plot of CEPS revenue data collected from January, 1999 to December, 2013. The graph shows that, the distribution of the revenue data is positively skewed and cannot be concluded to follow the normal distribution. The quantile-quantile plot of the CEPS revenue data is displayed in Figure 4.4. The Q-Q plot shows that the quantiles of the revenue data does not match the theoretical quantile of the normal distribution. This also means that the revenue data is not normally distributed.

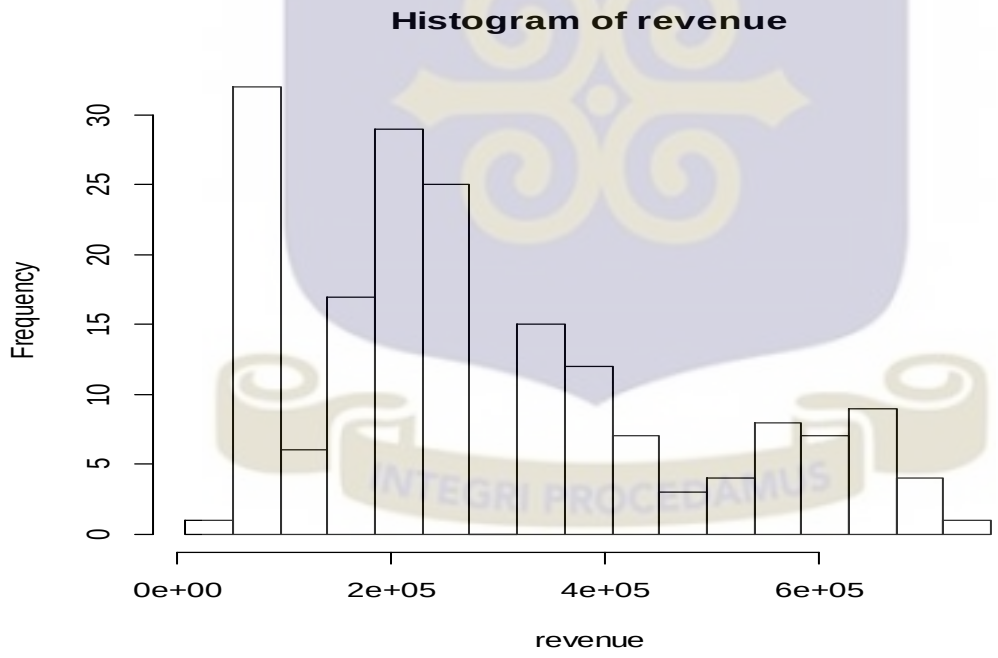

Figure 4.3: Histogram plot of the revenue data (1999-2013)

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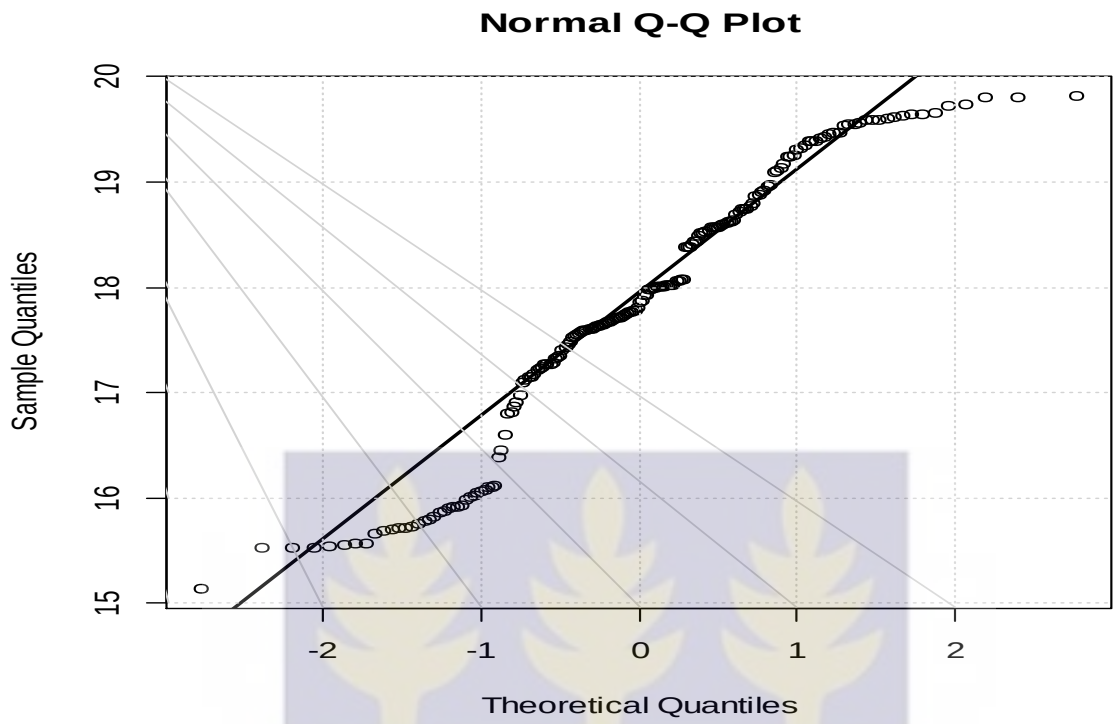

Figure 4.4: Q-Q plot of revenue data (1999-2013)

The study used three normality tests to statistically confirm the results of the graphical tests used in Figure 4.3 and Figure 4.4. Table 4.5 shows the results of the three normality tests used. The three tests; Anderson-Darling, Shapiro-Wilk and Kolmogorov-Smirnov tests, all reject the claim that revenue collected over the period is normally distributed at any level of significance. We therefore conclude that, the CEPS revenue collected from January, 1999 to December, 2013 is not normally distributed.

Table 4. 5: Normality test of Revenue data

Test	Statistic	p-value
Anderson-Darling	2.4204	3.83E-06
Shapiro-Wilk	0.9486	4.28E-06
Kolmogorov-Smirnov	0.5968	0.006877

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4.4 Independent Samples Test for Before and After the Introduction of GCNet

The study aims at examining the performance of revenue generation under CEPS sector through the introduction of the GCNet system. The study collected revenue data from the CEPS department of Tema port over the period, 1999-2013. The data was divided into two, comprising revenue generated before the introduction of GCNet system (January 1999-December 2003) and revenue generated after the introduction of GCNet system (January 2004-December 2013). The study used independent samples test to examine whether the revenue generated after the introduction of the GCNet system out performs the revenue generated manually. We consider Mann-Whitney test since the data was not normally distributed.

4.4.1 Mann-Whitney Nonparametric Test

The Mann-Whitney test is a nonparametric procedure used to test two independent samples that do not satisfy the rigid parametric assumptions. The Q-Q plot and three normality tests used in Section 4.3, show that the CEPS revenue data are not normally distributed and hence the need to use a nonparametric test.

Table 4.6 shows summary statistics of the ranks of the two groups; before and after the introduction of the GCNet system. It can be observed that, the mean rank for revenue after the introduction of the GCNet system is greater than before revenue data. This suggests that, there exists a significant difference in the performance of the revenue collection using the manual system and the GCNet system.

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Table 4.6: Summary Statistics (Ranks)

Revenue	N	Mean Rank	Sum of Ranks
Before	60	34.12	2047.00
After	120	118.69	14243.00
Total	180		

Table 4.7 shows the results of the independent two samples nonparametric test. The Mann-Whitney and the Wilcoxon tests recorded test results equal to 217.00 and 2047.00, respectively with a p-value equal to 0.00. This means that there is a significant difference in the median revenue before and after data of the introduction of the GCNet system at any level of significance. This confirms the result and conclusion of the independent samples t-test that, the introduction of GCNet system for revenue collection in the CEPS sector has performed significantly better than the manual system used in the past.

Table 4.7: Nonparametric test

Test	Statistic
Mann-Whitney	217.00
Wilcoxon	2047.00
Asymp. Sig. (2-tailed)	0.00

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4.5 Generalized Linear Model

In this section, we consider a generalized linear model to establish the relationship between the CEPS revenue collected through GCNet system and Gross Domestic Product (GDP). The revenue data was grouped as follows; import duty, import tax, levies, fees/fines and others and the data ranges over ten years period (2004-2013). The quarterly data for GDP and Customs'

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revenue was used for the generalized linear model. The data was fitted to family of Inverse Gaussian model with the link function of Power(-2).

Table 4.8 gives the coefficients of the generalized Inverse Gaussian linear model of the five components of Customs' revenue data and inflation. It is observed that all the components of the revenue data and inflation rate are significant at five percent significance level except, fees & fines component. This means that, GDP depends on import duty, import tax, levies, other taxes and inflation.

Table 4.9 shows the reduced model coefficients of the generalized linear model of the Inverse Gaussian family. The coefficients Tables (4.8 & 4.9) show that, GDP is negatively related to import duty, levies and other taxes and positively related to import tax and inflation rate.

Table 4.8: coefficients of six variable model of GDP; Model 1

Variables	Coefficient	Std. Error	Z-Statistic	p-values
Import Duty	-3.16E-17	1.42E-17	-2.23	0.0257
Import Tax	5.63E-17	2.14E-17	2.64	0.0084
Levies	-2.66E-17	1.16E-17	-2.29	0.0220
Fees & Fines	-5.73E-17	2.40E-16	-0.24	0.8110
Other taxes	-7.27E-17	2.92E-17	-2.49	0.0128
Inflation	3.23E-10	3.02E-11	10.69	0.0000

Table 4.9: coefficients of five variable model of GDP; Model 2

Variables	Coefficient	Std. Error	Z-Statistic	p-value
Import Duty	-3.16E-17	1.39E-17	-2.27	0.0232
Import Tax	5.36E-17	1.79E-17	2.99	0.0028
Levies	-2.54E-17	1.02E-17	-2.48	0.0131
Other taxes	-6.99E-17	2.65E-17	-2.64	0.0082
Inflation	3.25E-10	2.86E-11	11.37	0.0000

Table 4.10 shows the Akaike Information Criterion (AIC) and Schwarz Criterion (SC) for the two models with their statistics. Model 1 is the full model with six variables and Model 2 is the

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reduced model with five variables (without fees & fines component). The results show that, the reduced model (Model 2) have smaller AIC and SC statistics than Model 1 and this means that Model 2 is best fitted to the data than Model 1.

Table 4.10: Goodness of fit test

Test	Model 1	Model 2
Akaike Information Criterion	52.288	52.010
Schwarz Criterion	52.541	52.521

From Table 4.9, the generalized linear model of inverse Gaussian family of power (-2) is given as follows;

$$\begin{aligned} GDP^{-2} = &-3.16\,x10^{-16} * \text{import duty} + 5.36\,x10^{-16} * \text{import tax} - 2.54\,x10^{-16} * \text{levies} \\ &- 6.99\,x10^{-16} * \text{other taxes} + 3.25\,x10^{-16} * \text{inflation} \end{aligned}$$

Therefore, the required model for GDP on revenue components and inflation is given as;

$$GDP = \left[\begin{aligned} &-3.16\,x10^{-16} * \text{import duty} + 5.36\,x10^{-16} * \text{import tax} - 2.54\,x10^{-16} * \text{levies} \\ &- 6.99\,x10^{-16} * \text{other taxes} + 3.25\,x10^{-16} * \text{inflation} \end{aligned} \right]^{-1/2}$$

4.6 Forecasting of Quarterly GDP Values

The generalised linear model of Ghana GDP has been used to forecast the 2014 quarterly GDP values in millions of Ghana cedis. The result is displayed in table 4.10. The forecast was done using out sample data; that is, the 2014 quarterly revenue data was not used in fitting the model. The forecast values are greater than the observed values and a very small absolute forecast error ranging from 2.67% to 14.40%. This shows that, the generalized linear model of the Inverse Gaussian family of power (-2) fit the data better. The table 4.10 shows that, the third and fourth quarters observed values are closer to the model values than the first and second

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quarters of the model. This indicates that, the model performs better in forecasting the third and fourth quarter values.

Table 4.10: One year, quarterly GDP forecast values of the model in GH¢ Millions

Quarters 2014	Observed	Forecast	Absolute Forecast Error (%)
1	7,388.40	8,033.57	8.73
2	7,904.80	9,043.14	14.40
3	9,043.30	9,285.10	2.67
4	9,185.40	9,510.48	3.54

In summary, the chapter has presented data analysis and discussion of the results of both the primary and secondary data collected. The first section of the chapter analysed and discussed the field data collected. It looked at gender composition of the respondents, qualification of the responded personnel, and the performance of GCNet system from the respondents' point of view and the challenges hampering the efficient performance of the GCNet system. Section two, investigated the performance of the revenue data collected using a time series model. Test for the normality of the revenue data collected over the period was done in Section three and Section four performed independent samples tests to examine the significant impact of the introduction of GCNet system. Finally, in Section five, we fitted an Inverse Gaussian generalized linear model to determine the relationship and contribution of the various components of Customs' revenue data on the GDP of Ghana and the model forecasted the 2014 quarterly GDP values using the out-sample method of forecasting. In the next chapter, we present the summary, conclusion and recommendations of the research.

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CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of the findings from the study, and recommends some measures for government, stakeholders, Customs Division of GRA and other Agencies. The chapter provides the concluding statements of the research based on the findings.

5.1 Summary of the Findings

The research used both primary and secondary data to draw conclusions of the findings. Out of one hundred and fifty (150) personnel and staff to whom questionnaires were administered, one hundred and thirty-five questionnaires were completely answered whilst the other fifteen questionnaires were answered incompletely. The study shows that, more males (62%) than females (38%) participated in the answering of the questionnaires. Majority of the respondents' qualification was first degree and followed by diploma whilst second degree recorded the least. The performance of the GCNet system was rated by the respondents as Very Good and Good, and also ranked by the majority of the respondents as not challenging or completely not challenging on average.

The secondary data used for the study, spanned 1999-2013. The time series graph shows an upward trend over the period and very continuous steep increasing from 2009-2013. The performance was smoothed exponentially with parameter alpha, 0.714.

A histogram plot and Q-Q plot show, graphically, that the revenue data collected over the period is not normally distributed. Three statistical tests for normality: Anderson-Darling,

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Shapiro-Wilk and Kolmogorov-Smirnov tests, show that, the study data was not normally distributed.

The nonparametric Mann-Whitney test shows that, the revenue collected manually (before the introduction of GCNet system) is significantly less than revenue collected using the GCNet system, suggesting that, there has been a significant impact in the introduction of the GCNet system.

An inverse Gaussian generalized linear model was used to establish the linear relationship between GDP and the major components of GRA revenue data and inflation rate. The generalized linear model is as follows:

$$GDP = \left[\begin{array}{c} -3.16\,x\,10^{-16} * \text{import duty} + 5.36\,x\,10^{-16} * \text{import tax} - 2.54\,x\,10^{-16} * \text{levies} \\ -6.99\,x\,10^{-16} * \text{other taxes} + 3.25\,x\,10^{-16} * \text{inflation} \end{array} \right]^{-1/2}$$

The inverse Gaussian generalized linear model was used to forecast 2014 quarterly GDP values of Ghana and the maximum absolute forecast error attained was 14.40% and a minimum was 2.67%.

5.2 Conclusion of the Study

The findings from the study show that, the performance of the GCNet system over the years is very good and not coupled with many challenges. The study revealed that, there are some challenges like system failure, inadequate logistics supply, inadequate human resource, middle men, processing time and more, hindering excellent performance of GCNet system.

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The study shows that, the introduction of the GCNet system for revenue mobilization has significantly increased revenue over the period. It revealed that, GCNet system has outperformed the manual way of mobilisation of revenue at Tema port.

The study revealed that, the gross domestic product (GDP) of Ghana is dependent on the main components of GRA revenue data and inflation rate with a link function of power (-2) through a generalized linear model. It is observed that, there is a positive association between GDP and import tax, and inflation and whilst a negative relationship exists between GDP and import duty, levies and other taxes. The study shows that fees/fines significantly do not associate with GDP and the out-sample forecast of the GDP quarterly values of 2014 are greater than observed GDP values with a very small absolute forecast error. The study shows that, the model performs better in forecasting the third and fourth quarter values than the first and second quarter values.

5.3 Recommendations

The study shows that the GCNet system has performed significantly well over the years in revenue mobilisation despite some challenges it encounters during the operations of revenue mobilisation. The following are some recommendations to policy makers, stakeholders, Customs Division of GRA and other Agencies to help improve the efficiency of the system;

1. A stable supply of power to enhance smooth operation of the GCNet system.
2. Routine maintenance of system should be encouraged to avoid frequent system failure or breakdown during revenue mobilization.
3. Adequate and qualified personnel should be hired to avoid long queues and longer processing time.
4. Equipment and adequate logistics should be made available to improve revenue mobilization.

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5. Effective network system should be provided to eliminate break in information flow and middle men ("Goro" boys).
6. Personnel should be highly motivated to work extra hard to ensure efficiency and high revenue mobilization.
7. Personnel who are found corrupt should be given tougher punishment to serve as deterrent to others.
8. Effective and efficient public education on the operations and processes of revenue mobilization of Customs Division of GRA should be encouraged to avoid the usage of middle men.

5.4 Limitations of the Study

The limitations of the current study relate to the fact that some respondents were not able to be identified if the GCNet system is faced with challenges. The study was completely not able to attribute the performance of revenue over the period to the introduction of GCNet system or the increase in taxes or government policies in revenue mobilization. The manual system of revenue mobilization was not able to disaggregate the revenue into its main components.

Indeed, the identifiable limitations provide the foundation for researchers to approach future research work with caution. The limitations also provide the initial research framework for researchers to design a more enhanced methodology for prospective research works.

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APPENDIX A

QUESTIONNAIRE

I am an MPhil Statistics student at Methodist University College Ghana and I am conducting research on the topic "S***tatistical Analysis of the Impact of the GCNet on Revenue Performance in Ghana***"**.** This questionnaire is purely for academic purposes and will certainly respect your right of anonymity and examine the outcomes of the questionnaire with the highest degree of confidentiality. Kindly answer the questions as candidly as you can.

Section A: Demographic Information

1. Sector ……
2. **Branch ……**
3. Sex/ gender of respondent ☐ Male ☐ Female
4. Age of respondent……
5. Marital status

   ☐ Single ☐ Married ☐ Divorced/ Separated ☐ Widowed
6. Highest educational level

   ☐ JHS/ Middle school ☐ Secondary/Voc./Tech. ☐ Tertiary
7. Qualification attained

   ☐ SSSCE/WASCE ☐ Diploma ☐ Degree ☐ Masters ☐ PhD
8. Occupation/work schedule of respondent……

Section B: Information on GCNet System

9. Do you use the GCNet at work? Yes or No

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10. Rank the performance of the use of GCNet System for revenue generation, from 1 to 5, where **1 is Very Poor, 2 is Poor, 3 is Fairly Good, 4 is Good and 5 Very Good.**

……

The GCNet System is assumed to be faced with many challenges. Rank the following challenges in likert scale of 5.

1=Completely not Challenging, 2= Not Challenging, 3=Neutral, 4= Challenging and 5= Highly Challenging

	Challenges	**Rank**
11.	Stable supply of power	
12.	System failure or breakdown	
13.	Adequate human resource or personnel	
14.	Qualified human resource or personnel	
15.	Adequate logistics supply	
16	Long processing time	
17	Break in information flow	
18.	Middle men or Goro boys	

Thank you.

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APPENDIX B

Yrs	Q	IMPORT DUTY	IMPORT TAX	LEVIES	FEES/FINES	OTHER TAXES	GDP GH¢ Million
2004	1	39,047,852.79	49,306,259.14	4,369,848.25	895,287.79	1,938,868.03	2,907.41
	2	42,913,115.40	54,625,641.54	4,950,222.25	978,013.71	2,029,278.30	2,835.13
	3	47,100,434.26	62,976,195.65	5,246,448.54	1,083,503.75	6,967,749.30	3,537.67
	4	51,971,634.37	64,808,923.67	5,899,466.30	1,297,426.02	17,582,811.46	3,708.53
2005	1	48,084,109.57	62,230,412.58	5,487,632.05	1,165,477.90	17,057,382.23	3,520.13
	2	52,231,119.60	63,357,353.58	5,781,152.61	1,205,359.10	17,010,624.92	3,432.63
	3	53,201,071.31	62,157,914.65	5,978,711.74	1,331,930.40	17,101,122.01	4,283.21
	4	59,598,044.45	65,905,774.03	5,867,889.37	1,232,211.35	17,918,758.22	4,490.09
2006	1	53,139,737.05	60,951,133.99	6,000,756.88	1,573,527.46	17,061,306.32	4,087.50
	2	53,629,744.72	60,792,080.99	5,840,142.35	1,472,247.66	16,891,401.72	4,067.80
	3	60,552,278.91	67,816,004.52	6,561,446.06	1,606,493.12	18,974,781.01	5,073.10
	4	74,708,713.17	83,273,754.47	7,797,640.20	1,948,265.68	22,860,877.23	5,476.70
2007	1	80,003,037.96	83,773,375.73	7,949,238.08	1,848,473.34	23,831,137.24	4,544.00
	2	79,326,567.43	87,532,753.14	8,399,282.23	1,936,899.94	24,024,124.69	4,361.20
	3	87,685,445.97	69,480,190.59	20,500,321.04	1,361,712.78	19,309,091.56	5,362.90
	4	154,141,378.75	114,599,215.81	38,726,056.40	2,073,122.05	31,987,481.99	5,645.40
2008	1	142,777,985.68	108,069,044.66	38,496,494.96	2,298,345.75	29,869,272.88	4,943.70
	2	140,773,951.32	111,072,937.02	40,492,483.08	2,811,107.97	29,950,777.83	4,616.30
	3	98,085,402.48	84,770,918.68	29,996,875.53	2,862,777.75	23,346,877.08	5,984.20
	4	159,758,231.95	149,967,103.45	44,975,920.60	4,084,513.42	39,026,930.93	6,047.80
2009	1	80,003,037.96	83,773,375.73	7,949,238.08	1,848,473.34	23,831,137.24	5,073.40
	2	79,326,567.43	87,532,753.14	8,399,282.23	1,936,899.94	24,024,124.69	4,856.30
	3	87,685,445.97	69,480,190.59	20,500,321.04	1,361,712.78	19,309,091.56	6,114.30
	4	154,141,378.75	114,599,215.81	38,313,702.76	2,073,122.05	31,987,481.99	6,410.50
2010	1	153,017,709.44	150,711,558.02	56,555,593.93	5,897,762.06	38,539,069.29	5,415.40
	2	157,899,889.60	157,533,268.48	55,659,383.10	5,088,815.20	36,146,315.32	5,107.30
	3	184,092,078.39	186,932,472.38	57,552,398.86	4,771,406.90	47,370,740.29	6,647.90
	4	210,073,407.62	214,210,665.44	52,641,242.06	4,998,961.18	55,719,198.82	7,016.70

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2011	1	232,872,822.98	232,640,400.97	52,765,582.01	5,697,625.56	61,365,154.60	6,124.80
	2	262,289,595.68	255,410,625.52	56,977,145.41	7,431,184.46	71,417,462.86	6,102.30
	3	294,192,764.97	282,362,259.44	62,105,989.53	8,951,819.45	76,961,688.88	7,719.20
	4	314,189,799.07	308,291,725.28	64,795,038.32	7,543,894.81	87,961,205.14	7,945.00
2012	1	325,343,778.33	331,339,502.55	68,576,883.73	9,255,491.61	97,827,915.88	6,703.00
	2	353,556,730.09	351,582,021.58	73,528,981.89	11,335,186.84	102,840,368.80	6,703.60
	3	363,070,892.93	358,480,897.84	74,461,636.36	9,040,784.83	104,046,899.13	8,237.50
	4	382,195,539.90	387,151,709.92	64,543,131.83	10,153,370.68	119,427,583.17	8,698.60
2013	1	378,025,571.12	382,256,611.60	74,648,552.28	10,327,536.61	106,869,857.61	7,304.90
	2	391,133,888.13	396,806,385.71	78,812,754.13	11,851,339.50	112,375,838.95	7,437.30
	3	403,023,044.67	422,898,038.78	98,097,435.32	10,431,043.58	145,244,996.85	8,642.00
	4	450,040,080.05	450,351,795.52	159,326,263.63	10,742,330.08	127,721,450.13	9,123.10
2014	1	571,549,189.28	528,555,889.19	167,308,541.74	11,231,875.92	58,155.66	7,388.40
	2	581,765,890.88	547,859,573.33	177,597,892.45	12,627,041.21	6,659.50	7,904.80
	3	609,434,195.24	591,012,331.36	185,062,670.43	12,245,503.37	11,648,735.48	9,043.30
	4	669,494,929.29	659,107,979.46	183,958,030.87	9,902,896.83	38,890.96	9,185.40

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Months	After (2004-2013) GH¢	Before (1999-2003) GH¢	Months	After (2004-2013) GH¢	Before (1999-2003) GH¢
1	36,199,735.00	7,108,393.75	7	66,667,659.20	27,988,179.97
2	27,156,055.33	5,557,751.69	8	101,378,490.21	31,467,735.80
3	32,202,325.67	5,611,342.36	9	96,958,271.73	26,599,230.88
4	33,233,058.61	5,729,591.22	10	109,695,430.31	29,936,110.88
5	34,164,308.43	3,771,488.38	11	116,039,334.05	33,885,124.09
6	38,098,904.16	6,577,456.55	12	115,792,490.64	31,483,421.51
7	43,411,074.65	5,527,669.20	1	117,885,318.50	31,832,770.80
8	37,237,956.49	6,648,664.30	2	107,287,129.01	28,237,523.78
9	42,725,300.36	5,777,843.82	3	96,338,696.42	28,691,335.90
10	44,075,581.14	7,749,206.09	4	113,643,905.71	30,541,000.16
11	45,283,175.27	7,478,262.09	5	99,484,459.70	40,918,594.98
12	52,201,505.41	8,332,191.15	6	111,972,891.81	39,108,236.14
1	45,530,965.56	6,721,943.96	7	124,765,053.83	54,332,011.32
2	43,506,901.92	5,661,623.71	8	118,662,325.66	52,895,210.34
3	44,987,146.85	6,928,789.56	9	120,400,525.86	65,411,536.79
4	48,955,676.10	5,515,469.52	10	138,287,813.59	51,288,225.82
5	43,359,175.20	8,052,239.49	11	122,004,785.84	47,294,613.94
6	47,270,758.51	7,214,676.67	12	137,520,100.92	65,544,131.26
7	41,164,987.38	6,490,780.80	1	70,321,609.94	
8	50,032,557.39	8,752,758.84	2	61,271,557.00	
9	48,573,205.34	9,601,576.83	3	65,812,095.41	
10	46,038,648.83	8,172,708.56	4	64,615,752.84	
11	52,696,597.33	8,998,598.38	5	69,685,367.79	
12	51,787,431.26	8,117,059.77	6	66,918,506.80	
1	48,027,856.95	10,050,494.52	7	66,667,659.20	
2	44,225,931.76	6,327,713.46	8	101,378,490.21	
3	46,472,672.99	9,412,772.12	9	96,958,271.73	
4	41,893,692.53	7,838,472.32	10	109,695,430.31	
5	45,895,025.94	9,843,944.14	11	115,626,980.41	
6	50,836,898.97	9,375,066.29	12	115,792,490.64	
7	49,176,916.24	9,085,138.93	1	135,280,197.26	
8	56,768,948.19	9,884,057.14	2	123,308,263.78	
9	49,565,139.19	6,752,110.99	3	146,133,231.70	
10	57,910,008.77	13,915,439.54	4	138,583,134.52	
11	66,334,781.01	12,994,518.22	5	130,920,654.94	
12	66,344,460.97	16,277,629.28	6	142,823,882.24	
1	70,321,609.94	23,515,093.36	7	155,993,098.84	
2	61,271,557.00	22,120,159.05	8	165,442,122.96	
3	65,812,095.41	19,754,828.72	9	159,283,875.02	
4	64,615,752.84	20,135,531.04	10	161,568,188.86	
5	69,685,367.79	30,658,984.15	11	172,281,189.32	
6	66,918,506.80	21,040,544.27	12	203,794,096.94	

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Months	After (2004-2013) GH¢	Before (1999-2003) GH¢
1	197,670,318.22	
2	174,205,292.53	
3	213,465,975.37	
4	196,094,827.75	
5	228,226,725.46	
6	229,204,460.72	
7	227,533,035.17	
8	243,764,121.49	
9	253,277,365.61	
10	246,750,470.21	
11	263,952,712.00	
12	272,078,480.41	
1	281,971,691.80	
2	263,808,348.36	
3	286,563,531.94	
4	262,606,615.28	
5	309,434,044.62	
6	320,802,629.30	
7	320,160,102.15	
8	313,333,658.51	
9	275,607,350.43	
10	323,486,317.38	
11	331,788,088.66	
12	308,196,929.46	
1	336,511,811.05	
2	286,999,388.10	
3	328,616,930.07	
4	346,093,451.86	
5	339,254,154.79	
6	305,632,599.77	
7	340,330,265.09	
8	372,707,773.87	
9	366,656,520.24	
10	403,711,734.27	
11	397,220,726.06	
12	397,249,459.08	