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MEASURING COST AND TECHNICAL EFFICIENCY IN THE OPERATIONS OF THE NATIONAL HEALTH INSURANCE SCHEME IN GHANA: THE CASE STUDY OF ASHANTI REGION

BY

(BA Economics and Entrepreneurship Development)

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DECLARATION

I, Ebenezer Akpiok declared here that this submission is the true reflection of my own research, and that to the best of my knowledge, this work or part thereof has no materials that have been submitted for the award of any other degree of the University or published previously by another person except aspects that have been duly acknowledged in the work.

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ABSTRACT

Measuring cost and technical efficiency in the operations of the NHIS in Ghana is a vital issue. The study used DEA-Technical Efficiency Model and DEA-Cost Efficiency Model to estimate the technical and cost efficiency levels of the NHIS. A regression was also adopted to determine which factors are responsible for variation of technical and cost efficiency in the operations of the NHIS over the period (2009-2012). The findings indicates that only one NHIS of the sample units (NHIS) operates at its optimal from 2009-2012 in the case of technical efficiency while for cost efficiency results, none of the sample units operates at optimal level from 2009-2012. The technical efficiency result reveals that on average, efficiency results are higher, thus 0.719, 0.704, 0.701 and 0.730 respectively from 2009-2012 while the cost efficiency results suggests that on average, the efficiency results are low, thus 0.555, 0.441, 0.404 and 0.419 respectively from 2009- 2012. The determinant of technical efficiency results indicates that only AGE, Total Assets (TASSETS) and Location (LOC) that are inversely related to technical efficiency while only Total Premium (TPRM), Loss Ratio (LR), and Total Subsidy (TSUBSIDY) that relates positively to technical efficiency. In the case of cost efficiency, the determinants results shows that only AGE, Total Assets (TASSETS) and Total Subsidy (TSUBSIDY) that are negatively related with cost efficiency while only Total Premium (TPRM), Loss Ratio (LR), and Location (LOC) that relates positively with cost efficiency. The study concludes that AGE, TASSETS, TPRM, and LR except
TSUBSIDY and LOC are all significant determinants of the NHIS's operations in terms of cost and technical efficiency as they influence the operations of the NHIS in one way or the other over the period (2009-2012).

Keywords: Ghana, Ashanti, National Health Insurance Scheme, Cost and Technical efficiency

DEDICATION

This paper is dedicated to Mr Akpiok Amig (Father) and Madam Akogtilie Ayaric (Mother) for their perpetual care, love and support to me in my entire academic pursuits.

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LIST OF ABBREVIATIONS

MAX	-	Maximum
ADMIN	-	Administrative
MIN	-	Minimum
BCC	-	Banker, Charnes and Cooper, 1984
CBHIS	-	Community Based Health Insurance Scheme
CCR	-	Charnes, Cooper and Rhodes, 1978
CE	-	Cost Efficiency
CEMODELS	-	Cost Efficiency Models
CHI	-	Community Health Insurance
COEF	-	Coefficient
CRS	-	Constant Returns Scale
DANIDA	-	Danish International Development Agency
DEA	-	Data Envelope Analysis
DEAP	-	Data Envelope Analysis Programming

DMUs	-	Decision Making Units
DMHIS	-	District Mutual Health Insurance Scheme
DNHIS	-	District National Health Insurance Scheme
EE	-	Efficiency
EFF	-	Efficiency
EU	-	European Union
FTEs	-	Full-Time Equivalents
GDRGs	-	Diagnosis Related Groupings
HIV	-	Human Immune Virus
IMF	-	International Monetary Fund
INEFF	-	Inefficiency
LI	-	Legislative Instrument
MATUSE	-	% of Materials Use to Total Operating Cost
MHIS	-	Mutual Health Insurance Scheme
ML	-	Maximum Likelihood
MOH	-	Ministry of Health
NGO	-	Non Governmental Organisation
NHIA	-	National Health Insurance Authority
NHIC	-	National Health insurance Council
NHIF	-	National Health Insurance Fund
NHI	-	National Health Insurance
NHIS	-	National Health Insurance Scheme
NPP	-	New Patriotic Party
OECD	-	Organisation For Economic Co-Operation & Development
OLS	-	Ordinary Least Square
PCHIS	-	Private Commercial Health Insurance Scheme
PMHIS	-	Private Mutual Health Insurance Scheme
ROA	-	Return on Assets
SFA	-	Stochastic Frontier Analysis
SSNIT	-	Social Security and National Insurance Trust
TEMODELS	-	Technical Efficiency Models

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TE	-	Technical Efficiency
UNDP	-	United Nations Development Programme
UNICEF	-	Unite Nations International Children's Emergency Fund
USA	-	United State of America
VAT	-	Valve Added Tax
VIP	-	Very important persons
VRS	-	Variable Returns to Scale
WHO	-	World Health Organisation
RKS	-	Ranks
SAP	-	Structural Adjustment Programme
VAR	-	Variable
EXPLAN	-	Explanatory
GSS	-	Ghana Statistical Service

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The affordability of health care is a vital issue in most countries. The provision of affordable health care in many high, - middle-and low-income countries, is high on the development agenda, given the large numbers of people that lacks sufficient financial means to access health services; worldwide, millions of people are pushed into poverty every year by the need to pay for health care (International Labour Organization, 2008).

Health Insurance as a system of promoting universal health coverage has attracted considerable interest some time back (WHO, 2004; Ellenbogen, Ramsey and Danley 1996; Wagstaff, 2002). This may not be surprising as Carrin, Waelkens and Criell (2005) indicated that health financing via the development of health insurance is identified as a powerful choice for the transition to universal coverage and as a means of reducing the financial burden of health care cost. Yet, effective means of solving or dealing with the problem of escalating health-care costs and under-funding in poor sub-Saharan African countries including Ghana remain elusive, (Mensah, Oppong and Schmidt, 2010).

In the immediate post-independence era for instance, Ghana provided 'free' medical services to all citizens. However, by the early 1980s, under the impression of difficult economic challenges, deteriorating health infrastructure, and exceptionally large number of emigration of health workers, the government implemented a cost recovery scheme, partly as its response to pressure from the International Monetary Fund and World

Banksponsored Structural Adjustment Programs, (Mensah, Oppong-Koranteng and Frempah-

Yeboah, 2006).

In 1983, the Government was made to cut down expenditure on social services under the Structural Adjustment Programme (SAP), with education and health bearing the heaviest brunt (Owusu-Mensah, 2010). Full cost recovery for health service delivery was afterwards made operational (Owusu-Mensah, 2010).

In 1985, the government officially cancelled the Hospital Fees Regulation, 1963, (LI 1277) and replaced it with the Hospital Fees Regulation, 1985, (LI 1313) which mandated full cost recovery for health service delivery in the country or Ghana (Atim et al, 2001) cited in Owusu-Mensah, (2010). This was referred to as the "cash and carry" system and involved the total removal of government subsidies on health delivery. Patients were then informed or asked to make payment for full cost of medication and care (Owusu-mensah, 2010).

The concept was aimed at an increase in scare means or resources to health care facilities which would allow them to expand and upgrade their services. It was also meant to improve access to health care and reduce unnecessary visits by patients who tend to abuse the system because it was free (Owusu-mensah, 2010). For Agyepong and Adjei, (2008) the aim of the 1985 user fees was to recover at least 15 % of recurrent expenditure for quality improvements of healthcare. The financial aims were said to be achieved (MOH

2001) cited in (Agyepong and Adjei, 2008).

However, it was said to be poorly regulated, inconsistently implemented, and found to have worsened access to health care for the poor (Blanchet et al, 2012). For instance, in 1985, the year in which user fees were substantially raised, outpatient visits decreased from 4.5m to 1.6m. In one region, it was found that urban utilization fell by more than 50 % in one year after the increase in fees (Lund, 2003).

According to Oppong (2001) access and utilization of health services plummeted, as did health indicators. Facing very high treatment costs, many low-income households frequently postponed medical treatment, resorted to self-treatment, or used alternatives provided by unregulated healers, spiritualists, and itinerant drug vendors, often with outcomes that were disastrous.

Evidence gathered described the fee for service known as “cash and carry” system as a “stinking and dehumanising” system because patients who did not have the ability to pay for medical service were turned away from hospital only to die at home, (Atim et al., 2001).

As a result, starting from the early 1990s, the country (Ghana) began to seek other ways of financing health care, including NGO initiated community-based health insurance schemes (CBHIS) (Blanchet et al, 2012). While popular among members and international donors at the time, the schemes were only targeted to specific areas, failed to address key social insurance issues, and were not supported by general government revenue to allow them to

cater for the poor. Most importantly, with CBHIS covering only about 1 % of the population with limited benefit packages, (Atim et al., 2001) cited in (Blanchet et al, 2012).

The highly unpopular fee for service known as “cash and carry” system became a salient political issue and the main opposition party, the New Patriotic Party (NPP), began to call for its abolishment in its manifestos and campaigns, (Rajkotia, 2009). Ultimately, the National Health Insurance Scheme (NHIS) was established under Act 650 in 2003 by the Government of Ghana to provide a broad range of health care services to Ghanaians via the district mutual and private health insurance schemes, (cited in Blanchet et al, 2012). Mensah et al. (2010) envisaged the NHIS to eventually replace the cash-and-carry system and ensure efficiency by making health care affordable, improve access and health outcomes.

According to Ibiwoye and Adeleke, (2009) its multi-dimensional nature makes studies on health insurance coverage and access necessary. Some of these dimensions are the belief about its valve, perceived health status and such others like cost or availability of health insurance, (Brown and Richard, 2000) cited in (Ibiwoye and Adeleke, 2009).

The pursuit of efficiency has become a core objective of policy makers within most health institutions or bodies (WHO, 2006) cited in (Jehu-Appiah, et al., 2014). This is much more evident in Africa of which Ghana is not an exception where the ability to adequately meet health care needs is said to be exacerbated by extensive levels of inefficiencies (Kirigia et al, 2008; Zere et al, 2006; Tlotlego et al, 2010; Masiye, 2007;
Kirigia et al, 2002; Zere et al, 2005 and Kirigia et al, 2001) cited in (Jehu-Appiah, et al.,

2014).

This is obvious, particularly in the case of the 'Cash and Carry' system in Ghana where the system was not considered as an ideal for the country given its socioeconomiccultural and political context. Hence, the NHIS emerged as an alternative with the main task of extending social health protection to the poor and other disadvantaged populations by improving financial access to quality health services (Government of Ghana, 2003) cited in (Durairaj et al., 2010) through the principles of equity, solidarity risk sharing, cross-subsidization, reinsurance, client and community ownership and value for money in health-care delivery, (Durairaj et al., 2010).

However, notwithstanding its sudden take over in place of the 'Cash and Carry' system to provide financial access to quality health care, expenditure on claims payments rose 40 fold between 2005 and 2009 from GH¢ 7.6 million to GH¢ 308 million with cost per claim between 2008 and 2009 rising from GH¢ 8.48 to GH¢ 19.29 in just one year, (National Health Insurance Authority, 2010) coupled with enrolment of membership between 2005 and 2009 rising from 1,348,160 subscribers to 14,511,777 subscribers representing 6.31 % and 61.97 % respectively over the period (National Health Insurance Authority, 2009).

Following these developments associated with expenditure on claims payments coupled with enrolment of membership of the NHIS between 2005 and 2009 above, can we say the operations of the NHIS has been efficient as an alternative? If yes, to what extend and level can we say the operations of the NHIS has been efficient as an alternative? It's as a result of this that the study sought to measure the cost and technical efficiency in the operations

of the National Health Insurance Scheme (NHIS) in Ghana using Ashanti Region as a case study.

1.2 Problem Statement

Despite its (NHIS) emergence in place of 'Cash and Carry' system to provide financial access to quality health care, issues of NHIS subscribers been denied access of healthcare as a result of unpaid claims, allocated funds unable to meet emerging Claims liability, high cost of medicines, over 100% average increase in provider Fees and Charges (LI2216 of 2014), increasing enrolment to achieve Universal Health Coverage under the current financial constraint and unauthorized co-payment are said to exist in the operations of the NHIS (Jehu-Appiah, 2015).

Expenditure on claims payments also rose 40 fold between 2005 and 2009 from GH¢ 7.6 million to GH¢ 308 million, (National Health Insurance Authority, 2010) coupled with enrolment of membership between 2005 and 2009 rising from 1,348,160 subscribers to 14,511,777 subscribers representing 6.31 % and 61.97 % respectively over the period (National Health Insurance Authority, 2009).

Since the pursuit of efficiency has now become a core objective of policy makers within most health bodies (WHO, 2006), and is even much more evident in Africa of which Ghana is not an exception where the ability to adequately meet health care needs is said to be worsen by extensive levels of inefficiencies (Kirigia et al, 2008; Zere et al, 2006; Tlotlego et al, 2010; Masiye, 2007; Kirigia et al, 2002; Zere et al, 2005 and Kirigia et al, 2001) cited in (Jehu-Appiah, et al., 2014).

Then, the question that may arises here is that, has the operations of the NHIS been efficient as an alternative? If yes, to what extent and level can we say the operations of the NHIS has been efficient? It's in light of this that the study seeks to measure cost and technical efficiency in the operations of the NHIS in Ghana using Ashanti Region as a case study.

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1.3 The Study Objectives

1.3.1 Main Objective

The main objective of this study is to measure cost and technical efficiency in the operations of the NHIS in Ghana using Ashanti Region as a case study.

1.3.2 Output and Input Instruments

1. To measure the technical efficiency in the operations of the NHIS
2. To measure the cost efficiency in the operations of NHIS
3. To estimate major determinants of the observed level of cost and technical efficiency in the operations of the NHIS.

1.4 Research Questions

1. To what extent and level can we say the operations of the NHIS are technically efficient?
2. To what extent and level can we say the operations of the NHIS are cost efficient?
3. What are the factors responsible for variations of cost and technical efficiency in the operations of the NHIS?

1.5 Study Hypothesis

1. H_1: The operations of the NHIS are Technically efficient
2. H_2: The operations of the NHIS are Cost efficient
3. H_3: Size is positively associated with Technical efficiency
4. H_4: Subsidy is positively linked to Technical efficiency
5. H_5: Size is positively associated with Cost efficiency
6. H_6: Subsidy is positively linked to Cost efficiency

1.6 Significance of the Study

The study aims to measure cost and technical efficiency in the operation of the NHIS in the Ashanti Region of Ghana and then highlight possible policy implications of the results for policy makers. Thus understanding the level of inefficiencies and factors that affect the efficiency in the operations of the NHIS in the region would enable policy makers design effective strategies for the NHIS resource utilization so as to improve their operations in terms of cost and technical efficiency. The results of the study, conclusions drawn and recommendations will also serve as relevant source of reference and way forward in the future particularly for future studies on health insurance in the region.

1.7 Scope of the Study

This study covers the operation of all the National Health Insurance Schemes (NHIS) in the Ashanti region of Ghana established under the National Health Insurance Act (Act 650) in 2003.

1.8 Organization of the study

Following chapter one, the remaining part of the paper is as follows: chapter two provides an overview of Ghana's NHIS and presents the theoretical and empirical background for efficiency analysis. Chapter three describes the population, the sample size determination and techniques, specification of variables, data sources, theoretical models (SFA, DEA and regression models), empirical models (DEA and regression model) and mode of analysis. Chapter four presents the analyses of the empirical results of DEA-technical efficiency; DEA cost efficiency, the regression results of the determinants of technical efficiency and cost efficiency and test results for the study hypothesis. Chapter five presents the summary of findings, conclusions drawn, recommendations and limitations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is in three parts. The first part attempts an overview of Ghana NHIS. The second part tries to bring out the framework for measuring cost and technical efficiency and some of the limitations associated with the usage of any particular estimation technique whilst the third aspect focuses on some empirical studies on cost and technical efficiency indices and the empirical determinants of cost and technical efficiency.

2.1 Ghana's National Health Insurance Schemes

2.1.1 Health Insurance

Health insurance can be refer to as any form of insurance whose payment is contingent on the insured incurring additional expenses or losing income because of incapacity or loss of

good health. It also means a disability insurance or medical expense insurance (cited in Yellaiah and Ramakrishna, 2012).

It is many times used much more broadly to involve insurance that covers a long period nursing or disability care needs (Quaye, 1991).Technically, it is referred to as a mechanism through which the risks of incurring health care costs are spread among a group of individuals or households (Arhin – Tenkorang, 2001).

2.1.2 Healthcare Financing

The World Health Organization (WHO) refers to health financing as the "function of a health system concerned with the mobilization, accumulation and allocation of money to cover the health needs of the people, individually and collectively, in the health system." It made it clear that the "purpose of health financing is to make funding available, as well as to set the right financial incentives to providers, to ensure that all individuals have access to effective public health and personal health care" (WHO 2000).

The principal choices of financing a health care system are; general revenues, out-ofpocket payments, social insurance financing as well as private insurance financing, (Glied, 2008). General revenue financing here involves a system of revenue generation through a broad based tax. All or a portion of this tax may be dedicated to the health care system. General revenues may be collected at the federal, provincial/state, or local levels. Although often linked with progressive financing, general revenues can be generated via tax vehicles that are also more or less progressive – from a progressive income tax to a relatively regressive sales tax (or a highly regressive sin tax). General revenues are taking to finance certain

aspects of the health care system almost everywhere. In countries that mainly rely on social insurance, general revenue funds are often put to use in order to cover the costs of non-workers, (Glied, 2008).

Out-of-pocket payments are those payments made into the health care system that are collected directly at the point of service. With respect to this classification, full payments are usually included (as in the case of pharmaceuticals or nursing home care for those without insurance coverage) as well as co-payments and deductibles. A system with only out-of-pocket payment would (in a tax sense) finance health care regressively, once health service use rises less than proportionately with income, (Glied, 2008). For Schieber et al. (2006; 231) out-of-pocket payment in low-income countries accounts for almost half of health spending meanwhile it is twenty per cent for some high-income countries such as the Netherlands.

The term social insurance financing refer to a system through which some group of people, usually workers, are mandated to make contributions to a health care financing (or, for example, retirement) program, (Glied, 2008). Carrin et al. (2005) adds that health financing systems via the development of social health insurance are generally identified as a powerful method to achieve universal coverage with enough financial protection for all against healthcare costs.

These contributions (Social insurance) are usually either regressive (a flat per capita mandate) or proportional (a flat payroll tax rate). Social insurance financing based on payroll taxation encounters the problem where the tax base, which excludes non-labor

income, may be narrower than under broader scope general revenue financing (Amelung et al, 2003) cited in (Glied, 2008).

Some social insurance systems cap the maximum contribution, decreasing the progressivity of this financing process or method. Contributions generated via the social insurance system should finance the full insured cost of the health program (or a prespecified proportion of that cost). Thus, the contribution level or rate is tied to the cost of providing health insurance. Social insurance payments may defer with the choice of plan in a multi-plan system (as in Germany) or they may be fixed (as in the US Medicare program), (Glied, 2008).

Private insurance financing may be individual (although this is rare except in highly regulated contexts) or operate via employers or other purchasing organizations. Except in highly regulated contexts or in employer-sponsored groups, the price of coverage is related to expected health expenditures – older, sicker people pay more for coverage and premiums increase as health expenditures increase, (Glied, 2008).

The concept of progressivity does not have an obvious analogue in the private pay case. Under private coverage, individuals choose both how much to purchase and, by extension, how much to make payment as a share of their income. Even in a situation without health insurance, however, health care utilization increases less than proportionately with income (the income elasticity of health care utilization is, at the micro level, less than one). The premiums paid by lower income individuals are only slightly lower than those billed to

higher income people, a situation that would be seen as regressive if the premiums were taxes, (Glied, 2008).

2.1.3 Health Financing In Ghana

Prior to independence, financial access to current health care was predominantly by outof pocket payments at point of service use (Arhinful, 2003). Following independence, the government switched to tax-based financing of public sector health services where all of these services were made free. Private sector health services continued to be financed by payments made through out-of-pocket fees at point of service use (Agyepong and Adjei, 2008).

By the early 1970s, general tax revenue in Ghana, with its stagnating economy, could not provide the needed support for a tax-based health financing system. In 1972, very low out-of-pocket bills at point of service use were introduced in the public sector to discourage frivolous use. The stagnation of Ghana's economy was followed by a decline where the health sector was associated with widespread shortages of essential medicines, supplies and equipment, and poor quality of care, (Agyepong and Adjei, 2008).

In 1983, the PNDC government adopted a traditional IMF and World Bank economic recovery programme. In 1985, the public sector user fees for health care were significantly increased as part of the structural adjustment policies and became known as 'cash and carry'. The aim of the 1985 user fees was to recover at least fifteen percent (15%) of recurrent expenditure for quality improvements (Agyepong and Adjei, 2008).

The financial aims were met (MOH 2001).

Shortages of essential products such as medicines and some supplies were improved. However, these achievements were accompanied by inequities in financial access to basic and essential clinical services (Waddington and Enyimayew 1989, 1990).

2.1.4 Community Health Insurance Schemes (CHIS)

In the 1990s, Ghana started experimenting with several community based health insurance schemes in a number of pilot projects to study the effects and optimal design of CBHI including NGO initiated community-based health insurance schemes (CBHIS). The first community health insurance scheme introduced in Ghana was the Nkoranza Health Insurance Scheme started by the St. Theresa's Catholic Mission Hospital in 1992 (Atim and Madjiguene, 2000).

In the mid-1990s, a unit was created in the Ministry of Health to establish national health insurance as an alternative to the fees for service known as 'cash and carry' system. The unit tuned its efforts and resources on consultancies and feasibility studies for a pilot social health insurance scheme for the formal sector and other organized bodies or groups (Arhinful, 2003). Giving a detail history regarding the background of health insurance in Ghana in a paper (Agyepong and Adjei, 2008), cited in (Owusu-mensah 2010), indicated that UNICEF began to provide funding for exploratory research on the feasibility of district-wide community health insurance for the non-formal sector in 1993 and it was specifically targeted in the Dangme West (a purely rural district with a subsistence economy and widespread poverty) with strong support from the Ministry of Health, (Agyepong et al, 2006).

The study showed enthusiasm via a larger set of community members for the concept of Community Health Insurance (CHI). A pilot district-wide CHI was planned in the same district with assistance for design, implementation and finance from the Ministry of Health (MOH) and the European Union (EU). After the MOH and EU assistance had come to an end, the Dangme West District Assembly and community members continued their collaboration and completed the design of the pilot district scheme. The District Assembly made contribution as part of its United Nations Development Programme poverty reduction fund to support community mobilization and household registration. The World Health Organisation and the Danish International Development Agency provided the start-up funding. Registration of beneficiaries and delivery of benefits began in 2000 (Agyepong et al, 2006) cited in (Owusu-mensah, 2010).

Though popular among members and international donors at the time, the schemes were only targeted to specific areas, failed to address key social insurance issues, and were not assisted by general government revenue. Most importantly, with CBHIS that covers only about 1% of the population with limited benefit packages, (Atim et al, 2001) cited in (Blanchet et al, 2012).

2.1.5 Policy Context of the NHIS

The highly unpopular fee for service known as “cash and carry” system became a salient political issue and the main opposition party, the New Patriotic Party (NPP), started to call for its abolishment in its manifestos and campaigns. Subsequently, in fulfillment of the 2000 election campaign promise, the NHI Act (Act 650) was established in 2003,

(Blanchet et al, 2012).

The aim of the Act (Act 650) is to establish insurance fund for each of the 138 districts in Ghana in a bid to remove user fees and improve access to health care particularly for the poor and vulnerable in the society. Existing CBHI funds were given the opportunity to either become part of a "district mutual health insurance" scheme, or make payment of nearly $600,000 to remain private, hence forcing most private schemes to either merge or collapse, (Rajkotia, 2007).

The basic blocks of the national health insurance policy were district-wide Mutual Health Insurance Schemes (MHIS) in each district where the Act requires every Ghanaian citizen to join and belong to a district MHIS or a private mutual or commercial insurance scheme. However, government subsidies were to be provided for people that belong to the district MHIS thus creating an incentive for a lot of people to be part or join (Ministry of Health, 2004).

The mission of the NHIS is 'to ensure equitable universal access for all residents of Ghana to an acceptable quality of vital health services without out-of-pocket payment being made at the point of service use' (Ghana Ministry of Health, 2004a). It is regulated by the National Health Insurance Council (NHIC), headquartered in Accra. Regional and District offices of the NHIC are being put up to decentralize the operations of the Scheme. The Council ensures the management of the National Health Insurance Fund (NHIF) via the collection, investment, disbursement, and administration of the Scheme.

The Council also undertakes the licensing, regulation, and accreditation of health-care providers. By the end of 2007, the NHIS had accredited a total of 800 private health-care providers together with government health facilities (Ghana Ministry of Health, 2008).

In the District level, we have Health Insurance Assemblies that is made up of all members of the respective District Schemes in good standing. District Schemes are governed by Boards of Trustees, Scheme Managers, and District Health Insurance Committees. Those in charge of management of the schemes at the various Districts usually include an Administrator, Accountant, Publicity and Marketing Manager, Claims Manager, Data Control Manager, and Data Entry Clerk (Ghana Ministry of Health, 2004b; Sabi, 2005).

2.1.6 The Premiums

To facilitate membership based on the ability to pay, each administrative district is expected by law to look for and categorise residents of that district into four main social groups (the core poor or indigents; the poor and very poor; the middle class; the rich and the very rich) and allocate premiums accordingly. The premiums paid by the members of each category defer slightly from district to district and it generally ranges between a minimum of GH¢7.2 (US$10.8) and a maximum of GH¢48 per year. The essence was to allow the poor pay the lowest rate while the rich pay the highest rate. In reality however, it seems that almost all the districts health insurance schemes have resorted to a flat rate premium system due to the challenges in assessing an informal sector household's income data or ability to pay (Akazili et al, 2011:4).

2.1.7 The Benefit Package

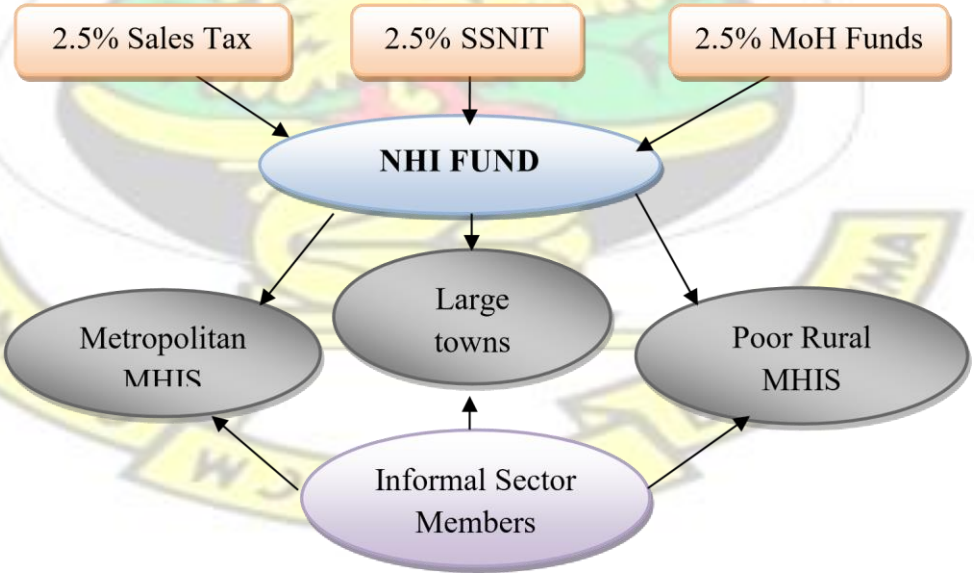
The benefit package of the NHIS is standardised throughout the entire country covering a wide range of outpatient services. These services include: drugs listed by the NHIA, general out-patient and in-patient services, laboratory tests, oral health, eye care, emergencies and maternity care such as prenatal care and deliveries. The benefit package also covers about ninety five per cent (95%) of all common diseases in Ghana; malaria, skin diseases, hypertension, diarrhoea, diabetics, upper respiratory tract infections, asthma, among others (Ministry of Health, 2004). Aside, the NHIS benefit gives payment for referrals (gatekeeper system) 'provided it is within the inclusive list'. There are no requirements of coinsurance, co-payment or deductible by the beneficiary of the scheme
(National Health Insurance Authority, 2009).

However, the policy also specifies some exemptions with respect to the benefit package, some of which are taking care of by an alternative national programmes or are either considered as expensive or non-medical, thus HIV anti-retroviral therapy, immunisation, dialysis for chronic renal failure, heart and brain surgery, appliances and prostheses, cosmetic surgeries and aesthetics treatment, VIP ward (accommodation), medical examination for purposes either than treatment, organ transplantation, mortuary services, echocardiography, angiography and diagnoses and treatment abroad (Ministry of Health, 2004).

2.1.8 Source of Funding

Financing the NHIS was based on individual premium payments and a two and a half per cent (2.5%) National Health Insurance Levy to be collected via the same mechanisms as the already existing twelve and a half per cent (12.5%) Value Added Tax. A National Health Insurance Fund (NHIF) was introduced by the Act and is mainly funded by the NHI levy of two and a half per cent (2.5%) sales tax on almost all goods and services. The two and a half per cent (2.5%) of formal sector worker contributions to the Social Security and National Insurance Trust (SSNIT) towards retirement benefits were to be automatically transferred to the national health insurance fund on a monthly basis. Each adult in a household is expected to become a MHIS member in their own right and pay the necessary contribution, which covers themselves and dependent children under the age of 18. The NHIF subsidises the contributions made by the indigent and the elderly as well (Agyepong et al, 2006).

Figure 1: Flow of Funds into the National Health Insurance Fund (NHIF)



Source: Agyepong et al, 2006 (Adapted) cited in Owusu-Mensah, 2010.

2.1.9 Health Care Provider and Payment Mechanisms

Health care provision for clients of the NHIS is carried out by accredited and contracted providers (both government and non-government). In 2008, there were 1,551 accredited non-government providers (400 hospitals/clinics, 237 maternity homes, 451 pharmacies, 329 licensed chemical shops and 128 diagnostic facilities) together with public providers. Private providers account for about 30% of NHIS health-care provision, (Durairaj, Almeida, and Kirigia, 2010)

In health insurance, the aim is targeted at spreading the risks of incurring health care costs over a group of subscribers that is "a system of risk sharing where the wealthy subsidizes the poor and healthy subsidizes the sick" (Bennett, 2004) cited in (Wulifan et al, 2014). The mechanism works in such a way that, resources of the insured are pooled and made used to cover the expenses only of the people affected by the risk. Those affected by the risk, benefit from the contribution of those who are not affected. As a result, they receive compensation that is higher than the amount they themselves invested in the insurance. They renounce ownership of contribution made and cannot therefore reclaim them if the risky event has not occurred (cited in Wulifan et al, 2014).

Methods used by providers for payment under the health insurance scheme include; a fee for service type of provider payment mechanism. This method was used for paying health care providers initially but was however replaced with the Ghana Diagnostic Related Groupings (GDRGs) in April, 2008. The reason was that the fee for each service was found to be low, hence not attractive, especially for the private providers to participate.

Providers are encouraged to participate in the NHIS in order to reduce congestions and delays for clients when seeking health care services. With the fee at point for service, providers were also asked to submit detailed information on all services and bills for claims submissions. This involves a lot of paperwork which providers were not happy at all (Ankomah, 2009) cited in (Dalinjong and Laar, 2012).

As a result, the GDRGs were brought in to provide solutions to some of these issues. The tariff includes the full cost of the estimated direct consumables for direct patient care, anesthesia and other investigations. The GDRGs also captures about 80% of the estimated overhead cost for public health facilities, involving building and equipment maintenance, housekeeping and utilities, (Ankomah, 2009) cited in (Dalinjong and Laar, 2012). It is expected that the new tariff will raise adequate revenue from the NHIS for providers to cover a significant aspect of their cost of operation but currently the NHIS is experimenting with capitation in the Ashanti Region, to test its feasibility for scaling up, alongside the GDRGs, (Dalinjong and Laar, 2012).

2.1.10 Allocation of Resources

In terms of resources allocation to the individual schemes, the NHIA basically transfers certain funds to the individual district schemes including the payroll-based health contributions of the respective formal sector employees of each scheme and a determined subsidy for each informal worker and the poor. A kind of need based resource allocation formulae is applied for the transfer of funds to the individual district schemes. Its basis (formulae) includes variables such as the regional population size, the population below the poverty line and the rates of under-five mortality (Mclntyre et al, 2008: 874).

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The National Health Insurance Council (NHIC) in 2003 which established Act 650 to ensure universal access to basic healthcare services to all residents of Ghana has a mandate to include provision of subsidies for healthcare of indigents and other exempt groups. As at September 2007 the Council had met its target of 55% coverage set for the year 2007 with one hundred and forty-three (143) schemes in fully operational with provisional accreditation granted to all government facilities. An amount of ¢120,000 (GH¢12.00) was paid as subsidy per head to the exempt group members and SSNIT contributors in the year 2007. However, given the increasing cost of medical bills, evident gathered from these bills submitted by service providers and that of the Review of the Medicines List and Tariff Structure, it has been proposed to increase the subsidy from GH¢12.00 to GH¢14.00 per person for 2008, (Ministry of Health, 2008).

2.1.11 Determination of Funds Allocation

The law (Act 650) proposes subsidies to DMHIS to include the health care cost of those exempted by law. The exempt groups are; a) Indigents, (b) Under 18 years of age with both parents and guardians as contributors, (c) Under 18 years with community approved single parents, (d) Pensioners under the SSNIT Scheme,(e) Aged (70 years of age and above). The Allocation Formula is thus; Allocation = (a + b + c + d + e) x GH¢14+Admin Cost, (Ministry of Health, 2008).

The Indigents as described by law are usually people who are very poor. The Ghana Living Standard Survey puts the poverty rate in Ghana at 40%. It must be stated that most of those considered very poor cannot afford the annual highly subsidized premium of ¢72,000.00.

Without relevant statistical data certain assumptions were made in arriving at a proportion of the population who would be considered indigents. Ghana's population as at 2000 was about 20 million, (Ministry of Health, 2008).

In estimating the indigent population, there is the need to avoid double counting, taking note of the fact that certain population groups are already included under the DMHISs. Consequently, 600,000 people that constitute the aged population (i.e. 3% of 20 million) and another 10,000,000 representing the population of those less than 18 years (i.e. 50% of 20 million) are subtracted from the total population. The remaining population will be 9.4 million (20 million less 10.6 million). It is assumed that 10% of the net population of 9.4 million would constitute the indigent population. Hence, the indigent population estimated to be 940,000. 85% of indigents (i.e.799, 000 indigents) are estimated to be included under the scheme in 2008. An amount of GH¢12.00 is allocated as premium for each indigent and hence, a 77 total amount of GH¢11.19 million (i.e. GH¢14.00 x 799,000) will be required as subsidy to DMHISs for the indigents in 2008, (Ministry of Health, 2008).

The law made it clear that those under 18 years should be catered for by government. The 2000 population census estimated the population strength of this group to be 10 million. It is estimated that 60% of this number will be included under the scheme in 2008. A provision of GH¢101.69 million (i.e. ¢14.00 x 7,500,000) has been made to cover the premium of the 7,500,000 under 18 years estimated to be covered under the scheme in 2008, (Ministry of Health, 2008).

Data available at SSNIT indicates that the number of SSNIT pensioners is estimated to be 70,000. It is estimated that 90% of this number (i.e.63, 000) will be included under the scheme in 2008. An amount of GH¢0.88 million (i.e. GH¢14.00 x 63,000) is allocated to cover the premium of the 63,000 SSNIT pensioners expected to be covered under the scheme in 2008, (Ministry of Health, 2008).

Individuals considered to be the aged population are those of 70 years and above. The 2000 population census estimated that the aged population is 3% of the total population of the country (i.e. 600,000). In considering the fact that the aged suffer a lot of chronic diseases such as hypertension, diabetes, cancers, heart diseases etc, and the fact that they are economically vulnerable makes them a very important population category to be considered in the development of the health insurance formula. It is expected that 85% of the aged (i.e. 510,000) will be covered under the scheme in 2008. An estimated amount of GH¢7.14 million (i.e. GH¢14.00 x 510,000) is allocated for the premium of the 510,000 aged expected to be covered under the scheme in 2008, (Ministry of Health, 2008).

2.1.12 Membership of the NHIS

According to the 2012 Annual Report of the NHIA of Ghana, the total active membership of the scheme increased from 8,227,823 in 2011 to 8,885,757 in 2012 representing a rise of 8% over the previous year. The table 2.1 shows the number of new members, renewals and total active membership distribution by region as at December 2012. Ashanti Region recorded the highest number of active members followed by Greater Accra and Brong Hafo Regions, respectively, with Upper West Region registering the least.

Table 2.1 Active Membership (2012)

Region	New	Renewals	Active Membership
Ashanti	384,454	1,152,103	1,536,557
Brong-Ahafo	355,534	738,680	1,094,214
Central	304,784	373,448	678,232
Eastern	368,063	668,202	1,036,265
Gt. Accra	564,503	636,244	1,200,747
Northern	360,153	392,162	752,315
Upper East	177,239	384,120	561,359
Upper West	101,523	291,377	392,900
Volta	287,449	446,949	734,398
Western	345,965	552,805	898,770
National	**3,249,667**	**5,636,090**	**8,885,757**

Source: Annual Report of the NHIA of Ghana (2012)

2.2.0 Theoretical Literature Review

2.2.1 Efficiency and Production of Health Services

Efficiency of a production unit according Lovell (1993) is the comparison between observed and optimal values or amounts of its products or outputs and inputs, where the comparison can take the form of the ratio of observed to maximum potential output obtainable from the given input, or the ratio of minimum potential to observed input needed to produce the given output (cited in Peacock et al. 2001).

According to Tahir et al., (2009), the maximum output level that can be produced from any given total number of inputs is referred as efficiency. Radam et al., (2010) also uses the definition of Tahir et al., (2009); but goes further to add that a production firm is efficient if it cannot improve any of its inputs or outputs without making worse some of its other inputs or output.

Health production represents the process of turning health inputs into health improvements. Health care is an intermediate input in the context of health production, but an output in the context of service provision. Some measures of efficiency in health services are formulated that compares resource use against service provision instead of the resulting health benefits to service recipients (Peacock et al. 2001). For Berger, Cummins, and Weiss, (1997) insurer inputs or operating expense can be put into three principal groups: labor, business services and materials, and capital. Majority of recent literature on financial institutions have it that, operating expense allocations has resulted in three principal services that insurers provide (Cummins and Weiss 2001) thus (a) risk pooling and risk bearing, (b) "real" financial services relating to insured losses, and (c) financial intermediation.

According to Cummins and Zi, (1996) for the case of life insurers, outputs may be measured by the services they provide to customers. Generally, life insurers provide two main services: risk bearing/risk pooling services and intermediation services. To them, Life insurers generate premiums and annuity considerations from customers and redistribute most of the funds to those policyholders who sustain losses (the risk bearing/risk pooling service). Also, funds generated in advance of paying benefits and held in reserves until

claims are paid is what they meant by intermediation service. They proxied incurred benefit payments for the risk bearing/pooling services of a life insurance firm because benefit payments are said to represent the delivery of contingent dollars to policyholders. This was a measure first proposed by Doherty (1981) and was used by a number of researchers including that of Weiss (1990) and Cummins and Weiss (1993) cited in (Cummins and Zi, 1996).

2.2.2 Outputs and inputs Foundations

Recent life insurer research applies incurred benefits plus additions to reserves for life insurance outputs (Yuengert 1993, Cummins, Tennyson, and Weiss 1998) cited in (Cummins and Weiss 1998). Incurred benefits are usually payments received by policyholders in the current year and are useful proxies for the risk-pooling and riskbearing functions once they account for the overall figure of funds pooled by insurers and redistributed to policyholders as compensation for insured events (Cummins and Weiss 1998).

Following the approach in Myers and Cohn (1987) and Cummins (1990), premium was used. For Yuengert, (1993) this is a fallacy, however, because premiums represent price times the quantity of output not output. So, while some of the earlier life insurance studies used premiums as an output measure (Fecher et al, 1993, Gardner and Grace, 1993) most of the more recent studies have corrected that error and applied more appropriate output measures (cited in Cummins and Weiss, 1998).

For Cummins and Weiss, (1998) the emerging consensus in the literature is that incurred benefits and variation in reserves should be applied to measure life insurance output. Yuengert (1993) uses additions to reserves but does not involve incurred benefits. Fukuyama (1997), following an intermediation approach to defining output, applies reserves and loans as his output measures. Another category of authors employs physical output measures such as numbers of policies and/or insurance in force (Bernstein, 1997, Weiss, 1986, Kellner and Mathewson, 1983).

In the case of insurance inputs, Berger, Cummins, and Weiss, (1997), categorized them into three main groups: labor, business services and materials, and capital. In other applications, it may make sense to split labor into agent labor and all other (mostly home office) labor because the two types of labor have different prices and are applied in different proportions by firms in the industry (Berger, Cummins, and Weiss, 1997).

2.2.3 Cost and Technical efficiency

For Yu, (2011) technical efficiency refers to where a producer achieves the maximum output level given all the input resources under a prevailing technology. In other words, the producer utilizes the resources in the most efficiency way or manner. Economists applies the idea of a production function to represent technology: suppose a producer employs capital K, labour L, and other intermediate inputs M to produce a single output Y, technology is represented by the production function F as follows:

$$Y \leq F(K; L; M) \quad \text{Eq (2.1)} .$$

The technical efficiency is then achieved when the inequality in Eq. (2.1) turns into equality.

The concept of technical efficiency was introduced by Farrell (1957), who applies the concept of efficiency proposed by Koopmans (1951) and the radial type of measures considered by Debreu (1951) cited in (Badunenko et al., 2006). A firm is said to be technically efficient if it derives the maximum output from a given bundle of inputs within a given technology, i.e, if it attains the highest possible productivity (Badunenko et al., 2006).

For Koopmans (1951; p. 60) an input-output vector is technically efficient if, and only if, increasing any output or reducing any input is possible only by decreasing some other output or increasing some other input. Farrell (1957; p. 255) went back over the empirical necessity of treating Koopmans' definition of technical efficiency as a relative notion, a notion that is relative to best observed practice in the reference set or comparison category, thus provides a way of differentiating efficient production units from inefficient production units (cited in Daraio and Simar, 2007).

Debreu (1951) cited in (Daraio and Simar, 2007) gives the first measure of productive efficiency with his coefficient of resource utilization. Debreu's measure is a radial measure of technical efficiency that centers on the maximum possible equi-proportionate reduction in all variable inputs, or the maximum possible equi-proportionate expansion of all outputs.

Farrell (1957) extended the work initiated by Koopmans and Debreu by noting that production efficiency has a second component that reflects the ability of producers to select the "right" technically efficient input-output vector in light of prevailing input and output

prices. This made Farrell to define the overall productive efficiency as the product of technical and allocative efficiency (cited in Daraio and Simar, 2007).

Cost efficiency on the other hand offers a measure of how close an organization such as the NHIS for instance or bank's cost is to what a best-practice that organization's cost would be for producing the same bundle of output under the same conditions (Coelli et al. (1998), and Thanassoulis (2001) cited in (Bader et al, 2008).

Yu, (2011) refers to cost efficiency as a technology that allows a producer (the NHIS for instance) to choose different combinations of input factors to produce a required output level. The choice of the combination depends on the market prices of the input factors. The objective of the producer is to choose an input bundle that minimizes total cost. For example, assumes r is the rental rate of capital services, w is the market wage rate, and wM is the price of intermediate input M, the producer chooses an input combination (K; L;M) to minimize total cost rK + wL + wM to achieve an output level Y . Both technical efficiency and cost efficiency are necessary conditions for the overall production efficiency. Given the market price p of the output, production efficiency is achieved when the producer chooses output level Y and input bundle (K; L; M) to maximize profit, which is;

$$pY - (rK + wL + wMM) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq}(2.2).$$

It can be seen from Eq. (2.2) that this cannot be achieved unless the producer produces the best possible amount of output with the lowest possible total cost. On the consumer side, efficiency is achieved when the consumers have the full information to make a rational

decision on their consumption choice. Since a consumer's preference is private information, economists normally assume that the consumer's actual choice is optimal, (Yu, 2011).

The idea of Walrasian equilibrium is a set of prices such that total demand for each good and services is equal to its total supply. If such equilibrium exists, no consumer or producer wants to vary their decisions. Under this ideal situation the economy's resources are put into their best uses and market efficiency is achieved, (Yu, 2011).

In other to measure efficiency level of a firm, the maximum possible output is vital, and more often attempt is made to estimate it as a function of input quantities. Such function is often referred to as frontier production function, thus with "frontier" stressing the idea of maximality which it embodies. Similarly, a frontier cost function would offer the minimum feasible cost as a function of output quantity and input prices (Schmidt, 1986) cited in (Balcha 2002).

Farrell (1957), drawing upon the work of Debreu (1951) and Koopmans (1951), refuted the idea of an absolute measure of efficiency and proposed that efficiency be measured relative to a best performance frontier determined by a representative peer group. In his framework, a firm's efficiency is measured relative to the efficiency of all other firms in the industry, subject to the restriction that all firms are on or below the frontier. A firm is viewed as technically efficient if it is operating on the best practice production frontier in the industry (cited in Zere, 2000).

2.2.4 Input-Oriented, Redial and Output-Orientated Efficiency Measures

According to Balcha (2002) Farrell's idea can be illustrated with simple example via input-oriented, redial and output-orientated efficiency measures. Technical inefficiency is measured either as a proportional reduction in input usage or as proportional increase in output production. The two measures provides the same result when constant returns to scale exists in production, but will be unequal when increasing returns to scale exist (Coelli, 1996) cited in Balcha (2002).

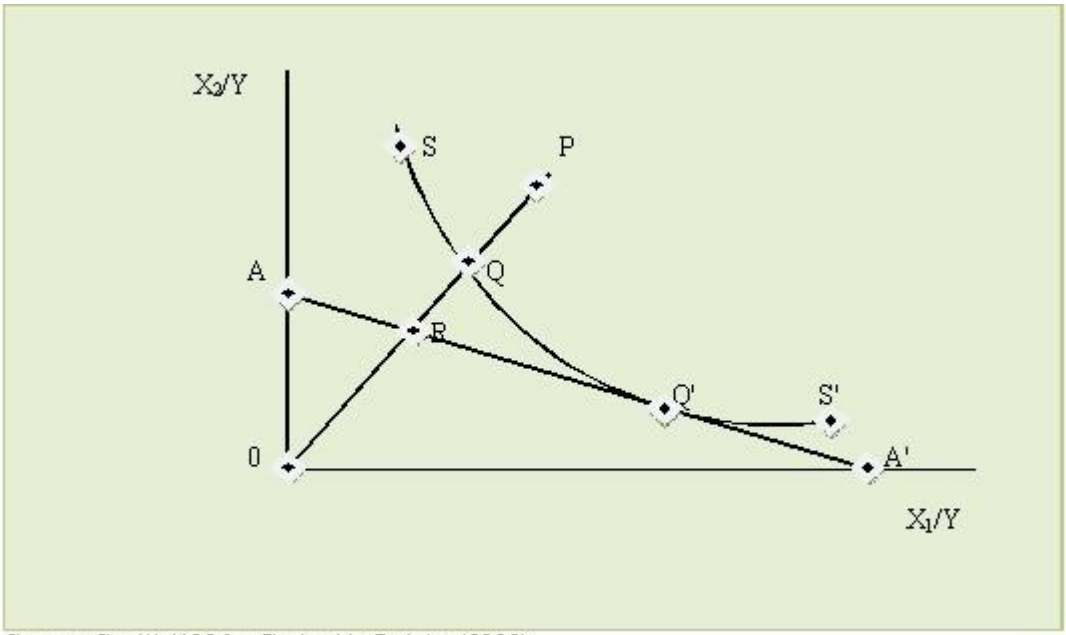
2.2.4.1 Input-Oriented, Redial Efficiency Measures

The input-oriented, redial efficiency measures of a firm (the NHIS for instance) illustrated by Balcha (2002) via the use of Farrell's idea involves the application of two inputs (X_1 and X_2) to produce output (Y) where he then assumes the firm's (the NHIS for example) production function (Frontier) to be $Y= f (X_1, X_2)$. He also assumes that it is characterized by CRS and may be written as: $1= f(X_1, X_2)$. Hence, illustrated by SS' in

(Y, Y)

figure 2 below.

Figure 2 Input-Oriented, Redial Measures (Production Possibility Curve)



Source: Coelli (1996:p.5) cited in Balcha (2002)

Assuming a firm (the NHIS for example) applies quantities of inputs, defined by the point P, to produce a unit of output. The technical inefficiency of the firm (NHIS) could be represented by the distance QP, which is the proportional reduction in all inputs that could theoretically be achieved without any reduction in output. This is usually expressed in percentage terms by the ratio QP/0P. The technical efficiency (TE) of the firm (the NHIS) can then be defined/written as: $TE = 0Q/0P = 1- QP/0P$.

If the input price ratio, represented by the line AA' in the figure above, is also known, then allocative efficiency of the firm (NHIS) may also be computed. The allocated efficiency of the firm operating at P is defined to be the ratio: $0R/0Q$. Once the distance RQ represents the reduction in production costs that would occur if production were to occur at the allocatively (and technically) efficient point Q', instead at the technically efficient, but

allocatively inefficient, point Q. The total economic efficiency of the firm is then defined as: (0R/0P) which is the product of technical and allocative efficiency i.e. (0R/0P) =(0Q/0P)(0R/0Q).

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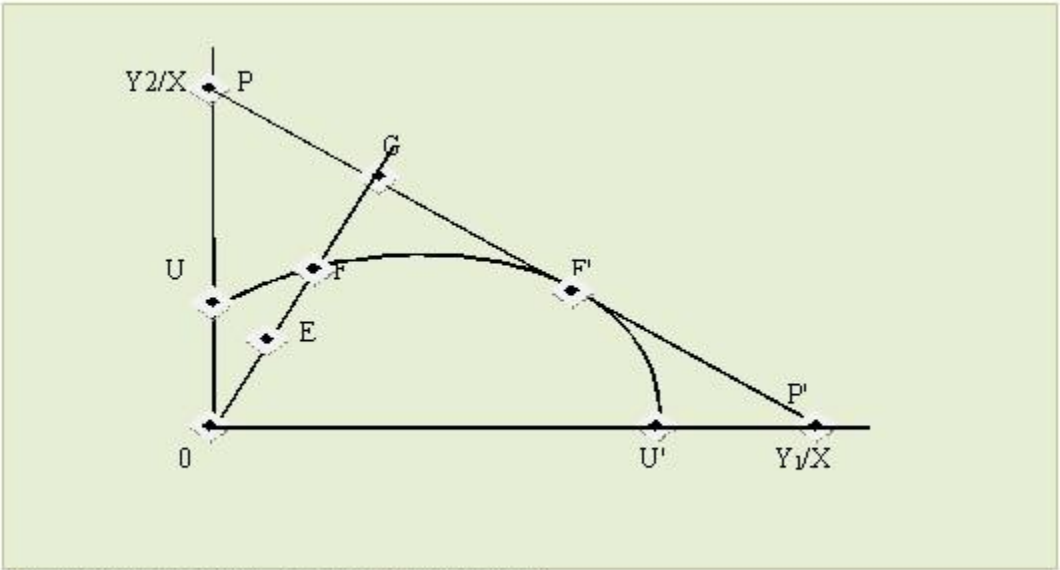
The above measures represent the input-oriented, redial measures of efficiency. This is because their focus is on measurement of variations in input use between different nonprofit organizations for a standardized output. The radial nature of efficiency measures allows comparison of non-profit organizations like that of the NHIS with similar inputoutput mixes. Furthermore each input and output can be measured in its natural physical unit without having to resort to a weighting system, to express the different units in a common denominator such as price, (Valdmanis, 1992).

2.2.4.2 Output-Orientated Efficiency Measures

For the output-orientated efficiency measures, Coelli (1996) cited in Balcha (2002) formulates that; production of the firm (the NHIS for example) should involves two outputs (i.e Y_1 and Y_2) and a single input (X). Again, assuming CRS, the technology can be represented by a unit production possibility curve in two ways. In the figure below, curve UU' is the unit production possibility curve of the firm (the NHIS for example) and the point E corresponds to an inefficient firm (the NHIS). Unlike input-orientated, the inefficient firm in this case lies below the curve because UU' represent the upper bound of the production possibilities.

Figure 3 Output-Orientated Measures (Production Possibility Frontier)



Source: Coelli (1996:p. 8) cited in Balcha (2002

Following Coelli (1996:p. 8) cited in Balcha (2002) in assuming EF to represents the technical inefficiency of the firm (the NHIS) in the figure above. In other words the amount by which output of the firm thus, the NHIS for example could be increased without requiring extra inputs. Then, the output-orientated measures of the technical efficiency of the firm implies: $TEo = 0E/0F$.

Like the input-orientated model, one can also measure allocative efficiency of the firm (the NHIS), if price information is there. Assuming PP' for instance to be iso-revenue, then the allocative efficiency of the firm becomes: $AEo = 0F/0G$. This has revenue increasing interpretation, while in the input-orientated case it has cost reducing concept. In respect to most studies, researchers have tended to select input-orientated models, because in many cases, for firms or decision making units, input quantities appear to be the decision

variables. However, in cases where a firm is given a fixed quantity of resources to produce as much output as possible, output-orientated approach could be more appropriate (Coelli, 1996).

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2.2.5 Efficiency Frontier Approaches

Currently, we have two approaches used in estimating frontier (Seiford and Thrall, 1990, Coelli et al. 1998): the parametric approach, which employs econometric methods, and the non-parametric approach, which involves linear programming techniques. Blow is an exposition of these approaches (cited in Zere, 2000).

2.2.5.1 Non-Parametric Approach: Data Envelopment Analysis (DEA)

Building on Farrell's seminal work, (Charness et al. 1978) cited in (Zere, 2000) proposed the non-parametric technique of Data Envelopment Analysis (DEA) for measuring the relative efficiency of the decision making units (DMUs). DEA applies linear programming methods to establish the frontier from sample data. The efficiency of all others in the group, subject to the restriction that all Decision Making Units lies on or below the frontier (Bjurek et al. 1990, Seiford and Thrall 1990, Coelli et al. 1998). This is carried out by solving a number of linear programming problems. DEA is the preferred method of efficiency analysis in the non-profit sector where (Coelli et al. 1998) where random noise is less of a problem; multiple-output production is relevant; price data is difficult to find; and setting behavioral assumptions such as profit (cost) maximization (minimization) is difficult (cited in Zere, 2000).

In the year 2000 for instance, fourteen African countries undertook health facility efficiency studies to guide them in the development of interventions to reduce waste of scarce resources. These studies shows or demonstrate that DEA is a relevant tool for policy advice (Marschall et al 2008; Ichoku et al, 2011; Kirigia et al, 2008; 2011 and 2000) cited in (Jehu-Appiah, et al., 2014).

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However, there are two major drawbacks to this method (Lovell 1993, Coelli et al. 1998): first, the DEA is non-stochastic that does not capture random noise and any deviation from the estimated frontier is interpreted as being due to inefficiency. Second, it is nonstatistical, in the sense that it is not feasible to conduct statistical tests of hypothesis involving inefficiency and the structure of the production technology (cited in Zere, 2000).

Ferrier and Valdmanis (1996), however, argued that, these issues may not be considered severe as they initially look like. First, as there is no a priori specification of the functional form of the technology, specification error that might show up as a noise is ruled out. Secondly, as inputs and outputs are measured in their natural physical units, a measurement error is most unlikely.

The empirical studies on efficiency that utilized DEA technique are many and includes**;** Noulas et al. (2001) applied DEA–CRS model for 11 Greek insurance companies from 1991– 1996, Cummins et al. (1999) employed DEA input oriented distance function, DEA Malmquist index for USA insurers from 1981–1990, Fukuyama (1997) used DEAMalmquist Index for 25 Japanese life insurance companies, 1988–1993. Kader et al. (2009) applied DEA to examine the cost efficiency among a balanced panel of 26 insurers

operating in ten Islamic countries over the three years 2004-2006. Hollingsworth and Wildman (2003), Retzlaff-Roberts et al. (2004), Bhat (2005), Afonso and St. Aubyn (2006), Grosskopf et al. (2006), Spinks and Hollingsworth (2009), Joumard et al. (2010), and Hadad et al. (2011).

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2.2.5.2 Parametric Approach: Stochastic Frontier Analysis (SFA)

Farrell suggested the second approach to efficiency measurement that involves a parametric function. He proposed the calculation of a parametric convex hull of the observed input-output ratios (Forsund et.al., 1980) cited in (Balcha 2002).

Most works that employs parametric models in estimating efficiency have applies Stochastic Frontier Approach (SFA) propounded by Aigner, Lovell and Schmidt (1977) cited in (Martinez-Gonzalez, 2008). SFA builds a cost, or a production frontier with a functional form and an assumption regarding the distributional form of the inefficiency error component, (Berger and Humphrey, 1997) cited in (Amanor, 2012).

The stochastic frontier analysis method can be carried out on both cross-sectional and panel data. For cross-sectional data, the error that represents statistical noise is assumed to be independently identically distributed whilst the inefficiency term is one-sided with a number of statistical distributive forms (i.e half-normal, exponential and truncated from below at zero). Likelihood function can then be defined once the two error terms are assumed independent of one another and of the variable inputs; maximum likelihood technique can be applied to find the input parameters, (Schmidt and Sickles, 1984: Murillo-Zamorano, 2004) cited in (Amanor, 2012).

However, the application of cross sectional data to look for conditional estimates of efficiency has been criticized as being inconsistent although yields unbiased estimators. As a result of this technical challenged and the fact that the distributive assumption applies under cross-sectional stochastic frontier models are too rigid and yet yield inconsistent estimates, panel data stochastic frontier models is advised. Panel data frontier models involve time invariant independent variables and therefore do not require a separate assumption of the independence of the inefficiency term and the input variables. More so, it does not require any rigorous or difficult estimation technique, the simple traditional estimation procedures for examining panel data can be applied to yield consistent estimators of the inefficiency parameters as modeling does not entail any distribution assumption on inefficiency effect, (Schmidt and Sickles, 1984: Murillo-Zamorano, 2004) cited in (Amanor, 2012).

Aigner and Chu (1968) cited in (Balcha 2002) considered the estimation of a parametric frontier production in input/output space and specified a Cobb-Douglas production (in log form) for a sample of N firms as:

$$\ln y_i = F(x_i; b) - u_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq } (2.3)$$

Where, $i = 1,2, \ldots, N$. y_i becomes the output of the $i-\text{th}$ firm; x_i equals the vector of input quantities applied by the $i-\text{th}$ firm; b equals a vector of unknown parameter to be estimated; F (.) denotes an appropriate functional form (in this case the Cobb-Douglas);

and u_i is a non-negative variable that represents inefficiency in production. The parameters of the model were estimated using linear programming, in such a way that

$\sum U_i$, is minimized,

Subject to constraints that: $U_i \geq 0 \qquad i = 1, 2, \dots, N$

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The ratio of observed output of the $i-$ th firm, relative to the potential output defined by the estimated frontier, given the input vector x_i, was suggested as an estimate of the technical efficiency of the $i-$ th firm; that is,

$$TE_i = \frac{Y}{\exp(F(X_i;\ B))} = \exp(-U_i) \quad \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \text{Eq (2.4)}$$

This shows the magnitude of the output of the $i-$ th firm relative to the output that could be produced by the fully efficient firm in applying the same input vector.

Afrait (1972) formulated a model like that of Eq. (2.3), except that u_i was assumed to have a gamma distribution and the parameters of the model were determined via the maximum likelihood (ML) method. The deterministic frontier estimators above was criticized that it does not accommodates possible influence of measurement errors and other noise upon the shape of the estimated frontier, once all observed deviations from the estimated frontier are assumed to be the result of technical inefficiency, (Balcha, 2002).

Base on this criticism, Aigner, Lovell and Schmidt (1977) brought up the estimation of a stochastic frontier production, where noise is accounted for by adding a symmetric error term (v_i) to the non-negative error term in Eq. (2.3) above to provide:

$$\ln y_i = F(x_i; b)v_i + -u_i \ldots \text{Eq (2.5)}$$

$$i = 1,2, \ldots, N$$

The parameters of the model were estimated by maximum likelihood (ML) method, given suitable distributional assumptions for the error terms. Aigner, Lovell and Schmidt (1977) assumed that v_i has normal distribution and u_i has either the half normal or the exponential distribution. This stochastic model specification does not only addressed the noise problem associated with earlier (deterministic) frontiers, but also allowed the estimation of standard errors and tests of hypothesis, which were not likely with the earlier deterministic models. The stochastic frontier is not, however, without drawbacks. The chief or principal criticism is that there is no a priori justification for the selection of any particular distribution form for the u_i (Coelli, 1995) cited in Balcha (2002).

In respect to the use of either a cost or a production function under the application of the duality theorem, most contemporary empirical works state that their stochastic frontier functions involves using a Cobb Douglas, a Fourier flexible or a translog function. Translog functions are nonetheless the most used. The snag is the correct choice of objective function in modelling; that is whether to apply a cost function or a production function as tools of measuring efficiency scores. However, researchers are usually guided by such factors as data obtainability, the nature of production sets and exogeneity assumptions to conclude on which objective function to employ (Murillo-Zamorano, 2004) cited in (Amanor, 2012).

For Amanor, (2012) empirical works that incorporated the basic model of SFA include the works of Kumbhakar, McGuckin and Ghosh (1991) on technical and allocative efficiency of US dairy farms assuming a truncated normal distribution for inefficiency.

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2.3.0 Empirical Literature Review

This part provides the empirical review on cost and technical efficiency as well as the determinants of cost and technical efficiency. There exist a number of empirical works in literature on organisations like health care, banking, life insurance and non-life insurance both in and outside the country. Below is the review of some of these empirical works.

2.3.1 Technical Efficiency

In relation to the empirical review on technical efficiency Borisov et al. (2012) work examines the technical efficiency of the national health systems from the new member states of the European Union for the period 2006-2009. Their results indicate that health systems from Latvia, Malta, Romania, Slovakia, and Slovenia were technically inefficient over the duration of the sample period (2006-2009).

For Chaffai and Quertani (2002) both parametric Stochastic Frontier Approach (SFA) and non-parametric Data Envelopment Analysis (DEA) were employed to investigate the technical efficiency of 13 life and non-life insurance companies in Tunisia over the period (1990-2000). Their findings suggested that the small non-life insurers can improve their efficiency level if they follow the managerial strategy of larger insurers.

Yao et al. (2007) made use of 22 insurance companies over the period (1999-2004) to study the technical efficiency of China's insurance industry. The study first computed the

efficiency results or scores and then runs a regression to figure out the key determinants of efficiency. The methodology incorporated here was DEA. The research was mainly pivoted on the hypothesis that firm size, ownership structure, human capital and mode of business are relevant factors affecting firm operations or performance. It was found that many of the 22 firms have improved their technical efficiency over the period.

The work of Cummins, Turchetti and Weiss (1996) involves the application of a DEA distance function to estimate the technical efficiency and a Malmquist index to analyse variations in technical efficiency in the Italian market. Considering a sample of 94 companies (life, non-life and mix) between 1985 and 1993, their results revealed that the technical efficiency in the Italian insurance industry ranges from 70% to 78%, over the sample period.

The empirical work of Osei et al. (2005) study involves evaluation of the relative technical efficiency and scale efficiency of public hospitals and health centres in Ghana. In their work, the sample of 21 public hospitals and 17 health centres were chosen by the simple random sampling technique. In all the total number of hospitals and health centres investigated, 47 per cent of hospitals and 70 per cent of health centres were found to be technically inefficient and the number of scale inefficient hospitals and health centres accounted for 59 percent and 47 per cent, respectively.

2.3.2 Cost efficiency

According to Guerra, (2011) governing bodies, policy makers, and hospital managers are vehemently working together to help reduce health care expenditure while putting up

appropriate strategies to improve health care efficiency. With respect to Harrison et al (2004) empirical work for instance, focused on federal hospitals in the United States for the period of four years (1998-2001), clearly indicated that if hospitals managers ensure maximal efficiency in their operation of hospitals potential cost savings can be achieve. The research work of Yuengert et al., (1993) makes vital contribution to the literature on efficiency measurements by computing a mixed error cost frontier model that allows for a much richer specification in which scale efficiency (a measure of how efficient a unit is in terms of operating on the most productive scale size), X-inefficiency (moving inefficient DMUs on the frontier), i.e., the difference between actual and minimum cost, and random error may be separated. The results revealed a substantial X-inefficiency and Scale efficiency that exists only up to $15 billion in assets.

In relation to Fecher et al. (1993) empirical work both parametric approach (a stochastic Cobb- Douglas frontier) and a non-parametric approach (DEA) were apply in construction of an efficient frontier with sample consisting of 84 life and 243 non-life French insurance companies. They observe that the findings are not that very sensitive to the approach adopted and that there is a great dispersion of efficiency levels between companies. Average efficiency for life insurance is only 30% while 50% for non-life.

In Kader et al. (2009) empirical study DEA was used to determine the cost efficiency among a balanced panel of 26 insurers that operates in ten Islamic countries over the three years (2004-2006). It was revealed or found that non-executive directors' contributions are inversely related to cost efficiency. The reason for this attribution was said to be possibly

due to a lack of financial management expertise among the nonexecutive directors of Takaful insurance firms.

Noulas et al. (2001) employs DEA methodology to investigate efficiency of non-life insurance companies in Greece with a sample consisting of 12 companies for the period of 1991 to 1996. His results depict an average efficiency of 65%, with a great dispersion between companies. They (authors) conclude that non-life insurance firms are very inefficient or not efficient hence their survival in the market would mean a reduction in costs and an improvement in productivity, i.e, an improvement in efficiency.

The empirical review of Hardwick (1997) involves a stochastic frontier approach between 1989 and 1993 to analyses cost inefficiency of the United Kingdom life insurance companies. He concludes that the life insurance industry is very inefficient, namely, that it is possible to produce the same level of output with less 30% of costs. He also observes that larger life insurance companies are less inefficient than that of the smaller once, which he attributes to exploitable scale economies.

For Afza et al. (2010b) DEA was employed to compute the efficiency results of insurance companies in Pakistan over the period 2003 to 2007. Their results revealed that the insurance companies obtained an average of 92.7% technical efficient, 81.12% allocative efficient as well as 75.44% costs efficient.

Joumard et al. (2010) measured the efficiency of health care spending in a total of 29 OECD countries. Their results indicate that technically inefficient countries could improve their

life expectancy at birth by more than two years on average, when health care spending is maintained at constant level.

2.3.3 Determinants of Cost and Technical Efficiency

A number of studies have indicated that institutional factors at the discretion of management as well as environmental factors beyond the control of a DMU (the NHIS for intance) affect the DMU's efficiency (Ferrier and Valdmanis 1996, Valdmanis 1992, Ozcan and Luke 1993, Rosko et al. 1995).

Al-Shami (2008) for instance, investigated the determinants of performance in the insurance companies of the UAE over the period 2004 to 2007. The results of the study failed to find any significant relationship between profitability and that of the age of the insurance companies.

However in the case of Afza et al (2012) age is found positively related with the performance of general insurers indicating that higher past experience results in higher present performance. Kashish and Kasharma (1998) also discovered that there exists positive relationship between insurance companies' age and their performance, (cited in Afza et al. 2012).

With respect to Bifarin et al (2010) study on determinant of technical, allocative and economic efficiencies in plantain production industry in Ondo State, Nigeria. The results revealed that the estimated coefficients for age with respect to technical and economic efficiencies had a negative sign and were both significant at 10% level. However, for

allocative efficiency, the sign of the coefficient for age was positive, portraying that the older the farmer the more allocatively inefficient he become.

Many studies obtain results in line with the theoretical predictions of a positive relationship between size and efficiency (Cummins and Zi, 1998; Luhnen, 2009; Eling and Luhnen, 2010b) cited in (Biener et al 2015). Some authors do believe that a total increase in assets can cause an organisation's operations to be more efficient (Berger, Hancock, & Humphrey, 1993; Yuengert, 1993; Gardner and Grace, 1993; Hao and Chou, 2002).

In the case for Simar and Wilson (2007) for instance six efficiency determinants; size, distribution systems, ownership, specialisation, leverage and growth were analyzed. Their results indicate a positive relationship between size and efficiency. In other words, large insurers were found to be more efficient than medium-sized and small insurers.

For Fecher et al. (1993) both parametric approach (a stochastic Cobb- Douglas frontier) and non-parametric approaches (DEA) were employed to formulate the efficient frontier with a sample consisting of 84 life and 243 non-life French insurance companies. The authors saw that the findings of the study were not that very sensitive to the approach incorporated, and that there is a wide or great dispersion of efficiency levels between companies, with another vital conclusion that there exists a positive correlation between the size of the company and efficiency.

In relation to firms determinants, Mehari and Aemiro (2013) investigated the impact of firm level characteristics; size, leverage, tangibility, Loss ratio (risk), liquidity, age and growth

in writing premium on performance of insurance companies in Ethiopia. Return on total assets (ROA) which is a key indicator of insurance company's performance was employed as dependent variable while age of the company, size of the company, growth in writing premium, liquidity, leverage and loss ratio are independent variables. The study involves 9 insurance companies over the period 2005-2010 as the sample. The study results reveal that the variable size is positively related to ROA and statistically significant at the 5 % level indicating that performance of large size insurance companies is better than small size companies.

With respect to Hardwick (1997) cited in Mehari and Aemiro (2013) large insurers are likely to perform better than small insurers due to the fact that they can achieve operating cost efficiencies by way of increasing output and economizing on their unit cost of innovations in products and process development. For Wyn (1998) cited in Mehari and Aemiro (2013) argues that large corporate size makes it possible for insurers to effectively diversify what the call their assumed risks and respond more quickly to changes in market conditions. As result, firm size becomes an important determinant of the financial strength of insurers both in developing and developed economies.

Karim, Chan and Hassan (2010) investigated the relationship between non-performing loans and efficiency of bank in terms of their operations in Malaysia and Singapore. The results reveal that the banks total assets incorporated to control for scale of operation are positively related to cost efficiency thus indicating that banks enjoy economies of scale, which is consistent with theory.

In contrast, other studies argues that the very largest firms encounters issues of diseconomies of scale (e.g., due to complexity), as a result, they are not as efficient as middle-sized insurers (Fenn et al., 2008). Diacon et al. (2002) found however that large and small insurers are more (technically) efficient than the middle-sized insurers, revealing what we call a u-shape of efficiency values (cited in Biener et al 2015).

Borges et al (2008) argues that the large life insurance companies are not more efficient than the small once (life insurance companies). This construction was based on a traditional hypothesis in financial institutions efficiency studies, where size and efficiency are said to be related (Cummins, Rubio-Misas and Zi, 2004**)**. Gardner and Grace (1993) also believe that as total assets increases, inefficiency increases with the claim that no-admit assets cause this point.

For Eling and Luhnen (2008) DEA and SFA were used to estimate the efficiency of 3,555 insurers over the period of 2002 to 2006 from 34 countries around the world. The results suggested that the size of the firm has positive and negative relationship with non-life and life insurers respectively. Yuengert (1993) draws conclusion that size and efficiency are statistically unrelated. Zanghieri (2008) adds that there exists a nonlinear relationship between size and efficiency. For life and non-life insurance he reveals the existence of a concave relations between size and cost/profit efficiency (curvilinear and inverted ushape) (cited in Biener et al 2015).

In relation to loss ratio as a determinant of efficiency, Adam and Buckle (2003) researched on the determinants of performance in 47 Bermuda registered insurance and reinsurance

companies over the period 1993-1997. The findings depict that leverage and company type were positively related, whereas loss ratio (risk) and liquidity were inversely related to performance of the insurance companies. Size and scope variables were also found negatively related to performance of the insurance companies, but these results were insignificant.

For Al-Shami (2008) study which focused on the determinants of performance in the insurance companies of the UAE over the period 2004-2007. The study estimated performance level via the division of profits before tax by the total assets (ROA). Its results indicate that size and volume of capital were positively related to profitability, whereas leverage and loss ratio were inversely related with profitability of the insurance companies.

However in the case of Tan and Floros (2013) the relationship between bank efficiency, risk and capital for a sample of Chinese commercial banks were examined. The study applies three efficiency indexes and four risk indicators under a three stage least square method in a panel data framework. The results of the study suggest that there exist a positive and significant relationship between risk (loan-loss provision as a fraction to total loans or LLPTL) and efficiency in Chinese banking industry. For Altunbas et al (2007) a large sample of European banks between 1992 and 2000 were used to analyse the relationship between capital, risk and efficiency. In contrast to the established US facts, the study results did not find a positive relationship between inefficiency and bank risk-taking.

In the case of Hrechaniuk et al. (2007) the factors responsible for variation in performance levels in Ukrainian, Lithuanian and Spanish insurance companies over the period 1998-

2005 were examined. The results indicate that investments, past performance and growth were positively related with the performance of nonlife insurers whereas leverage was found negatively related to performance of the insurers. But for size and loss ratio, mixed results were found for the study.

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For total subsidy as a determinant of efficiency Latruffe et al. (2009) study results indicates that there is an inverse impact of coupled CAP subsidies on efficiency of French farms specialised in cereals, oil seeds and beef production (cited in Rizov et al, 2013). Mary (2012) research work also computes the impact of various forms of CAP subsidies on the efficiency of French crop farms for the period 1996–2003. The coupled CAP payments (i.e. set-aside premiums, least favoured area payments and livestock subsidies) indicate an inverse relationship or impact on productivity (cited in Rizov et al, 2013).

In Luoma et al. (1996) cited in Linna et al. (2003), argues that high government or state subsidies correlate with inefficiency in public health institutions. For them, if local institutions (like districts or municipalities) receive generous subsidies, incentives for exercising cost control within primary care may weaken. Sauer and Park (2009) cited in (Rizov et al, 2013) study results reveals a positive relation or influence of organic subsidies on technical efficiency changes and technological changes for organic dairy farms in Denmark over the period (2002–04). Yee et al. (2004) findings indicated that there exist a positive link between TFP of US farms and public expenditure on investment in research, extension and infrastructure (cited in Rizov et al, 2013).

On the contrary, there exists no significant impact of state subsidies on Technical

Efficiency (TE) of Russian corporate farms (Grazhdaninova and Lerman 2005) cited in (Zhu et al 2008). Taylor et al. (1986) studied on the impact of credit programs subsidized by the World Bank on Technical Efficiency (TE) of Brazilian traditional farmers also indicates no effect (cited in Zhu et al 2008). For Linna et al. (2003) state subsidies are not significant determinants of inefficiency.

Brokmann (2015) analyse the relationship between the subsidy reliance of a MFI and its cost-efficiency via a Stochastic Frontier Analysis (SFA) with a panel data of 203 MFIs from 49 different countries for a period of 8 years (2006-2013). The study results depict no significant relationship. Other factors such as the control of corruption in a country, the political stability, the average loan size and the percentage of female borrowers, all had significant positive effect on MFIs cost-efficiency. These findings are all relevant in terms of both public and private policy decision making.

Mehari and Aemiro (2013) study on insurers' size, tangibility and leverage are statistically significant and positively related with firm performance level. However, loss ratio (risk) is observed to be statistically significant and inversely related with performance. As a result, insurers' size, Loss ratio (risk), tangibility and leverage are all vital determinants of performance of insurance companies in Ethiopia.

Many factors outside the control of management have been revealed as significant drivers or determinants of premium volume or growth including changes in regulation, general economic conditions, and market competition (Enz, 2000). But other aspects, such as financial strength ratings and reputation, are said to be more influenced via strategic decisions made by management. Premiums growth is also likely due to higher operating

expenses resulting from marketing efforts. If insurers massively raise premium volume, proper underwriting may well also be abandoned in the process, resulting in an increased exposure to what we call adverse selection. Discipline in respect to underwriting is relevant as this might affect efficiency (Epermanis and Harrington, 2006) cited in (Biener et al 2015). One empirical study that involves analyzes of the relationship between premium growth and efficiency is Luhnen (2009). This study of German p/l insurers documents that there exists a negative impact of premium growth on efficiency (cited in Biener et al 2015)

However, Biener et al (2015) empirical study on the determinants of efficiency and productivity in the Swiss insurance companies in the life, property/casualty, and reinsurance sectors (1997–2013) indicates a positive link between Premium growth and efficiency. The study regression results for premium growth do not reveal a clear pattern over all subsectors. A positive relationship between premium growth and all efficiency measures in reinsurance was established; for life insurance, the study observes a positive relationship for RE and for p/c insurance for TE. This is not in line with their hypothesis H7. However, the only case in which their hypothesized negative link was supported is RE in the p/c insurance industry. Except for this one confirmation of H7, all other coefficients were in a direction opposite to that expected; consequently, could not support their hypothesis H7 with the sample.

Adu et al (2014) studied on the demographic variables as determinant of principal managerial efficiency. Their results revealed that there is no significant difference between school locational disparities and principals' managerial efficiency. In other words, there is no significant difference in the managerial efficiency of principals in rural and urban areas

(location). Yinyinola (2008) findings also indicates no significant difference observed in the Mathematics achievement test scores (efficiency) and location (rural and urban) of participants in the experimental and central groups (cited in Adu et al, 2014).

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CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The chapter starts with the profile of the study area, study population, the sample size determination and techniques, inputs, input prices and outputs variables and the explanatory factors, data sources, instrumentation, data collection, theoretical models (SFA, DEA and regression model), empirical models (DEA and regression model) and mode of analysis.

3.1 The Profile of the Study Area

Ashanti Region lies approximately between longitude 0.15' to 2.25' west and latitude 5.50' to 7.40' north. It has common boundary with Brong Ahafo Region in the north, Central Region in the south, Eastern Region in the east and Western Region in the west. The Region has a land size of 24,390sq km representing about 10.2% of the land area of Ghana (Ashanti Regional Half Year Report, 2010). The region is a core area of the Asante nation whose boundary in the 18th and 19th centuries stretched southwards towards the Atlantic Ocean (except the Anlo enclave), and northwards to the Gonja and Dagomba lands. To the east and west, the Asante nation stretched beyond the current borders of the country. It was initially smaller than the boundary of the Ashanti region today. The territorial expansion was through wars and annexation of lands of other ethnic groups. The Asante nation in the early 20th century contracted in area through defeat in wars and agitation of some ethnic groups for separation. It currently extends beyond the Ashanti Region in that

some of the people of the Asante nation are in the Brong- Ahafo, Eastern and Central regions (Ghana Statistical Service, 2013).

The region whose capital is the Kumasi Metropolis had 30 administrative districts as at 2012. The districts numbered 18 in the 1990s, 21 in 2000, 27 in 2010 and 30 in 2012. The increase in the number of districts is due to the division of existing districts whose population reaches a certain threshold. Four of the districts are municipalities, namely, Obuasi, Bekwai, Offinso and Mampong. The Kumasi district is a metropolis and is currently divided into 10 sub-metros. The head of the political administration, like the other regions, is a Regional Minister who heads a Regional Coordinating Council (RCC) which coordinates the activities of the Metropolitan, Municipal and District Assemblies (MMDAs), the lower block of political administration, and implementer of developmental activities. The head of a District Assembly is the District Chief Executive. The region had 36 constituencies in 2010 but this increased to 37 in 2012. Each constituency elects a member of parliament and the region has the largest representation (16.5%) in the current 240-member Parliament (Ghana Statistical Service, 2013).

The Metropolitan, municipals and districts in the region are; Adansi North, Adansi South, Afigya Kwabre, Ahafo Ano North, Ahafo Ano South, Amansie Central, Amansie West, Asante Akim North Municipal, Asante Akim South, Atwima Kwanwoma, Atwima Mponua , Atwima Nwabiagya , Bekwai Municipal, Bosome Freho, Bosumtwi , Ejisu Juaben Municipal, Ejura-Sekyedumase, Kumasi (Metropolis),

Kwadaso Sub-Metro, Nhyiaeso Sub-Metro, Subin Sub-Metro, Asokwa SubMetro, Oforikrom Sub-Metro, Asawase Sub-Metro, Manhyia Sub-Metro, Old Tafo Sub-Metro, Suame Sub-Metro, Bantama Sub-Metro, Kwabre Mampong Municipal, Obuasi Municipal, Offinso Municipal, Offinso North, Sekyere Afram Plains, Sekyere Central, Sekyere East and Sekyere South (Ministry of Local Government and Rural Development, 2012) cited in (Ghana Statistical Service, 2013). The social administration of the region is through a traditional system of chieftaincy and elders. Each community in the region, like other parts of the country, has a chief of some level from Odikro (chief) to Omanhene (paramount chief). The Asantehene is the only King of Asante. Each chief has "divisional chiefs" with portfolios, similar to the national President and Ministers. The ascension to chieftaincy (except Nkosohene) is through the matrilineal system. Festivals are common features of all the ethnic groups in the country. In the Ashanti Region, festivals are few. The Akwasidae is a major festival held regularly at six-week intervals and nine times in a year. It is celebrated to remember past Asante leaders and heroes / heroines. If it falls on a Sunday, it is celebrated as Adaekese. In terms of ethnic groups, the region like other regions of the country has many ethnic groups. The 2010 Population and Housing Census for instance indicate the largest group as the Akan (Ghana Statistical Service, 2013).

The Religion has about 77.8 % of the people in 2010 as Christians of different denominations with 15.3% as Muslims, the second largest, 5.4% for those with no religious affiliation and 0.7% for traditionalists. With respect to the economically active population employed in the region, agriculture including forestry but little fishing is their leading economic activity (30.5%). It is followed by wholesale and retail trade (25.4 %),

manufacturing (10.5%) and accommodation and food services 6.1%. Around the 1940s to the 1970s, the region was the leading producer of cocoa. The region has Timber and livestock except that cattle rearing are limited due to the tsetse fly. The region has the largest mining site in the country at Obuasi (Ghana Statistical Service, 2013).

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The region has a museum at the Asantehene's palace, a Cultural Centre and a sword which was stuck in the ground by Komfo Anokye in Kumasi, the Bosomtwi Crater Lake, the inland fort in Kumasi, the kente weaving industry at Bonwire and the Akwasidae festival as some of its tourist attractions (Ghana Statistical Service, 2013). Some of the Social infrastructure and amenities of the region include air, road and rail networks to many parts of the country. The air network links Kumasi to Tamale (Northern Region),

Sunyani (Brong Ahafo Region), Accra (Greater Accra Region) and Takoradi (Western Region). The rail network links Kumasi to Accra and Takoradi on different routes. The road network links Kumasi to Tamale via Techiman and Yeji (Brong Ahafo Region). The road link to Wa (Upper West) is also via Techiman. Other roads link Kumasi to Sunyani (Brong Ahafo), Koforidua (Eastern) and Accra (Greater Accra), Cape Coast (Central), and Takoradi (Western). The roads to Ho (Volta) and Bolgatanga (Upper East) are not direct. The region has Komfo Anokye Teaching Hospital as the second largest hospital in the country after the Korle Bu Teaching Hospital in Accra. Kumasi has the second largest public university in the country, the Kwame Nkrumah University of Science and Technology (KNUST) established in 1956. The initial purpose was for training students in science and technology but it has expanded to cover most disciplines, including agriculture, medicine, law and business administration (Ghana Statistical Service, 2013).

The region is the most heavily populated region in Ghana, with a population of 4,780,380 representing the highest proportion (19.4 %) of the total population of 24,658,823 in the country as at 26 September, 2010. The female population is 2,464,328, about 3% points higher than that of the male population (2,316,052). Nearly 61% of the region's population lives in urban areas, the second highest level of urbanisation after that of the Greater Accra Region. The proportion of emigrants from the region is 27.6%, the highest nationally (Ghana Statistical Service, 2013).

3.2 Population of the Study

Polit and Hungler (1999:37) refer to a population or sample frame as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications. This research work is a case study based and the sample frame of the study comprises the entire NHIS in the Ashanti region of Ghana.

Even though, the research on its outlook reflects the entire country's NHIS established by the Legislative Instrument (LI 1809) 2004 under the Health Insurance Act, 2003 (Act 650) in all the ten (10) regions of Ghana, the study is limited to Ashanti region with a total number of thirty (30) NHIS as the study population.

3.3 Determination of Sample Size and Techniques

The study employed purposive sampling technique to select information rich cases for indepth study. With purposive sampling method, Ashanti region was selected for the study as a result of the fact that the region has the largest number of schemes (i.e Ashanti Region

= 30 NHIS) in the country. So, due to the large nature of the study population in the Ashanti Region, it becomes important that the study population be sample such that, results of the paper can be used to make inferences that could be generalized.

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As a result, the study adapted a mathematical approach defined by Yamane (1967:886) in the determination of the sample size. This approach provides accommodation for some level of precision and a scientific means for sampling. As a sample is refers to as a finite part of a statistical population whose properties are studied to gain information about the whole (Webster, 1985). Below is the mathematical model specification by Yamane (1967:886) for the sample size determination of the NHIS in the region;

$$n = N/(1 + N(\propto)^2)$$

Where: n = sample size, N = sample frame and α = the level of precision. The total number of NHIS in the Ashanti region are thirty (30) but out of the thirty (30) NHIS, seven (7) NHIS were recently established ones and do not have data to cover the period of the study (2009 – 2012). As a result, subtracting the seven (7) NHIS from the thirty (30) NHIS, we have twenty three (23) NHIS which then becomes the sample frame (N) for the study. The level of precision (α) is also represented by the margin of error specified for the study which is ten per cent (10 %) with an unknown sample size (n).

Hence, the study mathematically defines the sample sizes (n) above as;

$$n = 23/(1 + 23(0.1)^2) = 18.699 = 19 \text{ NHIS}$$

As a result, the sample sizes (n) for the study then becomes 19 NHIS in the Ashanti Region.

After the mathematical determination of the sample size (19 NHIS), all the twenty three (23) NHIS in the Ashanti region were then given equal chance of selection to form the

sample population of the study via the adoption of a simple random sampling process. The nineteen (19) NHIS that were selected based on the simple random sampling technique are represented with letters (i.e A-S) due to ethical reasons or issues of confidentiality (i.e expressed permission has not yet been obtained for disclosure of names of those NHIS) and were; A NHIS (1), B NHIS (2), C NHIS (3), D NHIS (4), E NHIS (5), F NHIS (6), G NHIS (7), H NHIS (8), I NHIS (9), J NHIS (10), K NHIS (11),
L NHIS (12), M NHIS (13), N NHIS (14), O NHIS (15), P NHIS (16), Q NHIS (17), R NHIS (18) and S NHIS (19).

3.4 Specification of Variables

This portion provides the specification of the inputs, input prices and output variables as well as variables employed as cost and technical efficiency determinants.

3.4.1 Outputs Variables Selection

Like all service sectors, the insurance or life insurance industry presents difficulties with regards to output definitions and measurement (Greene and Segal 2004). Following the insurance and banking literature and the difficulty involving specification in respect to outputs, we incorporated or used the value-added approach to measure outputs (Berger and Humphrey 1992b and Cummins et al. 1999, Grace and Timme, 1992**;** Berger et al, 2000; Leverty and Grace, 2010). Accordingly, we distinguish between the three essential services provided by insurance bodies: risk-pooling/bearing, financial services and intermediation (cited in Biener and Eling, 2010).

The emerging consensus in literature is that incurred benefits and changes in reserves should be applied in the measurement of life insurance output (Cummins and Weiss, 1998). For Worthington and Hurley, (2002) the inclusion of present value of real losses incurred as insurance output is backed or supported by Cummins and Weiss, 1993; Berger et al., 1997; and Cummins et al., 1999 in literature. Since one of the focus of the NHIS is risk-pooling/bearing, to proxy for risk-pooling/bearing following Cummins and Weiss, 1993; Berger et al., 1997; and Cummins et al., 1999 in literature, incurred losses is used as insurance output where for the case of the NHIS, the incurred losses is proxied as the claims incurred.

Cummins et al. (1999:1260) for instance argue that 'the rationale for the use of losses to proxy for insurance output is that the primary function of insurance is risk pooling, i.e. the collection of funds from the policyholder pool and the redistribution of funds to those pool members who incur losses. Losses are also a good proxy for 'real services' provided by insurers such as coverage design and providing legal defense in liability suits'.

Following much more existing work in literature, another insurance output variable in this analysis is specified as total premium of the NHIS thus in line with insurance premium proxied for insurance output in most works (Praetz (1980), Grace and Timme (1992), Gardner and Grace (1993), Rai (1996), and Hardwick (1997). Also following Myers and Cohn (1987) and Cummins (1990) cited in (Cummins and Weiss 1998), premium was used as insurance output and it was seen as appropriate because the purpose of insurance

is to redistribute funds from those members of the pool who do not have a loss to those who do suffer a loss.

3.4.2 Inputs and Input prices Variables Selection

Inputs associated with insurers normally involve or consist of three groups as in the case of Cummins and Weiss (2000): labour, materials anad business services, and capital. Based on data availability, the inputs used in this study are; total fixed assets or capital which is measured by the total fixed assets value of the NHIS, total labour (personnel) measured by the services provided by the employees of NHIS and the other total operating expenses measured by the total operating expenses less the total labour (personnel) expenses.

The input prices employed in this model include price of total labour, price of total fixed asset/capital and price of other total operating expenses. The price of total labour is computed by dividing the total labour expenses incurred by the total personnel of the NHIS. This proxy is consistent with Khaled et al, (2001) cited in Kader et al (2009), where price of labor is proxied by taking the estimated average wage rate per employee for each firm (i.e. the estimated total wage bill divided by the number of employees).

The price of total fixed capital is proxied by dividing the total non-labour expenses by the total fixed capital expenses or cost of the NHIS. This is also in line with Khaled et al, (2001) cited in Kader et al (2009), where they computed capital input price as total operating costs minus labor costs divided by an estimated cost of capital. These definitions enable them compute input prices and quantities.

Our third input Price is price of other total operating expenses proxied by dividing other total operating expenses by the volume of output (total premium plus total claim incurred to service providers) of the NHIS. This proxy was made following Greene and Segal (2004) where all operating expenses (materials) other than labor and capital expenses were used as third input with most of these expenses related directly to selling and servicing policies. As a result they use the number of policies sold and serviced during the year and then quantify the price of all operating expenses (materials) as the related expenses divided by the total number of policies sold or terminated.

3.5 Data Sources

With regards to the calculation of cost and technical efficiency indices as well as efficiency determinants, data for the study on inputs and outputs variables were obtained from the sample NHIS in the Ashanti region and cover a period of 4 years (2009-2012). Data on location of the NHIS (i.e whether in ordinary district, municipal and sub metro/metropolitan) was also obtained from reports of the National Health Insurance Authority, (2009) and Ghana Statistical Service, 2012; 2013 and 2014.

3.6 Instrumentation

A survey method was used to collect the data from the selected sample NHIS. A survey research is a specific type of field study that involves the collection of data from a sample of elements drawn from a well-defined population through the use of a questionnaire (Babbie, 1990; Fowler, 1988; Frey, 1989; Lavrakas, 1993; Weisberg, Krosnick and Bowen, 1996).

A questionnaire is defined as a document containing questions and other types of items designed to solicit information relevant or appropriate for analysis (Babbie, 1990:377) cited in (Acharya, 2010). Questionnaire is equally applied in survey research, experiments and other types of observation. Indeed, most people ask different questions in their daily life to satisfy their queries. Journalists, market researchers, observers and other interested persons in different events for instance ask a set of questions to others. They use this to form an opinion or conclusion according to the answers that they receive. The application of a questionnaire or a set of questions is a similar process in research which usually is firmly constructed to receive answers related to the chosen variables for analysis (Acharya, 2010).

In the case of this research, the survey questionnaire or instrument was designed for the NHIS of the selected sample to generate the needed data for the work. The instrument involved names of the NHIS, year started, input, output, cost variables and some definitions of variables used.

3.7 Data Collection

In administering the instrument, the researcher made used of introductory letters both from the Department of Economics-KNUST and NHIA-Ghana (Head Office). The instrument was designed to generate annual financial information/data on the various input, output and cost variables specified for the sample NHIS. Each NHIS of the selected sample was given an instrument, and the instrument was delivered personally by the researcher. Before then, I initially met the regional manager of the NHIA in the Ashanti region with the instrument together with the introductory letter from the Department of Economics-KNUST but he

said information or data would only be released from the NHIS if only had permission from their Head Office in Accra (NHIA-
Head Office).

As a result, I eventually met the Research and Development unit of the NHIA-(Head Office) with the instrument together with the introductory letter from the Department of Economics-KNUST where they (Research and Development unit of the NHIA- Head Office) intend gave a letter seeking the NHIS to release the data or information as per the attached questionnaire/instrument for the exercise. I again informed the regional manager of the NHIA in the Ashanti region with a copy of the letter from the NHIA-(Head Office) together with the instrument and the introductory letter from the Department of Economics-KNUST. While some of the sample NHIS were able to provide the data in three month time, others used four months after several trips were made from and to by the researcher to collect the data.

3.8 Theoretical Review of SFA and DEA Model

This aspect presents theoretical review of Stochastic Frontier Analysis (SFA) and Data Envelop- ment Analysis (DEA) Models.

3.8.1 Stochastic Frontier Analysis (SFA) Model

The stochastic frontier analysis (SFA) model was initially introduced or developed by Aigner, Lovell and Schmidt (1977). The production or cost model is primarily or typically based on a Cobb – Douglas function and formulated as:

$$\log y = \beta' x + v - u \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . \mathrm{Eq}(3.1)$$

Where: y is observed outcome; $B'x + v$ is optimal production frontier; $B'x$ is the deterministic part of the frontier and $v \sim N(0, \sigma^2_V)$ is the stochastic part. The components of x are generally logs of inputs for a production model or logs of output and input prices for a cost model, or their squares and/or cross products. Inefficiency is u, where $u = |U|$ and $U \sim N(0, \sigma^2_V)$, (cited in Kokkinou,2010). The SFA model becomes:

$$y = \beta' x + v - u \quad , \quad u = |U| \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq}(3.2)$$

In the SFA model ε is equal to $v - u$, where; ε is the error term, u measures the technical inefficiency i.e shortfall of output y from its maximal possible value given by the stochastic frontier $[g(x_0, \beta) + v]$ .When a model of this nature is estimated, the obtained residuals $\hat{\varepsilon} = y - g(x - \hat{\beta})$, may be referred to as estimates of ε (Jondrow et al, 1982) citted in (Kokkinou, 2010). With conditional distribution of u given ε, $E[u|\varepsilon]$ becomes the mean productive efficiency. Under each of the assumed feasible distributional forms for the inefficiency term in a model, this mean hat distribution contains whatever information ε yields about u. β′x becomes the predicted value where

Jondrow et al. (1982) computed the residual by:

$$E[u|v - u] \text{ or } E[u|v + u] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq}(3.3)$$

Or

$$\hat{E}[u|\varepsilon] = \frac{\sigma\lambda}{1+\sigma^2}\left[\frac{\emptyset(z)}{1-\Phi(z)} - z\right], \ \varepsilon = v \pm u, \ z = \frac{\varepsilon\lambda}{\sigma} \ldots\ldots\ldots\ldots\ldots\ldots, \text{Eq}(3.4)$$

The marginal effects in the model are the coefficients β .The results obtained are critically dependent on the model type and the set assumptions (Kokkinou, 2010).

3.8.2 Data Envelopment Analysis (DEA) Model

DEA developed by Charnes et al. (1978) is a linear programming based performance measurement technique which can be used for analyzing the relative efficiency of productive units, having the same multiple inputs and multiple outputs (cited in Karimzadeh, 2012). It does not specify a functional form for the production frontier hence suitable for complicated production process that is unlikely to be well described by any mathematical equation (Banker 1993) cited in Peacock et al (2001).

As a sophisticated type of ratio analysis (DEA) it is superior to simple ratio analysis mainly for its built-in ability to make like-with-like comparisons (Jomini and Chan, 2000) cited in (Peacock et al 2001). For Weber (1996) cited in (Gallear, Ghobadian, Li, O'Regan, Childerhouse, and Naim, 2014), mathematically, DEA starts via the identification of an 'efficient frontier' from the observed inputs and outputs of the set of decision-making units under examination.

The efficiency score for a DMU is defined as the total weighted score of outputs divided by the total weighted score of inputs. To avoid the potential challenged in assigning these weights among various DMUs, the DEA technique computes weights that give the highest possible relative efficiency score to a DMU while keeping the efficiency scores of all DMUs less than or equal to one under the same set of weights (Liu et al., 2000) cited in

(Gallear, Ghobadian, Li, O'Regan, Childerhouse, and Naim, 2014). It is this approach that ensures that all DMUs are evaluated on the basis of relative efficiency (Easton et al., 2002).

DEA's total objectivity in the establishment of weights for the input and output measures is considered to be a major benefit (Braglia and Petroni, 2000). The feedback potential of DEA, via the provision information vital to managers in improving performance, makes it a valuable tool in quality decision making (Easton et al., 2002). Even though, for Lovell (1993) and Coelli et al. (1998) there are two major drawbacks (i.e merits of SFA) to this method: first, the DEA is non-stochastic and second, it is non-statistical (cited in Zere, 2000). But Ferrier and Valdmanis (1996), however, argued that, these drawbacks may not be as severe as they initially seem. First, specification error that might show up as a noise is ruled out. Secondly, as inputs and outputs are measured in their natural physical units, a measurement error is most unlikely. Fukuyama (1997), Cummins and Zi (1998), and Cummins et al. (1999), have applied this approach to a number of insurance bodies.

3.8.2.1 Technical Efficiency Model

The technical efficiency (TE) model broadly is the ratio of the sum of weighted outputs to the sum of weighted inputs of the decision making unit (DMU). The value of TE varies between 0 and 1 of the DMU; where a value of 1 implies the DMU is the best performer located on the production frontier and has no reduction potential. Any value of TE lower than 1 indicates inefficient usage of inputs of the DMU (Mousavi–Avval et al., 2011b).With standard notations, the TE of the DMU is express mathematically as:

$$TE_j = \frac{u_1y_{1j} + u_2y_{2j} + \cdots + u_ny_{nj}}{v_1x_{1j} + v_2x_{2j} + \cdots + v_mx_{mj}} = \frac{\sum_{nr-1} u_ry_{rj}}{m}\sum_{s-1} v_sx_{sj} \quad \text{Eq. (3.5)}$$

Where, u_r, is the weight given to output n; y_r, the amount of output n; v_s, the weight given to input m;x_s, the amount of input m; r, number of outputs (r = 1, 2, . . ., n); s, number of inputs (s = 1, 2, .., m) and j, represents jth DMUs with j = 1, 2, . . ., k, where a Linear Program (LP) was developed by Charnes et al. in 1978 to solve Eq. (3.4) (cited in Mobtaker, 2012).

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For Charnes et al. (1978), the technical efficiency model is specified by considering for example all N DMUs each producing M different outputs using K different inputs. The K × N input matrix, X, and the M × N output matrix, Y, represent the data of all N DMUs, while for the individual DMUs, these are represented by the vectors x_i and y_i. Its purpose is to construct a non-parametric envelopment frontier over a data points such that all observed points lie on or below the production frontier. Though there are several ways of modeling the DEA but adapting its input oriented, constant returns to scale version, the DEA for a DMU is modeled by:

$$\min_{\theta,\lambda} \theta$$

$$\text{s. t.} \quad -y_i + Y\lambda \geq 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq. (3.6)}$$

$$\theta x_i - X\lambda \geq 0 \qquad \lambda \geq 0$$

Where, θ is a scalar and λ is a $N \times 1$ vector of constants. The value of θ becomes the technical efficiency (TE) score for a particular DMU. The value of $\theta \leq 1$ identifies the amount of any inefficiency that may be present but with $\theta \leq 1$, a value of unity or 1 indicates a point on the frontier and hence, a technically efficient DMU, according to Farrell's (1957) definition.

3.8.2.2 Cost Efficiency Model

Cost efficiency (CE) of a DMU is defined by the ratio of minimum costs to actual costs for a given output where a vector is computed by measuring the distance of its observed (cost) point from an idealized cost frontier. The estimation of CE is bounded between 0 and 1. A cost efficiency of 1 represents a fully cost efficient firm; 1-Cost Efficiency implies the amount by which the company could reduce its costs and still produce at least the same amount of output (Martina and Sanjay, 2012). Given the output and input variables, the cost efficiency scores for a DMU can be estimated via the DEA dual reference technology by solving the linear programming (including the convexity constraint) below: $\underset{\lambda, x_i}{\text{Min}}_{*}\ w_i x_i^*$

$$\text{s. t.} \quad -y_i + Y\lambda \geq 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq. (3.7)}$$

$$x_i^* - X\lambda \geq 0$$

$$N1\lambda = 1$$

$$\lambda \geq 0$$

Where,

w_i is a vector of input prices for the $i-th$ DMU and x_i^* is the cost-minimizing vector of input quantitie

s for the $i - th$ DMU given the input price vector w_i and the output vector y_i. The ratio of minimum cost to observed cost $(w_i x_i^* / w_i x_i)$ measures the CE of the $i - th$ DMU (Worthington and Hurley, 2002).

3.9 Tobit Regression Model

There are two regression models commonly used to estimate the determinants of efficiency: Ordinary Least Squares (OLS) regression and Tobit regression (Tobin, 1958). The Tobit model developed by Tobin (1958) is also known as truncated or censored regression models

where expected errors are not equal zero. Hence, estimation with Ordinary Least Squares (OLS) would lead to bias, since OLS assumes a normal distribution of the error term (Zaini et al., 2010). More formally, the standard Tobit model can be express according to Zaini et al (2010) as follows:

$EFF_i^* = \beta_* \beta x + \varepsilon_i, \qquad \varepsilon_i \sim . N(0, \sigma^2)$ ... ... Eq. (3.8)

if $0 < EFF_i^* < 0$ $EFF_i = 0$ if $EFF_i^* = 0$ $EFF_i = 1$ Otherwise Where EFF_i^* is the cost efficiency scores, β represents a vector of parameters to be estimated, X is a vector of explanatory variables, and ε_i is a normally distributed error term.

Since efficient DMUs having a DEA efficiency score of 1 and a relatively large number of fully efficient DMU being estimated, the distribution of efficiency is truncated above from unity (cited in Uslu and Linh, 2008). As a result, efficiency scores in the regression model then becomes a limited dependent variable. In such a case, applying OLS regression is inappropriate (Gujarati, 2003, p.616). In respect to this, a Tobit censored regression model is used instead (Chilingerian, 1995; Chilingerian and Sherman, 2004) cited in (Uslu and Linh, 2008).

3.10 Empirical DEA Model Specification

This part presents the empirical DEA specifications of the Technical and cost Efficiency Model for the study.

3.10.1 Technical Efficiency Model

To estimate the technical efficiency of the NHIS from 2009 to 2012, the study employed the DEA-technical efficiency model or linear programming based on the output and input variables, where we have Total Premium and Total Claims Incurred as the output variables while Total personnel, Total Fixed Assets and Other Operating Expenses as the input variables. Employing the input-oriented constant returns to scale version of the DEA, the study formulates its empirical technical efficiency model or linear programming of the NHIS by:

$$\underset{w,TE_n}{\text{Min}} \quad TE_n$$

$$\text{s. t} \qquad \Sigma w_j x_{ij} \leq TE_n x_{in} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eq. (3.9)}$$

$$\Sigma w_j y_{kj} \geq y_{kn}$$

$$w_j \geq 0$$

Where ; $n = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots N \Longrightarrow$ NHIS, $i = 1 \ldots\ldots\ldots\ldots\ldots\ldots I \Longrightarrow$ Inputs,

$j = 1 \ldots\ldots\ldots\ldots N \Longrightarrow$ Weights, $k = 1. \ldots\ldots\ldots K \Longrightarrow$ Outputs, $x_{in} =$ observed amount of inputs i for NHIS n,

$y_{kn} =$ observed amount of outputs k for NHIS n $w_j =$ weights of j assigned to inputs i and ouput k of all N NHIS

$TE_n =$ Technical efficiency score for NHIS n

With $TE_n < 1$, indicates the amount of inefficiency that is present in NHIS n.

However with $TE_n = 1$, identifies technically efficient NHIS.

3.10.2 Cost Efficiency Model

To estimate the cost efficiency of the NHIS from 2009 to 2012, the study employs the

DEA-cost efficiency model with output, input and input price variables, where we have Total Premium and Total Claims Incurred as the output variables while Total personnel, Total Fixed Assets and Other Operating Expenses as input variables with Price of Total Personnel, Price of Total Fixed Assets and Price of Other Operating Expenses as the input price variables and formulates its empirical cost efficiency model by;

$$\underset{x_i}{\overset{*}{\text{Min}}}_{*} \quad \Sigma p_i x_i \quad w,$$

$$\text{s. t} \qquad \Sigma w_j x_{ij} \leq x^{*}_{in} \ldots \ldots \ldots \ldots \ldots \text{Eq. (3.10)}$$

$$\Sigma w_j y_{kj} \geq y_{kn}$$

$$w_j \geq 0$$

Where; p_i is a vector of input prices for the $n-$ th NHIS and x_i^* is the costminimizing vector of input quantities for the $n-$ th NHIS. So, given the input price vector P_i and the output vector y_i, then, we defined the cost efficiency as the ratio of minimum cost to observed cost. That is the $\Sigma px_{*i} / \Sigma p_i x_i$ estimates the CE of the $n-$ th NHIS.

3.11 Empirical Tobit Regression Model

The study formulates its empirical Tobit regression to estimate a number of independent factors that influences the operations of the NHIS over the period (2009-2012). These independent variables are: AGE proxied for the effect of experience on efficiency in the operations of the NHIS, Total Assets (TASSETS) proxied to control for the effect of size on efficiency in the operations of the NHIS, Total Premium (TPRM) proxied for the effect of premium growth on efficiency in the operations of the NHIS, Loss Ratio (LR) proxy for

the ratio of Claims Incurred to Premium Earned on efficiency in the operations of the NHIS, Total Subsidy (TSUBSIDY) proxied to control for the effect of state or government subsidy on efficiency in the operations of the NHIS and Location (LOC) proxied for the effect of NHIS location on efficiency in the operations of the NHIS. The use of tobit regression here has been justified with the fact that, the efficiency scores computed with the DEA model have a limiting value (the range is from zero to one) and OLS regression will produce biased parameter estimates (Austin et al., 2000) cited in (Chang and Lan, 2010). Therefore, application of Tobit regression gives more accurate parameter estimates (Chang. and Lan, 2010). Since Tobit regression gives more accurate results, the study specified its empirical TE and CE Tobit model below as:

$$\mathrm{Ln}(\mathrm{EFF_{TE}})_i = \alpha_0 + \beta_1 \mathrm{AGE} + \beta_2 \mathrm{Ln}(\mathrm{TASSETS}) + \beta_3\ \mathrm{Ln}(\mathrm{TPRM}) + \beta_4\, \mathrm{LR} + \beta_5 \mathrm{Ln}(\mathrm{TSUBSIDY}) + \beta_6 \mathrm{LOC} + \mathcal{E}_i \ldots\ldots\ldots\ldots\ldots \text{Eq. (3.12)}$$

$$\mathrm{Ln}(\mathrm{EFF_{CE}})_i = \alpha_0 + \beta_1 \mathrm{AGE} + \beta_2 \mathrm{Ln}(\mathrm{TASSETS}) + \beta_3\ \mathrm{Ln}(\mathrm{TPRM}) + \beta_4\, \mathrm{LR} + \beta_5 \mathrm{Ln}(\mathrm{TSUBSIDY}) + \beta_6 \mathrm{LOC} + \mathcal{E}_i \ldots\ldots\ldots\ldots\ldots \text{Eq. (3.13)}$$

Where,

The Dependent Variables;

$\mathrm{EFF_{TE}}$ = Technical Efficiency scores/results (average scores) of the NHIS,

$\mathrm{EFF_{CE}}$ = Cost Efficiency scores/results (average scores) of the NHIS,

Independent Variables are;

AGE = Age proxied for the effect of experience on efficiency

LR= Loss Ratio proxied for the Claims Incurred to Premium Earned on efficiency

TPRM = Total Premium (TPRM) proxied for the effect of premium growth on efficiency

LOC = Dummy variable proxied for the effect of location on efficiency (Loc).Where;

1 = if NHIS is located in ordinary district

0 = if otherwise or NHIS located in a municipal, sub metro/metropolis

Control Variables

TASSETS = Total Assets proxied to control for size on efficiency

TSUBSIDY = Total Subsidy proxied for the effect of Government subsidy on efficiency

3.12 Mode of Analysis

The study obtained its results via the use of Microsoft excel, DEAP Version 2.1: A Data Envelopment Analysis (Computer) software program and STATA 12. The Data Envelopment Analysis (Computer) was used to obtain estimates of the cost efficiency results or scores and technical efficiency results or scores of the NHIS from 2009 to 2012.

STATA 12 was employed for the analysis of the tobit regression model in order to estimate determinants of the observed level of cost and technical efficiency in the operations of the NHIS. The application of Microsoft excel was used to obtain descriptive statistics of the observed data on outputs, inputs and input prices as well as the explanatory variables employed for the analysis of the tobit regression in order to estimate determinants of the observed level of cost and technical efficiency in the operations of the NHIS.

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CHAPTER FOUR

EMPIRICAL ANALYSIS AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents the analyses of the empirical results of technical efficiency, cost efficiency and the regression results of the determinants of technical efficiency and cost efficiency in the operations of the NHIS.

The results are generated by the use of Microsoft excel, DEAP Version 2.1: A Data Envelopment Analysis (Computer) software program and STATA 12. The presentation of the study results is followed by: First, descriptive statistics of variables used.

Second, the technical efficiency results of the NHIS for the period (2009-2012). This is followed thirdly by the cost efficiency results or scores of the NHIS for the period (2009 to 2012).

Fourthly, the study presents the determinants of technical efficiency results in the operations of the NHIS over the period (2009-2012).This is also followed by the regression results of cost efficiency in the operations of the NHIS over the period (2009-2012) and conclusion on results.

Table 4.1 Descriptive Statistics of Variables used

Variables	Unit	Mean	Standard Deviation	Minimum value	Maximum value

Outputs					
Total premium collected	GH¢	222,176.54	184,535.24	19,385.50	717,267.00
Total claim incurred	GH¢	4,124,972.94	3,575,136.05	375,904.79	13,852,401.78
Inputs					
Total personnel	#	18.24	6.17	9	36
fixed assets/capital	GH¢	71,403.89	67,026.12	103.82	344,640.18
Other operating expenses	GH¢	1,152,038.33	4,191,618.39	14,300.04	31,527,190.00
Input Prices					
Price of total personnel	GH¢	6,209.94	2,212.33	300.84	16,570.92
Price of total fixed assets	GH¢	27.95	106.59	0.06	873.61
Price of other operating	GH¢	0.24	1.06	0.00	9.17
Expenses					
Explanatory Var.					
Age	#	6.08	1.47	2	8
Tassets	GH¢	216,489.28	468,868.54	16,994.46	3,861,526.81
Tprm	GH¢	11.98	0.85	9.87	13.48
Lr	%	27.71	80.55	4.71	714.58
Tsubsidy	GH¢	3,812,026.49	3,609,374.88	112,324.07	13,942,703.09
Loc	#	0.68	0.47	0	1

Source: Field Survey, (2014)

4.1 Descriptive Statistics of Variables

Table 4.1 below presents the descriptive summary statistics of the outputs, inputs and input price variables as well as the explanatory variables used in the efficiency analyses, including the mean, standard deviation, minimum and maximum values over the period (2009-2012).

4.2. The Technical Efficiency (TE) Results

Table 4.2 below provides the estimated technical efficiency results of the NHIS from 2009 to 2012. The results on Table 4.2 indicates large differences across the NHIS and the period (2009- 2012) with overall average technical efficiency results of the NHIS to be 0.7135 representing 71.35 %. Table 4.2 below, illustrates the summary results of the technical efficiency scores of the NHIS for the period (2009-2012).

Table 4.2 Technical Efficiency Results (2009-2012)

Percentile Distribution of the TE Results (2009-2012)

NHIS	2009 TE	2010 TE	2011 TE	2012 TE	AVERAGE (2009-2012)	RKS
1	0.921	1.000	1.000	0.803	0.931	6th
2	0.954	1.000	1.000	1.000	0.9885	2nd
3	1.000	0.899	0.718	1.000	0.90425	8th
4	1.000	0.762	1.000	1.000	0.9405	4th
5	0.190	0.259	0.478	0.482	0.35225	18th
6	1.000	0.817	1.000	1.000	0.95425	3rd
7	1.000	0.411	0.510	0.585	0.6265	12th
8	1.000	0.842	1.000	0.910	0.938	5th
9	1.000	1.000	0.639	0.453	0.773	10th
10	0.561	0.485	0.514	0.637	0.54925	13th
11	0.283	0.474	0.732	0.676	0.54125	14th
12	0.338	1.000	0.416	0.276	0.5075	15th
13	1.000	0.918	0.684	0.970	0.893	9th
14	0.165	0.212	0.255	0.401	0.34675	19th
15	0.732	0.519	0.653	0.728	0.658	11th
16	1.000	0.904	0.804	1.000	0.927	7th
17	0.200	0.527	0.486	0.585	0.4495	16th
18	1.000	1.000	1.000	1.000	1.000	1st
19	0.321	0.350	0.423	0.360	0.3635	17th
Mean	**0.719**	**0.704**	**0.701**	**0.730**	**0.7135**	

Note: TE = Technical Efficiency. RKS= Ranks

Source: Field Survey, (2014).

The results from the table indicates that only one NHIS among the sample NHIS in the Region obtained efficiency results of 1.000 for the period (2009-2012); making that NHIS the most efficient unit of the sample NHIS. This efficient unit of the sample is R NHIS (18). The finding is remarkable and implies that in terms of technical efficiency in the operations of the NHIS in the region, R NHIS (18) is combining its inputs better than its peers within the sample NHIS in producing its outputs.

Table 4.2 with the technical efficiency results, indicates that B NHIS (2) had average technical efficiency results of 0.9885 with 1.15 % room of improving its technical efficiency in terms of the operations of the NHIS. F NHIS (6) had 0.95425 average technical efficiency results and has about 4.575 % level of reducing its technical inefficiency in the operations of the NHIS. D NHIS (4) had 0.9405 average technical efficiency results or scores and has about 5.95 % level of technical inefficiency to reduce in the operations of the NHIS. H NHIS (8) had 0.938 average technical efficiency results with about 6.2 % room of improving its technical efficiency in the operations of the NHIS. A NHIS (1) had 0.931 on average, technical efficiency results or scores with about 6.9 % room of clearing its technical inefficiency level in the operations of the NHIS. P NHIS had (16) average technical efficiency results of 0.927 with 7.3 % level of improving its technical efficiency in the operations of the NHIS. All these units are the sample NHIS positioned from 2nd to 7th respectively within the ranks in Table 4.2 for the period (2009-2012).

The table further indicate that C NHIS (3) had 0.90425 average technical efficiency results with about 9.575 % room of improving its technical efficiency in terms of the operations of the NHIS. M NHIS (13) had 0.893 on average technical efficiency score or results with 10.7 % level of improving its technical efficiency in the operations of the NHIS for the period. I NHIS (9) had 0.773 efficiency results or score on average with 22.7 % level of reducing its technical inefficiency in terms of the operations of the NHIS for the period of the study. O NHIS (15) had 0.658 efficiency results on average and has about 34.2 % level of reducing its technical inefficiency in the operations of the NHIS. G

NHIS (7) had 0.6265 on average, technical efficiency results with about 37.35 % level of technical inefficiency to overcome in the operations of the NHIS for the period under review (2009-2012). J NHIS (10) had on average technical efficiency results of 0.54925 and has about 45.075 % level of overcoming its technical inefficiency in terms of running the NHIS. These sample NHIS were the selected NHIS positioned from 8th to 13th respectively within the ranks for the period of study (2009-2012) shown on Table 4.2 above.

The results on Table 4.2 again, indicates that K NHIS (11) had 0.54125 technical efficiency results on average and has about 45.875 % level of technical inefficiency in the operations of the NHIS to overcome over the duration of the study (i.e. 2009-2012). L NHIS (12) had on average technical efficiency results of 0.5075 and has about 49.25 % level of reducing its technical inefficiency in the operations of the NHIS for the period. Q NHIS (17) had 0.4495 on average technical efficiency results with about 55.05 % level of improving its technical efficiency in terms of the operations of the NHIS over the period. S NHIS (19) had on average technical efficiency results of 0.3635 with about 63.65 % level of technical inefficiency in the operations of the NHIS to overcome for the period under review (2009-2012). E NHIS (5) had 0.35225 technical efficiency results on average, with about 64.775 % level of improving its technical efficiency in the operations of the NHIS over the study period. Again these sample NHIS of the sample units were those positioned from 14th to 18th within the ranks respectively illustrated on Table 4.2 above over the period (2009-2012).

Another noticeable feature of the technical efficiency results of the NHIS on Table 4.2 is that of N NHIS (14), which obtains on average, technical efficiency results of 0.34675 that

positioned it as the lowest technical efficient unit (NHIS) out of the sample NHIS in the region. This suggests that N NHIS (14) is not combining its inputs as efficiently as it should in achieving its outputs and has about 65.325 % room of reducing its technical inefficiency in the operation of the NHIS over the period of study (2009-2012). .

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Table 4.2 indicates that the technical efficiency results of the NHIS for objective one obtained via the DEA-technical efficiency model over the period of study (2009-2012) suggest on average a higher technical efficiency results for the NHIS, thus 0.719, 0.704, 0.701 and 0.730 respectively over the period under review (2009-2012), even though, some marginal level of technical inefficiencies still exist in the operations of the NHIS.

In terms of comparison with literature, Our empirical technical efficiency results of the NHIS on Table 4.2 indicates that the average technical efficiency results of the NHIS for the period (2009-2012) ranges from 70.1 % to 73.0 % is consistent with the findings of Cummins, Turchetti and Weiss (1996) study of the Italian market, considering a sample of 94 companies (life, non-life and mix) between 1985 and 1993. They use a DEA distance function to estimate the technical efficiency and a Malmquist index to analyse changes in technical efficiency. Their results have shown that technical efficiency in the

Italian insurance industry ranges from 70% to 78%.

4.3 The Cost Efficiency Results

Table 4.3 below presents the estimated cost efficiency results of the NHIS over the period under review (2009-2012). The cost efficiency results of the NHIS obtained portrays large

differences across the sample NHIS and over the period under review (2009-2012) with the overall average cost efficiency results of 0.45475 representing

45.475 % level.

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Table 4.3: The Cost Efficiency Result (2009-2012)

Percentile Distribution of the CE Result (2009-2012)						
NHIS	2009 CE	2010 CE	2011 CE	2012 CE	AVERAGE (2009-2012)	RKS
1	0.228	0.417	0.359	0.379	0.34575	11th
2	0.775	0.959	0.756	0.906	0.849	2nd
3	0.966	0.445	0.088	0.687	0.5465	10th
4	0.857	0.304	0.857	1.000	0.7545	4th
5	0.140	0.123	0.171	0.245	0.16975	18th
6	0.872	0.424	0.530	0.580	0.6015	7th
7	0.300	0.141	0.209	0.284	0.2335	16th
8	1.000	0.668	1.000	0.361	0.75725	3rd
9	0.977	1.000	0.589	0.262	0.707	5th
10	0.407	0.261	0.210	0.372	0.3125	13th
11	0.239	0.200	0.336	0.424	0.29975	14th
12	0.309	0.633	0.167	0.167	0.319	12th
13	0.891	0.785	0.409	0.492	0.64425	6th
14	0.093	0.068	0.084	0.157	0.1005	9th
15	0.058	0.054	0.049	0.060	0.05525	19th
16	1.000	0.523	0.305	0.542	0.5925	8th
17	0.163	0.230	0.292	0.259	0.236	15th
18	1.000	1.000	1.000	0.772	0.943	1st
19	0.274	0.153	0.269	0.009	0.17625	17th
Mean	**0.555**	**0.441**	**0.404**	**0.419**	**0.45475**	

Note: CE = Cost Efficiency. RKS = Ranks Source:
Field Survey, (2014).

Table 4.3 contains the summary cost efficiency results of the NHIS of the study over the period (2009-2012). The results obtained over the period (2009-2012) indicates that only one NHIS of the sample NHIS had 0.943 on average cost efficiency results over the period thus making it the most cost efficient NHIS of the sample for the study. This cost efficient NHIS of the sample units of the study is R NHIS (18). This finding is quite remarkable for the study and depicts that in terms of cost efficiency in the operations of the sample NHIS, comparing R NHIS (18) to its peers in the sample, it is better in combining its inputs in

producing its outputs even though, some level of cost inefficiency still exist, thus have 5.7% room of improving its cost efficiency in the operations of the

NHIS for the period (2009-2012).

Table 4.3 with the cost efficiency results shows that B NHIS (2) had 0.849 cost efficiency results on average, with about 15.1 % level of cost inefficiency associated with the operations of the NHIS for the period under review (2009-2012). H NHIS (8) had 0.75725 on average, cost efficiency results with about 24.275 % level of cost inefficiency associated in the operations of the NHIS the period. D NHIS (4) had an average cost efficiency results of 0.7545, with about 24.55 % level of overcoming its cost inefficiency in terms of running the NHIS for the period of the study. I NHIS (9) had 0.707 average cost efficiency results and has about 29.3 % level of reducing its cost inefficiency in terms of the operations of the NHIS over the period. M NHIS (13) had 0.64425 average cost efficiency results with about 35.575 % room of improving its cost efficiency in terms of the operations of the NHIS within the period of the study. F NHIS (6) had 0.6015 average cost efficiency results also with about 39.85 % level of overcoming its cost inefficiency associated with the operations of the NHIS for the period of the study. These sample NHIS just discussed above are the sample NHIS positioned from 2nd to 7th respectively within the ranks on table 4.3 depicting the summary of cost efficiency results of the sample NHIS for the period (2009-2012).

The table (4.3) indicates further that P NHIS (16) had 0.5925 cost efficiency results on average and has about 40.75 % level of reducing its cost inefficiency associated with the

operations of the NHIS over the period (2009-2012). C NHIS (3) had on average, cost efficiency results of 0.5465 with 45.35 % level of cost inefficiency associated with the operations of the NHIS for the period (2009-201). A NHIS (1) had 0.34575 on average, cost efficiency results with 65.425 % level of cost inefficiency associated with the operations of the NHIS for the period of the study. L NHIS (12) had on average cost efficiency results of 0.319 with about 68.1 % level of cost inefficiency associated with the operations of the NHIS over the period of the study. J NHIS (10) had 0.3125 cost efficiency results or scores on average with 68.75 % level of improving its cost efficiency associated with the operations of the NHIS for the period under review (2009-2012). K NHIS (11) had on average, 0.29975 cost efficiency and has about 70.025 % room of clearing its cost inefficiency associated with the operations of the NHIS for the period of the study. These sample NHIS discussed above are the sample NHIS positioned from 8th to 13th within the ranks respectively on table 4.3 illustrating the cost efficiency results of the sample NHIS for the period (2009-2012).

The cost efficiency results of the NHIS illustrated on Table 4.3 further indicates that Q NHIS (17) had 0.236 on average, cost efficiency results with about 76.4 % level of cost inefficiency associated with the operations of the NHIS for the period (2009-2012). G NHIS (7) had 0.2335 cost efficiency results or score on average, with about 76.65 % level of improving upon its cost efficiency associated with the operations of the NHIS over the period of the study. S NHIS (19) had on average, cost efficiency of 0.17625 with 82.375 % level of cost inefficiency associated with the operations of the NHIS over the period of study. E NHIS (5) had 0.16975 on average, cost efficiency score or results with about

83.025 % level of cost inefficiency associated with the operations of the NHIS over the duration of the study. N NHIS (14) had 0.1005 cost efficiency results on average, with about 89.95 % level of improving upon its cost efficiency associated with the operations of the NHIS over the period under review (2009-2012). These sample NHIS just discussed above are the sample NHIS positioned from 14th to 18th within the ranks respectively on table 4.3 with the cost efficiency results of the sample NHIS over the period.

Another feature in Table 4.3 with the estimated cost efficiency results of the sample NHIS over the period (2009-2012) is that of O NHIS (15), which had cost efficiency results of 0.34675 on average that positioned it as the least ranked cost efficient unit (NHIS) out of the sample NHIS. This suggests that O NHIS (15) is not combining its inputs as efficiently in terms of cost as it should in achieving its outputs and has about 94.475 % room of overcoming its cost inefficiency in the operations of the NHIS. The results on Table 4.3 indicate that the DEA-Cost Efficiency Models suggest low average cost efficiency results of the sample NHIS, thus 0.555, 0.441, 0.404 and 0.419 respectively over the period (2009-2012).

4.4 Determinants of Technical Efficiency Results

Table 4.4 below presents the technical efficiency results of the NHIS explained by various factors over the period under consideration (2009-2012). The technical efficiency results, shown on Table 4.4 reveals that AGE proxied for the effect of experience in the operations of the NHIS for the period 2009-2012 is statistically significant determinant of technical efficiency at 1% level. The relation is an inverse one and implies that age is negatively related to technical efficiency in the operations of the NHIS. Hence consistent with the

findings of a study on the determinant of technical, allocative and economic efficiencies in plantain production industry in Ondo State, Nigeria, where for allocative efficiency, the sign of the coefficient for age was positive, indicating that the older the farmer the more allocatively inefficient he become (Bifarin et al, 2010).

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Table 4.4 Determinants of Technical Efficiency Results (2009-2012)

Explanatory Variables	Coeff.	Std. Err.	t-ratio	P>|t|	[95% Conf.	Interval]
Cons.	-3.270796	.7650109	-4.28	0.000***	-4.796563	-1.74503
Age	-.0718589	.0243023	-2.96	0.004***	-.1203283	-.0233895
Tassets	-.0890696	.0374702	-2.38	0.020**	-.1638015	-.0143377
Tprm	.3274051	.0676188	4.84	0.000***	.1925437	.4622666
Lr	.001597	.0005475	2.92	0.005***	.0005051	.0026889
Tsubsidy	.0285259	.0368359	0.77	0.441	-.0449411	.1019929
Loc	-.0576933	.0994656	-0.58	0.564	-.2560712	.1406845
Sigma	.2775976	.0234764			.2307755	.3244197
Pseudo R^2	0.6210					
Log Likelihood	-14.950151					

The P value is reported in Table 4.4 as;
*Significant at the 0.10 level;
** Significant at the 0.05 level;
*** Significant at the 0.01 level.

Number of obs. = 76
LR chi2(6) = 49.00
Prob. > chi2 = 0.0000

Obs. summary:
4 left-censored observations at lneff.<=-1.0591512
72 uncensored observations
0 right-censored observations

The technical efficiency results of the study on Table 4.4 also indicates that Total Assets (TASSETS) proxied to control for the effect of size in the operations of the NHIS is inversely related to technical efficiency in the operations of the NHIS for the period (2009-2012). The relation depicts that, Total Assets (TASSETS) is found statistically significant

at 5 % level with a coefficient of -.0890696 in determining technical efficiency in the operations of the NHIS. The findings; particularly with respect to the relation, falls in line with Gardner and Grace (1993) where they believe that as total assets increases, inefficiency increases. They claim that no-admit assets cause this point. This is also in line with Borges et al (2008) that large life insurance organisations or companies are not more efficient than small life insurance companies. This formulation was based on a traditional hypothesis in financial institutions efficiency studies, where size and efficiency are related (Cummins, Rubio-Misas and Zi, 2004**)**. The relation also fell in line with other studies who argues that the very largest firms suffer from diseconomies of scale (due to complexity) so they are not as efficient as middle-sized insurers (Fenn et al., 2008).

The empirical results on table 4.4 indicate that, Total premium (TPRM) proxied for the effect of premium growth is positively related to technical efficiency in the operations of the NHIS over the period (2009-2012). The relation is statistically significant at 1% level in determining the technical efficiency in the operations of the NHIS. The results are in line with some of the findings of Biener et al (2015) empirical study on the determinants of efficiency and productivity in the Swiss insurance companies in the life, property or casualty, and reinsurance sectors from 1997–2013. The regression results for premium growth do not reveal a clear pattern over all subsectors. However, a positive relationship between premium growth and all efficiency measures in reinsurance were established; for life insurance, the study observes a positive relationship for RE and for p/c insurance for TE.

Another feature on Table 4.4 is that, Loss Ratio (LR) proxied for the effect of claims incurred to service providers to that of premium earned by the NHIS is found statistically significant determinant of technical efficiency in the operations of the NHIS at 1% level for the period (2009-2012). LR has a positive coefficient (.001597) indicating that it is positively related to technical efficiency in the operations of the NHIS. The relation is in order with Tan and Floros (2013), they assesses the relationship between bank efficiency, loss ratio (risk) and capital for a sample of Chinese commercial banks using three efficiency indexes and four risk indicators under a three stage least square method in a panel data framework. The empirical evidence suggests that there is a positive and significant relationship between loss ratio (risk) and efficiency in Chinese banking industry.

The results on Table 4.4 indicate that Total Subsidy (TSUBSIDY) proxied to control for the effect of government subsidy on efficiency of the NHIS is found not statistical significant determinant of technical efficiency in the operations of the NHIS, even though, has a positive coefficient (.0285259). When relates to literature, it confirms the works of Sauer and Park (2009) that there exist a positive influence of organic subsidies on technical efficiency changes and technological changes for organic dairy farms in Denmark over the period (2002–04). The finding is also consistent with Yee et al. (2004), where a positive relation was found between the TFP of US farms and public expenditure on investment in research, extension and infrastructure.

The empirical results on table 4.4 also shows that, location (LOC) proxied to control for the effect of NHIS location on efficiency is found positive but not statistically significantly determinant of technical efficiency in the operations of the NHIS for the period (2009-

2012). Hence, have some link with Adu et al (2014) they studied on the demographic variables as determinant of principal managerial efficiency. Their results revealed that there is no significant difference between school locational disparities and principals' managerial efficiency. In other words, there is no significant difference in the managerial efficiency of principals in rural and urban areas (locations).

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4.5 Determinants of Cost Efficiency Results

The determinants of cost efficiency results in the operations of the NHIS over the period (2009-2012) are illustrated on Table 4.5 below. The Table with the summary statistics of cost efficiency determinants results indicates that AGE proxied for experience on efficiency is found inversely statistically significant at 5% level as a determinant of cost efficiency in the operations of the NHIS for the period 2009-2012. The inverse coefficient of AGE is -.1600541. Hence, in line with a study on the determinant of technical, allocative and economic efficiencies in plantain production industry in Ondo State, Nigeria, where for allocative efficiency, the sign of the coefficient for age was positive, depicting that the older the farmer the more allocatively inefficient he become

(Bifarin et al, 2010).

Table 4.5 Determinants of Cost Efficiency Results (2009-2012)

Explanatory Variables	Coeff.	Std. Err.	t-ratio	P>|t|	[95% Conf. Interval]	
Cons.	-5.124496	1.930872	-2.65	0.010***	-8.975499	-1.273493
Age	-.1600541	.0612828	-2.61	0.011**	-.2822787	-.0378295
Tassets	-.1924577	.0932903	-2.06	0.043**	-.3785193	-.0063962
Tprm	.605572	.1707306	3.55	0.001***	.2650605	.9460834
Lr	.0036265	.0013841	2.62	0.011**	.0008659	.006387
Tsubsidy	-.0193625	.0928908	-0.21	0.835	-.2046273	.1659023
Loc	.348167	.2526666	1.38	0.173	-.1557606	.8520946
Sigma	.7011296	.0596271			.5822071	.8200522
Pseudo R^2	0.0971					

LogLikelihood -82.847146

The P value is reported in Table 4.5 as;	Number of obs. = 76
* Significant at the 0.10 level;	LR chi2(6) = 17.81 **
Significant at the 0.05 level;	Prob. > chi2 = 0.0067
*** Significant at the 0.01 level.	

Obs. summary:
4 left-censored observations at lneff<=-2.8958869
72 uncensored observations
0 right-censored observations

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The cost efficiency results on Table 4.5 shows that Total Assets (TASSETS) proxied to control for the effect of size in the operations of the NHIS is statistical significant determinants of cost efficiency at 5% level in the operations of the NHIS for the period (2009-2012). The relation is negative with a coefficient of -.1924577 thus with the relation in line with the findings of Gardner and Grace (1993), they believe that as total assets increases, inefficiency increases. They claim that no-admit assets cause this point.

The empirical statistics of cost efficiency determinants results on Table 4.5 indicate that Total premium (TPRM) proxied for the effect of premium growth on efficiency is positively related to cost efficiency in determining the operations of the NHIS over the period (2009-2012). The relation is statistically significant at 1% level with an estimated coefficient of .605572. The relation is in line with some of the findings of Biener et al (2015) empirical study on the determinants of efficiency and productivity in the Swiss insurance companies in the life, property/casualty, and reinsurance sectors from 1997– 2013. The regression results for premium growth do not reveal a clear pattern over all subsectors. However, a positive relationship between premium growth and all efficiency measures in reinsurance

were established; for life insurance, the study observes a positive relationship for RE and for p/c insurance for TE.

Table 4.5 above indicates that with respect to Loss Ratio (LR), the determinants of cost efficiency results depicts that the ratio of Claims Incurred to Premium Earned is found positive for the duration (2009-2012). The positive relation is statistically significant determinant of cost efficiency at 5% level with an estimated coefficient (.0036265). This is consistent with Tan and Floros (2013), they assess the relationship between bank efficiency, loss ratio (risk) and capital for a sample of Chinese commercial banks employing three efficiency indexes and four risk indicators under a three stage least square method in a panel data framework. The empirical results or evidence suggests that there is a positive and significant relationship between loss ratio (risk) and efficiency in Chinese banking industry.

The results on Table 4.5 indicate that Total Subsidy (TSUBSIDY) is inversely related to cost efficiency in the operations of the NHIS over the period (2009-2012). The relation is not statistically significant determinant of cost efficiency with the estimated coefficient of -.0193625. This is in line with some of the findings of Brokmann (2015) who uses a Stochastic Frontier Analysis (SFA) to analyse the relationship between the subsidy reliance of a MFI and its cost-efficiency, using panel data of 203 MFIs from 49 different countries within a period of 8 years (2006-2013). The results revealed or shown that there is no significant relationship hence constitutes a relevant finding for public and private policy makers.

Table 4.5 indicates that, location proxied for the effect of NHIS location (LOC) on efficiency is positively related to cost efficiency with an estimated coefficient (.348167) over the period (2009-2012). The relation is not statistically significant determinant of cost efficiency in the operations of the NHIS hence in line with the works of Adu et al (2014) they studied on the demographic variables as determinant of principal managerial efficiency. Their results revealed that there is no significant difference between school locational disparities and principals' managerial efficiency. In other words, there is no significant difference in the managerial efficiency of principals in rural and urban areas (locations).

4.6 The Test Results for Hypothesis

The technical efficiency and cost efficiency results on table 4.2 and table 4.3 respectively indicates that while some NHIS operates at optimal levels (i.e efficient and provides support for hypothesis 1 and 2) in either all or certain periods over the period of study (2009-2012) others (NHIS) are not at all. The technical efficiency determinant results on Table 4.4 also depicts that TASSETS is inversely related to technical efficiency (i.e hypothesis 3 is not supported) in the operations of the NHIS over the period (2009-2012) while in the case of TSUBSIDY, the relation is positive (i.e hypothesis 4 is supported) for the period (2009-2012). The cost efficiency results of the determinants on Table 4.5 also show that both TASSETS and TSUBSIDY are negatively related to cost efficiency (i.e hypothesis 5 and 6 are not supported).

The study concludes that AGE, TASSETS, TPRM, and LR except TSUBSIDY and LOC are all significant determinants of the NHIS's operations in terms of cost and technical efficiency as they influences the operations of the NHIS in one way or the other over the period.

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CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of the main work, summaries of key findings, conclusions drawn, recommendations and limitation of the study.

5.1 Summary

Measuring cost and technical efficiency in the operations of the NHIS in Ghana is a vital issue. The study main objective is to measure cost and technical efficiency in the operations

of the NHIS in Ghana using Ashanti Region as the case study over the period (2009-2012). The specific objectives of the research were centred in measuring; the technical efficiency in the operations of the NHIS, cost efficiency in the operations of the NHIS as well as estimate determinants of the observed level of cost and technical efficiency in the operations of the NHIS.

The empirical DEA- cost and technical efficiency models as well as the use of tobit regression model were the methods employed for the study. The use of DEA-cost and technical efficiency model was justified base on: Coelli et al. (1998) that it is the preferred method of efficiency analysis in the non-profit sector where: random noise is less of a problem; multiple-output production is relevant (i.e the demerits of SFA) (cited in Zere, 2000); its total objectivity in the establishment of weights for the input and output measures that is considered to be a major benefit (Braglia and Petroni, 2000) and its potential feedback through the provision of helpful information to managers for use in improving performance, via quality decision making (Easton et al., 2002). Even though, for Lovell (1993) and Coelli et al. (1998) there are two major drawbacks (i.e merits of SFA) to this method: first, the DEA is non-stochastic and second, it is non-statistical (cited in Zere, 2000). But Ferrier and Valdmanis (1996), however, argued that, these drawbacks may not be as serious as they initially seem. First, specification error that might show up as a noise is ruled out. Secondly, as inputs and outputs are measured in their natural physical units, a measurement error is most unlikely.

Meanwhile the choice of tobit regression has been justified with the fact that, the efficiency scores computed with the DEA model have a limiting value (the range is from zero to one)

and OLS regression will produce biased parameter estimates (Austin et al., 2000) cited in (Chang and Lan, 2010). Therefore, adoption of Tobit regression gives more accurate parameter estimates (Chang and Lan, 2010).

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5.2 Summaries of Key Findings

The main findings drawn from the study are; first, the technical efficiency model indicates that only one NHIS i.e R NHIS (18) of the sample units (NHIS) operates at its optimal capacity throughout the period under review (2009-2012). The finding is remarkable and implies that in terms of technical efficiency in the operations of the sample NHIS, R NHIS (18) is combining its inputs better than its peers in producing its outputs.

Secondly, the technical efficiency results or scores suggest a higher average efficiency results or scores, thus 0.719, 0.704, 0.701 and 0.730 respectively over the period of study (2009-2012), even though some level of inefficiencies still exist.

Thirdly, the cost efficiency results or scores also indicate that none of the sample units operates at optimal level throughout the period under review (2009-2012). Even though, while some attained optimum level for some periods, others are not at all.

Fourthly, the cost efficiency results or scores revealed that on average, the efficiency results are low. That is 0.555, 0.441, 0.404 and 0.419 respectively over the period of the study (2009-2012).

Further, the determinant of technical efficiency results indicates that only AGE, Total Assets (TASSETS) and Location (LOC) that are inversely related to technical efficiency in the operations of the NHIS for the period (2009-2012). The relation indicates that both AGE and Total Assets (TASSETS) are statistically significant determinants of technical efficiency at 1% and 5% level respectively while Location (LOC) is statistically insignificant. The results also shows that only Total Premium (TPRM), Loss Ratio (LR), and Total Subsidy (TSUBSIDY) that are positively related to technical efficiency throughout the period (2009-2012), where both Total Premium (TPRM) and Loss Ratio (LR) are significant determinants at 1% level while statistically insignificant in the case of Total Subsidy (TSUBSIDY).

The cost efficiency determinants results indicate that only AGE, Total Assets (TASSETS) and Total Subsidy (TSUBSIDY) that are negatively related with cost efficiency in the operations of the NHIS for the period (2009-2012). The inverse relation is statistically significant at 5% level with respect to both AGE and Total Assets (TASSETS) while insignificant in the case of Total Subsidy (TSUBSIDY). The findings also depicts that only Total Premium (TPRM), Loss Ratio (LR) and Location (LOC) that relates positively with cost efficiency over the period (2009-2012), where; Total Premium (TPRM) and Loss Ratio (LR) are statistically significant determinant of cost efficiency at 1% and 5% level respectively while statistically insignificant with respect to Location (LOC).

5.3 Conclusions

The study applied DEA-Technical Efficiency Model and DEA-Cost Efficiency Model to estimate the efficiency levels of the NHIS as well as a regression to estimate the determinants of technical and cost efficiency in the operations of the NHIS over the period (2009-2012). The main conclusions drawn from the study's findings include; first, the technical efficiency results indicates that only one NHIS i.e R NHIS (18) of the sample units operates at its optimal capacity throughout the period under consideration (2009-2012).

Secondly, the efficiency result reveals that on average, technical efficiency results are higher, thus 0.719, 0.704, 0.701 and 0.730 respectively over the period (2009- 2012), even though some level of inefficiencies still exist while the cost efficiency results on the other hand suggests that on average, the results are low, thus 0.555, 0.441, 0.404 and 0.419 respectively on over the period under consideration.

Thirdly, the estimated average technical efficiency level lies between 70% and 73% while the estimated average cost efficiency level also fall between 40% and 56%, thus suggest that with respect to inputs combination, the NHIS in the region technically combines inputs more efficiently than cost in the production of their outputs. Even though, there is much more cost inefficiencies associated with the operations of the NHIS, there is still evidence of reducing them across the years if managers ensure maximal efficiency in the operations of the NHIS. Harrison et al., (2004) research in the United States for the period of four

years (1998-2001) for instance, clearly indicated that if hospitals managers ensure maximal efficiency in the operation of hospitals they can achieve potential cost savings.

Fourthly, the determinant of technical efficiency results indicates that only AGE, TASSETS and LOC that are inversely related to technical efficiency in the operations of the NHIS over the period (2009-2012). The relation indicates that both AGE and TASSETS are statistically significant determinants of technical efficiency. The results also show that only TPRM, LR, and TSUBSIDY that are positively related to technical efficiency for the period (2009-2012), where both TPRM and LR are statistically significant determinants.

Further, the cost efficiency determinants results indicate that only AGE, TASSETS and TSUBSIDY that are negatively related with cost efficiency in the operations of the NHIS for the period (2009-2012). The inverse relation is statistically significant with respect to both AGE and TASSETS. The findings also depicts that only TPRM, LR, and LOC that relates positively with cost efficiency over the period (2009-2012), where; TPRM and LR are statistically significant determinant of cost efficiency. The study concludes that AGE, TASSETS, TPRM, and LR except TSUBSIDY and LOC are all significant determinants in the operations of the NHIS in term of cost and technical efficiency as they influence the operations in one way or the other.

5.4 Recommendations

This aspect provides the policy implications of the results obtained. Firstly, adequate training should be organised by experts (professionals with in-depth knowledge on efficient scarce resource utilisation to ensure optimal level of output) for managers, accountants as

well as other staffs of the NHIS in the region on timely basis regarding efficient scarce resources/inputs combination in order to help reduce the inefficiencies associated with the operations of the NHIS particularly with respect to cost inputs usage.

Secondly, more branches or subsidiaries of the NHIS in the region should be considered or established as this will assist reduce the inefficiencies associated with increases in size of existing NHIS in terms of their operations and enhance greater access to health services by the citizenry.

Thirdly, a comprehensive financial accounts and timely publication in the operations of the NHIS in the region should be legally mandated on yearly basis. Since this will assist check their operations in terms of cost and technical efficiency.

Future studies may consider analyzing cost and technical efficiency in the operations of the Private Mutual Health Insurance Schemes (PMHIS) and Private Commercial Health Insurance Schemes (PCHIS) in the region. This will help establish the performance levels of these insurance schemes in the region in terms of cost and technical efficiency.

5.5 Limitation of Study

Considering the number and the fact that the NHIS in the Ashanti region were situated quite far away from each other and what it takes financilally to reach all the NHIS in the region knowing that business schedule constraints inevitably results in making several trips to and fro the NHIS. To circumvent this bottleneck, I had to devise an easier way by choosing 10% level of precision in order to reduce the number to a sample size of 19

NHIS from a total population of 23 NHIS.

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APPENDICES

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Date. January 17, 2014

TO WHOM IT MAY CONCERN

LETTER OF INTRODUCTION: MR ALPIOK EBENEZER

Mr. Akpiok Ebenezer is a final year postgraduate student of the **MPhil (Economics)** programme at the Faculty of Social Sciences; KNUST. He is collecting materials for his Thesis work in partial fulfillment of the requirements for the award of **MPhil** degree.

The title of the thesis is **"Cost and technical efficiency of the operations of the metro and district national health insurance schemes (MDNHIS) in Ghana".**

Any courtesies extended to him will be very much appreciated.

DR. (SR) E. AMPORFU
HEAD OF DEPARTMENT

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NHIS
Your access to healthcare

Our Ref. No: NHIA/R&D/001
Your Ref. No:

27th February, 2014

Dear Sir/Madam,

REQUEST FOR INFORMATION

The bearer of this letter Ebenezer Akpiok from Kwame Nkrumah University of Science and Technology (KNUST) is writing his thesis on the topic: **cost and technical efficiency of the operations of the metro and district national health insurance schemes (DNHIS) in Ghana,** of which data on inputs and outputs variables of **DNHIS** are needed for the work.

I have been directed to ask you to provide the needed information as per the attached questionnaire.

Thank you for your co-operation.

Yours truly,

.....

Dr. Francis Asenso-Boadi

Dep. Director, R&D

For; (CEO NHIA)

2. DATA INSTRUMENT (QUESTIONNAIRE)

Dear Sir /Madam,

This instrument is designed on the topic: **Cost and technical efficiency in the operations of the National Health Insurance Scheme (NHIS) in Ghana: The case study of Ashanti Region** as the thesis in partial fulfilment of the requirements for the award of Mphil Degree in Economics. I would be very grateful if you could kindly take some time to provide information to this instrument.

Note: The research is being conducted mainly for academic purpose, nothing else, hence any information provided would be held in high confidentiality.

NAME OF SCHEME: …….... YEAR STARTED.....

Year	Total Prem -iums	Total Subsi -dy	Total Assets	Total Claims Incurred	Total Labour (Emplo -yees)	Non-Labour Expenses	Total Fixed Assets (Capital)	Total Labour Cost	Total Operating Costs
2009									
2010									
2011									
2012									

Amounts in Ghana cedi

Name: .....

Signature: .....

Date: .....

Stamp: .....

Operational Meaning/Definition of Variables

Total Premium: means the total amount of money paid by the policyholder for insurance over a defined period of time. In other words, the total specific amount collected by the insurer (scheme) to provide insurance coverage under a given defined period of time. **Total Assets:** means the total amount of all the things owned and considered useful or helpful by the scheme i.e. total current plus total fixed assets.

Total Incurred Claims: the total amount of money paid to health care providers by the scheme upon the occurrence of a specific loss.

Total Subsidy: The total amount of money that is paid usually by the government to the scheme in order to provide insurance coverage for people like that of the exempted groups.

Total Labour (Employees): The total number of people or personnel employed by the scheme.

Admin & Logistical Expenses (Non-Labour Expenses): Costs that excludes labour costs but made up of every other variable cost associated with the general administration of the scheme

Total Fixed Assets (Capital): that is the total expenses made on assets which the scheme uses on a continuous basis, such as property, plant and equipment.

Total Labour Cost: the sum total of all wages paid to the employees, as well as the cost of the employees benefits and payroll taxes paid by the employer (scheme).

Total Operating Costs: costs associate with administering the scheme on a day to day basis. Operating costs include both fixed costs and variable costs.