A MEASUREMENT OF EFFICIENCY AND PRODUCTIVITY IN HEALTH FACILITIES IN GHANA: A CASE STUDY OF THE ASHANTI REGION

By

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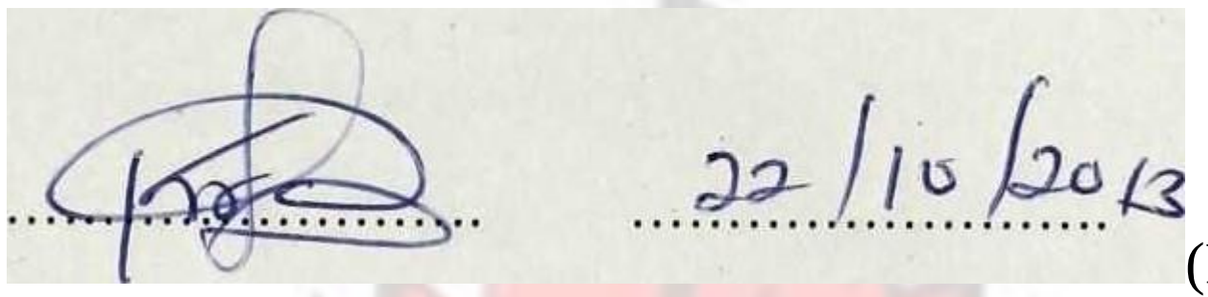
DECLARATION

I hereby declare that this thesis submitted herein is an original work I have personally undertaken under supervision of Mr. E. F Oteng-Abayie except where due acknowledgement has been made

in the text.

Date Okyere Krapah  (PG5542111)

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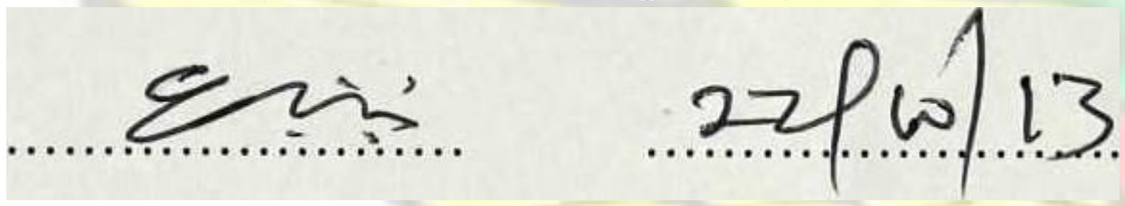

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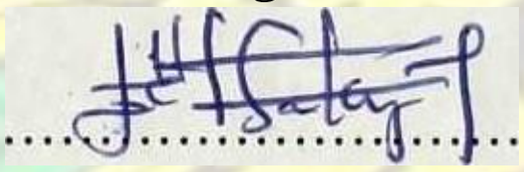
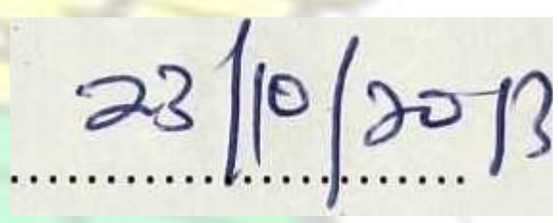
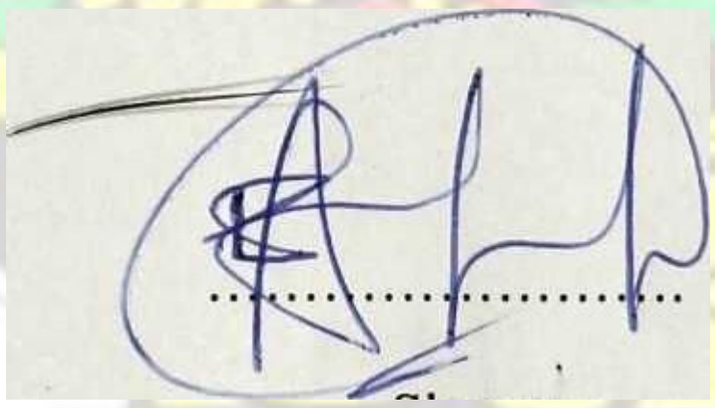
Certified by Dr: Daniel Sakyi 





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DEDICATION

this work is dedicated to Madam Georgina Fosuah, my mum and Mr. C.S Antwi, my Dad. I also want to dedicate I t my siblings; Rebecca and Godfred.

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My utmost gratitude is to the Most High God, for his guidance, protection and inspiration throughout the work. I also express my profound and sincere gratitude to my supervisor, Mr.

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ABSTRACT

Amongst the aim of every organization, is to maximize output. Unfortunately organization are unable to meet this objective basically due inefficiency. Inefficiency has brought a deviation between realized and potential outputs. It is the believed that the healthcare system in Africa and for that matter Ghana has not been efficient. Government of Ghana has over the years increased its allocation to the health sector in order to increase quality healthcare but productivity remains low. Using the Data Envelopment Analysis, the study measured the

efficiency levels and productivity changes of some selected health facilities in the Ashanti Region. 24 health facilities were selected. The major finding was that, facilities with large amounts of inputs tend to be inefficient. Also efficiency could improve without necessarily increasing inputs. In view of this health facilities should maintain input levels that correspond to their output level. User cost could be reduced to attract more patients to the facilities.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

"If scarcity did not exist, there would be no need to consider equity (who gets and who pays what and how much) or efficiency (what are the costs and what benefits of different arrangements)...." (Wagstaff and Van Doorslaer, 1993). The 2000 world Health Report called the attention to the importance of efficiency on the functions of a health system in ultimately achieving the goals of health improvement, responsiveness and fairness in financing (Hsu, 2010),and in a world with an ever increasing business environment and opportunities, continuous improvement in efficiency is vital for any successful organizations. Hospitals and health centres are no exceptions.

Productive efficiency consists of technical efficiency and allocative or factor price efficiency. Productive efficiency represents the efficient resource input mix for any given output that minimizes the cost of producing that level of output or, equivalently, the combination of inputs that for a given monetary outlay maximizes the level of production. Technical efficiency reflects the ability ofa firm to maximize output for a given set of resource inputs, while allocative (factor pricey efficiency reflects the ability of the firm to use the inputs in optimal proportions given their respective prices and the production technology (Forsund et al., 1980).

Improvements in efficiency and productivity gains can be considered as one of the goals of a firm in a competitive market. Therefore, measurements in efficiency and productivity gains are the non-financial performance indicators used for firm's performance. In any organization, whether it is profit-oriented or not, measurements of productivity help to analyze the efficiency of resource use in the organization. Moreover, productivity indices help to set realistic targets for monitoring activities during an organizational development process by highlighting bottle-necks and barriers to performance (Kamau, 2011).

Improving efficiency in the provision of health care is a major problem facing most developing countries especially Ghana, mostly due to an increasing population, though constrained with inadequate resources and health care personnel. It is common knowledge that health care systems in developing countries are inefficient. A world Bank's report on financing Health Service in developing countries (Aikin et al, 1987) indicates that one of the major problems of African health care systems is the inefficiency in government health programmes and the others being problems of allocations and inequity. Ghana is a clear example of such a health system.

Ghana, a developing country, has had a lot of health sector reforms since independence, with all basically aiming at increasing the coverage of quality health care. The reforms also targeted the efficiency with-Which resources are utilized and in service delivery. 'The reforms were to

improve the level of productivity on the health care sector.

In line with this, vision 2020 in 1995 had strategic health objectives of a significant reduction in rates of infant, child and maternal mortality, effective control of risk factors that expose individuals to major communicable diseases increase access to health services especially in rural areas (Osei et al, 2005).

Other programmes were Basic minimum package of service emphasizing on public health care including reproductive health, decentralizing greater management and financial responsibility to districts etc. These and other reforms on the health sector have always had problems materializing basically due lack resources and inefficiency with which resources are used.

With all these sector reforms Ghana still has inadequacy of resources in the health sector. The Health expenditure; total (0/0 of GDP) in Ghana was last reported at 5.22 and the health

expenditure per capita (US dollar) in Ghana was last reported at 67.03. Hospital bed per 1000 patients is 1.46 and physician per patient is 0.15 per 1000 (World Bank, 2012). The need for efficiency therefore has become a paramount challenge to healthcare delivery in Ghana.

Unfortunately, there have been a few literatures on efficiency and productivity in healthcare system in developing countries, especially Ghana. Out of 188 studies reviewed by Hollingsworth in 2003, only one study of Zere et al (2000) examined efficiency and productivity of hospitals in South Africa, a developing country. There is somehow an appreciable improvement in the number of empiriCal analysis on this issue. Amongst them are Tlotlego et al (2010) in Bostwana, Kirigia et al (2010) in Benin and Osei et al (2005) on Ghana's hospitals' efficiency. Efficiency of primiry care in rural Burkina Faso was also done by Paul Marshall and Steffen Flessa (2011). Inspired from empirical literatures, which have investigated the efficiency and productivity of hospitals around the world; it is important to examine how efficient Ghanaian hospitals are. The study measures the relative efficiency and changes in productivity of hospitals during the health reform process from 2008 to 2011, and then highlight possible policy implications of the results for policy makers.

1.2 Problem statement

For productivity to increase in any organization, that organization should be operating at a higher level of efficiency for a given resource. Ghana in its quest to expand coverage of quality of healthcare delivery has come out with a lot of programmes and reforms. Though, there have been some achievements made by these programmes, the level of productivity in hospitals in Ghana still remains, low. An argument is normally made on inadequate resources, lack of healthcare personnel especially in the rural areas; but the greatest challenge to productivity in health facilities remains, inefficiency.

Surprisingly only few works on productivity and efficiency in health facilities have been done in Ghana and the very few, for instance Osei et al (2005), attest to the fact that a high rate of inefficiency existin our hospitals and health centres in Ghana.

Thiš—cqearly shows that not much attention has been given to efficiency by providers, though a lot of resources have been pumped into the sector. It is incumbent on researchers and policy makers to take a critical look and delve into issues of efficiency and productivity especially in health facilities in Ghana.

1.3 Research objectives

The main objective of the study is to examine the relative technical efficiency and productivity of hospital in Ghana, with a non-parametric model.

Specifically the study seeks;

1. To evaluate the technical efficiency of some selected health facilities in the Ashanti Region.
2. To examine the changes in productivity in the health facilities within the period of study.
3. To assess some of the factors that are likely to influence efficiency (inefficiency) in health facilities.
4. To make recommendations for facility managers in the health care sector especially in the Ashanti Region.

1.4 Scope of Study

Thirty (24) hospitals and health centres are selected from the Ashanti Region. Facilities were from both the public and the private sector. From the public sector, facilities are selected from the district hospitals and health centres. The period of study is from 2008 to 2011. The Ashanti Region will be as the study area.

1.5 Justification

The significance of the study is to appraise the performance of hospitals in Ghana. This will inform policymakers and authorities the need to put in appropriate measures in improving efficiency and productivity in hospitals and other health centres. The research will add to literature and serve as a basis for further research work for other students.

1.6 Organization of the study

Chapter one highlights, the background of the-study, problem statement and justification, the objectives of the research, scope of study, methodology, and limitation. Chapter two examines some related literate on efficiency and productivity on hospitals. Chapter three presents the theoretical analysis for the Data envelopment analysis (DEA) and productivity measurement, tobit OLS regression analysis-fertõ§tûdy. Chapter four highlight data sources sample methods data description and presentation of data. Data analysis, findings, conclusion and recommendation are done in chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section of the paper brings to light the theoretical underpinnings of basic concepts that relate to the topic. The first part reviews the Ghanaian health system. The second part reviews other related research works explaining concepts such as definitions of efficiency and productivity; forms of efficiency; measurements of efficiency (estimation techniques) and factors influencing efficiency in hospitals under the theoretical or conceptual framework. Again, similar works done in this area has also been reviewed under the empirical evidence.

2.1.0 A preview of the Ghana Healthcare System

Ghana, a former British colony has a total land area of 239,460 km^2. Majority of the country's land is tropical and partly savannah. Ghana is a low income developing country located in subSaharan Africa and situates on the Gulf of Guinea in the south and bordered by the Republic of Togo, the Ivory Coast and Burkina Faso. It is estimated from the 2010 population and housing census that Ghana has a population of over 24 million with a growth rate of about 1.9%.

The life expectancy at birthg_Qhana-is-estimated to be 57.7 years: 55 years for males and 59.2 years for females (MOH). The probability of dying (per 1000 live births) between ages 15 and 59 years is 303. The maternal mortality per 100 000 live births is 214. There are slightly more women (53 per cent) than men (47 per cent) in the overall population. Infant mortality worsened from 64 per 1000 live births in 2003 to 71 in 2006 (US Census Bureau, 2008). Ghana recorded an under-five mortality rate of 111 per 1,000 live births in 2006 (MOH).

The healthcare system in Ghana is organized under four main categories of delivery systems in Ghana: public, private-for-profit, private-not-for-profit and traditional systems. Efforts are being made since 1995 to integrate traditional medicine into the orthodox mainstream (Abor et al, 2008).

The Ministry of Health is the supreme body which super sees all activities in the healthcare system in Ghana. The ministry is also responsible for policy planning processes and information management, particularly concerning the areas of financing, human resources and infrastructure (MOH, March 2008).

There are three main bodies under the Ministry of Health: Public sector; Private Sector; and the Traditional Sector.

Under the public sector are the Ghana Health Service; Teaching Hospitals; Quasi Government Institution Hospitals. The Ghana Health Services also has under it, Government Hospitals; PolyClinics; and Healtwcentres.

The-private sector has the Mission-Based Providers and Private Medical and Dental Practitioners with the supervising body being The Private Hospitals and Maternity Homes Board. The traditional sector has; Traditional_Medical Providers; Alternative Medicine; and Faith Healers with the supreme body being the Department of Traditional and Alternate Medicine (Abor, et al, 2008).

The country's health services are organized at the Community; Sub-district; District; Regional; Tertiary; and National levels (Osei et al, 2005).

Community health centre delivers outreach programmes, and also care through herbalists, traditional birth attendants and/or retail drug peddlers.

Sub-district health centre provides primary health care (curative care, disease prevention services and maternity services). A health centre constitutes an essential component of the closeto-client health services. It services a geographical area with 15 000 to 30 000 population.

A district hospital provides support to sub-districts in disease prevention and control, health promotion and public health education; referral outpatient and inpatient care, training and supervision of health centres; maternity services, especially the management of complications and emergencies and surgical contraception.

A regional hospitál provides specialized clinical and diagnostic care; management of high-risk pregnancies and complications of pregnancy; technical and logistical back up for epidemiological surveillance; and research and training.

A teaching hospital (tertiary) provides specialized services; undertake research; and provide undergraduate and postgraduate training in health and allied areas.

With a population of a little short of 23.5 million people in, there were only 1,439 health care facilities (IRIN, 2008). Access to these facilities remained a problem: Medical facilities were not evenly distributed across the country, with most rural areas lacking basic facilities such as hospitals and clinics as well as doctors and nurses (Van den Boom et al, 2004). Ghanaians on average live about 16 km from a healthcare facility where they can consult a doctor, but half of the population lives within a 5 km radius. By the same token, the other half cannot consult a doctor within 5 km, which corresponds to a 1 hour walking distance, and one quarter even lives more than 15 km from a facility where a doctor can be consulted.

Ghanaians enjoyed free medical care till the mid 80's. In 1985, the government of Ghana introduced user fees into the health services marking a significant shift in health policy towards cost recovery, decentralization of management and rationalization of services. A series of actions towards restructuring its health sector began in the early 1990s. This included developing a Basic

Minimum Package of Services; refocusing the emphasis on PHC including Reproductive Health; decentralizing greater management and financial responsibility to Districts.

The Ministry of Health, following the thrust of Vision 2020, developed its current policy and strategy guidelines in 1995 in the Medium-Term Health Strategy (MTHS) document. The five main objectives of the MTHS are: improving access to health services; improving quality of care; improving efficiency; fostering partnership between private and public health serviceproviders; and improving financing of health services.

The country spends a total of US$ 252 million (4.2% of the GDP of US$ 6 billion) annually on health. About 53.5% of this expenditure is incurred by the government and 46.5% by the households through out-of-pocket expenses. The total per capita expenditure on health at an average exchange rate is US$ 11.

In 1983, the government adopted the International Monetary Fund (IMF) and World Bank-promoted Structural Adjustment Program (SAP). Since a key component of the SAP was to reduce government expenditure to the barest minimum, the full burden of paying for health care was borne by patients.

The National Health Insurance Scheme (NHIS) was introduced in 2003 by the National Health Insurance Act, 2003, Act 650 with the view to improving financial access of Ghanaians, especially the poor and the vulnerable, to quality basic health care services. Under the NHIS, the rich subsidizes the poor, the healthy subsidizes the sick and the economically active pays for children, the aged and the indigents (NHIS, 2011). The funding of the insurance scheme is based on a cross-subsidization system. In this payment system, "the rich" is supposed to "subsidize t. . .] the poor", "the healthy-sttbšîðîîšíhe sick" and "the economically active adults pay for children, indigents and the aged" (70 years and above) (Hepnet, 2007). Through the Social Security and National Insurance Trust (SSNIT), workers contribute 2.5 percent of their salaries.

The minimum premium of GHÉ7.2 is paid per annum from informal workers (Hepnet, 2007). According to the scheme, Ghanaians are supposed to pay an annual fee according to their income (CBC, 2005). The government covers the aged, indigent and children whose parents pay into the scheme. Financing comes through a 2.5 percent National Health Insurance Levy on selected goods and services. It is also funded by the HIPC initiative (CBC, 2005).

Three types of insurance schemes exist under the National Health Insurance Scheme. A DistrictWide Mutual Health Insurance scheme through which the workers of the public sector directly pay a share of their wages into the health insurance system; a Private Mutual Health Insurance scheme, through which subsistent farmers, people working in the informal sector and unemployed people who were not formerly employed in the public sector are to pay their contribution; and a Private Commercial Health Insurance Scheme, through which those employed by larger companies and multi-national companies pay their contributions (Hepnet, 2007).

Benefit package covered within these schemes include; full Out Patient admission treatment (surgery and medical) cost including feeding; full payment for medicine if within the approved list; payments for referrals. Exclusion from the list include; treatment not covered by the scheme, entails: appliance, prostheses, rehabilitation, dentures, organs aids, cosmetics surgery and assisted reproduction; HIV retroviral drugs, hormone and organ replacement therapy; Heart and brain surgery other than accidents; Diagnosis and treatment abroad; as well as Dialysis for chronic renal failure and cancsrsáHepnetJ2007). Despite massive efforts by the government, the health care system is still characterized by underfunding and a lack of personnel: The Ghana Health Service acknowledges that there is an "urgent need for additional health facilities and more qualified health personnel, especially in rural communities" (IRIN, 2008).

In quest to increase total health coverage among Ghanaians improve efficiency in health care delivery, the Government of Ghana has introduced and implemented various health sector reforms (e.g. user fees in public health facilities, NHIS, etc). Hospitals and health centres also consume over 75% of both the recurrent and capital budgets of the Ministry of Health but they still characterized by high

level of inefficiency (Osei, 2005). Majority of hospitals and health centres assessed by Osei in 2005 were both technical and scale inefficient.

2.2.0 THEORETICAL REVIEW

2.2.1 Meaning of Efficiency

Efficiency is a comparative concept. It is a result of transforming input into output is compared to a benchmark which is basically represented by the best-practice case (Burger and Moormann, 2008). The precise definition of the underlying elements, however, depends on the particular case at hand (Forsund and Hjalmarsson, 1974).

Efficiency is a measure of the deviation between actual performance and desired performance (Frimpong, 2010). To Hsu (2010), efficiency (technical) refers to the extent that resources are not being wasted. It measures the degree of producing the maximum amount of outputs from a given

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amount of inputs or, conversely, using the minimum. A scientific definition of efficiency usually foliõWÇthe Pareto-Koopmans concept. "Full (100%) efficiency is attained for an object [.. .l if and only if none of its inputs or outputs can be improved without worsening some of its other inputs or outputs" (Cooper, Seiford and Zhu, 2004). Examples of inefficiencies are excessive hospital length of stay, over-prescribing, over-staffing, use of branded over generic drugs, and wastage of stock.

There are two major concepts that provide the basis for traditional view of efficiency; Pareto optimality and perfect competition. Pareto optimality is a static concept of affairs within which no possible change can be made resulting in one person being better off, without the other being worse off. With this, the neoclassical view of perfect competition where price equates marginal cost comes to play (Cordato, 1980).

Culyer (1991) has explained efficiency in the healthcare system as:

- providing only those services, a regulatory environment, and other structures that are effective in the sense that patients enjoy better health with the services than without them; providing effective services at least resource cost; concentrating resources on those services that are provided at least cost and offer the biggest pay-off in terms of health; providing such a mix of effective services at the least resource cost and on such a scale that the benefit from using resources is neither larger nor smaller than their cost.

2.2-ïForms of Efficiency

Efficiency is mostly viewed in three forms; cost efficiency, scale efficiency; technical efficiency and allocative efficiency.

Cost efficiency is defined as the minimum observed cost for producing a level of output. Cost efficiency involves minimizing total cost of production for a given 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.

Suppose a producer uses capital K, labour L, and other intermediate inputs and suppose 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 (hospital) is only efficient when it chooses an input combination (K; L;M) to minimize total cost rK+ WL + wmM to achieve an output level Y(Yu, 2011).

Scale efficiency refers to the impact on unit costs as the volume of production increases (Mwase, 2006). This happens because, as the number of units (e.g., patients) increases, fixed costs (e.g., the salaries of medical staff) are spread over a larger number of units, thus reducing cost per unit. A health facility that sees more patients given its fixed cost is likely to have lower unit over a certain range of output, after which it is possible to increase its total cost due to increases in output. It is

possible to find an optimum range of bed numbers, inpatient days, or outpatient visits at each level of facility, below and above which average costs will increase. This is what is known as scale (or economies of scale). Analyzing efficiency according to this measure can be done by developing cost functions for the short-run where some costs are fixed

(Wagsíaff and Barnum 1993).

Allocative efficiency refers to the selection of inputs to produce a certain level of output at a certain level of input prices which the cost of production is the minimum (Al-Delamiand, and AlAni, 2006). The hospital is efficient when the product mix attains maximum social welfare. When resources are efficiently allocated, it is not possible to make one person better off without making another person worse off(Pareto optimality).ln the health care system, allocative efficiency takes the form of allocation of resources among different types of diseases, patients, geographical areas (urban/rural), socio-economic groups, services (curative/preventive), and levels of care (tertiary, secondary and primary) (Mwase, 2006).

A firm is considered technically efficient if it is not possible to reduce the level of inputs to produce a given level of output (Forsund et al., 1980).Technical efficiency addresses the question of whether the producer maximizes outputs with given inputs at the prevailing technology. In other words, the producer utilizes the resources in the most efficient way. The existence of technical inefficiency would mean that some inputs can be reduced without affecting the level of output (Satya and Jreisat, 2012). Not all input combinations used in the process of health care delivery are technically efficient. Sometimes inappropriate inputs are combined, leading to waste of resources. This includes poor deployment of staff, poor distribution of drugs and medical supplies, and inappropriate use of equipment, all situations that are common in developing countries (Worl&-Oank 1994).Suppose a producer uses capital K, labour L, and other

intermediate inputs M to produce a single output Y, technology is represented by the production futïCt1ón F as follows:

$$Y = f(K; L;M) \quad \ldots\ldots\ldots\ldots (1)$$

Technical efficiency is achieved when the inequality in (1) turns into an equality. In general, a producer can be inefficient due to obsolete technology or poor management (Yu, 2011).

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 (hospital) chooses output level Y and input bundle (K; L; M) to maximize profit, which is;

$$py - (rK + WL + wmM) \quad (2)$$

It can be seen from (2) that this cannot be achieved unless the producer produces the best possible amount of output with the lowest possible total cost (Yu, 2011).

2.2.3 Measurement of Efficiency (Estimation techniques)

Two approaches are mostly used for measuring the frontier function of efficiency. They are the non-parametric method (Charnes et al, 1978) and the parametric methods (Aigner and Chu 1968, Ali and Chaudry, 1990). The parametric methods are considered to be more sophisticated compared to non-parametric techniques, whereby the estimation of efficiency is based on economic optimization, given the underlying assumption of a stochastic optimal frontier. The parametric techniques mostly frequently used include the Stochastic Frontier Approach (SFA)and the Distribution Free Approach (DFA) (Kiyota, 2009). Parametric methods allow for incorporating both input allocative and technical efficiencies. The SFA decomposes random error terms and the production unit inefficiency and takes into account the existence of exogenous shocks.

The non- parametric approach also known as Data Envelopment Analysis is widely used and is considered for the study.

The Data Envelopment Analysis (DEA)

Data Envelopment Analysis is widely used due to its simplicity. DEA was first proposed by Charnes et al. (1978). Their work was based on a seminal paper by Farrell (1957). DEA defines a production frontier of the most efficient producers which envelopes all others such that those on the frontier are considered efficient and those below are inefficient. The degree of inefficiency is the ratio of actual to optimal performance. It is a non-parametric linear programming methodology for evaluating relative efficiency of each production unit among a set of fairly homogeneous decision-making units, e.g., district hospitals, health centres, etc. It sketches a production possibilities frontier (data envelop or efficient frontier) using combinations of inputs and outputs from best performing health facilities (Sebastian and Lemma, 2010). It uses little assumptions and requires simple functional form.

DEA can be used to evaluate the efficiency of a firm by comparing it with a 'best practice' or output efficient An output efficient firm would have a score of 100% or 1.00 as being located on the output efficien frontier whereas an output inefficient firm would be inside the andhave a score of less than 1.00. DEA allows for the selection of multiple outputs and inputs in complex production environments based on managerial concerns (Suzuki and Sastrosuwito, 2011).

There two major challenges of using the DEA (Lovell 1993, Coelli, 1998). First, the DEA is non stochastic and does not capture the random noise. Any deviation from the "best practice frontier" (the estimated frontier) is interpreted as inefficiency. At times some deviations could be as a result of statistical errors. It is also difficult to conduct statistical tests of hypotheses concerning the inefficiency and the structure of the production function (Osei, 2005).There is no need for economic optimization but rather focuses on technical efficiency (Kiyota, 2009). The foundation of the Stochastic Frontier Analysis was laid independently by Aigner et al (1977) and by Meeusen and van den Broeck (1977).

There have been advances to estimate technical change, efficiency change, and productivity change measures using stochastic frontier analysis (Kumbhakar and Lovell, 2000; Greene, 2004) in recent times. Data mostly is the cross-sectional data (Alabi and Osifo, 2005; Amos, 2007), and time series (Miljkovic and Shaik, 2010).

2.2.4 Factors Influencing Efficiency in Hospitals

Marschall and Flessa (2011) observed that accessibility of primary health care on the demand side and staffing on-the supply side were the factors influencing efficiency of hospitals Burkina

Faso. Tlotlego et al (2010) in Botswana showed that efficiency depends on the availability of apprõþñate health technology, complementary inputs and institutional changes; the existence of channels of communication between health policy-makers and hospital management teams; access to new appropriate technologies at affordable prices; availability of training facilities opportunities to enable relevant health workforce to acquire new skills to take full advantage of a new technological possibility; and the availability of funds to finance the needed health technology investments.

In Benin, Kirigia et al (2010) observed that efficiency depends on human resources, number of beds at the primary health level, reducing non salary running costs.

Tlotlego et al, 2010 identified increase in the number of outpatient visits and inpatient days are ways hospitals could be efficient in Botswana. Reducing the number of hospital staff in some hospitals is another way to improve efficiency and productivity in hospitals.

Hsu (2010) observed that demand factors such as income levels, population density and purchasing power of the public sector influences technical efficiency in South Africa. Also the availability of

resources (human resources and infrastructure) and decision-making ability are constrains to the overall ability of providers to choose an efficient input/output mix.

Akazili et al (2008) found that those receiving incentives from the Health Management Team in Ghana were likely to be technically efficient.

The measurement of efficiency in the healthcare sector is difficult both conceptually and

lly (Grosskopf and Valdmanis, 1987) due to the production process. Health status is a function of many variables, most of them exogenous to the health sector e.g. household income, education etc (Zere, 2010).

2.2.5 Measurement of Output in Health Care

Output is defined as the total value of all flows of commodities produced by establishments classified to the industry. It is also confined to commodities produced by establishments within the industry and sold outside the enterprise. It is defined as net of all intra-industry transactions, i.e. excluding not only the transfers between the establishments in an industry belonging to the same enterprise but also all flows between establishments in that industry belonging to different enterprises. In this case, the definition of output will depend on the level of industry aggregation adopted (ABS, 1996)

The output of health sector is more difficult to define and measure since most services are less tangible and tend to be more heterogeneous. The measurement of quality and productivity is well defined in a manufacturing context, but no such measures for healthcare services is (Grönroos; Ojasalo, 2004). Quality measurement involves high complexity as the healthcare sector is highly regulated, thus comparing e.g. value for money of the service rendered might not be an appropriate signal for quality (Tirole, 1988).Patients are not able to assess and compare the quality of the medical treatments they receive caused by missing expertise and an inability to relate the healthcare result with the treatment received (Ting et al., 2009).

In measuring output in the health sector, Cutler and Berndt (2001) argue that ideally quality of life should be measured with revealed preference analysis-using the choices that individuals actually make between different treatments options to infer their value of different health states.

They further argue that productivity measurement in medical care must consider the future costs resulting from medical treatments provided today.

2.2.6 Difficulty in Efficiency Measurement

Asymmetric information

It is assumed in the neoclassical model that agents have full o perfect information about economic activities. In the healthcare production sector this assumption does not hold. In many situations either the physician or the patient has difficulty or no incentive to reveal the full information about the transaction to the other party. Effects of asymmetric information are adverse selection, moral hazard, and statistical discrimination.

Externality

There is an externality when the consumption or production of a good or service affects the welfare of other consumers or the profit of other producers. Externality can either be positive (Research and Development) or negative (pollution). It is always difficult for efficiency to be achieved in a market in the presence of externality. Coase (1960) famously asserts that externality arises in situations which property rights are not well-defined.

2.2.7 Relevance of Measuring Efficiency in Health Facilities

Measurement of efficiency is important in since most hospitals are constrained by scarce resources and giveffthe recent economic downturn and escalating healthcare costs.

- It allows a system to produce more and better at zero cost (Hsu, 2010).

—FTo inform government policy by assessing the effects of deregulation mergers, or market structures on efficiency.

- To address research issues by describing the efficiency of an industry, ranking its firms, or checking how measures may be related to the different efficiency techniques employed.
- To improve managerial performance by identifying "best practices" and worst "practices" associated with high and low measured efficiency.
- It permits individual with very little institutional knowledge or experience to select "best practice" forms within the industry (Berger and Humphrey, 1997).

2.2.8 The Concept of Productivity

Productivity is a measure of the effective use of resources usually expressed as the ratio of output to input (Stevenson 2005). Therefore Productivity— Output/ Input (Mohanty, 1998). To Perera (2007), productivity is the ratio of the value of a product or service to the customer over the cost of resources used to produce that product or service. Productivity is the ratio of the amount of acceptable goods and services produced (outputs) to the amount of resources (inputs) used to produce them. The measurement of efficiency represents an advancement of productivity analysis. The concept of productivity is linked closely with the issues of efficiency and encompasses several efficiency elements such as price efficiency, allocative efficiency, technical efficiency and scale efficiency (Kamau, 2011). Though the terms like productivity, efficiency iveness are used together and practicians sometimes alternate their meanings, we must not identify productivity with efficiency and/or effectiveness. Productivity requires both efficiency and effectiveness, because a certain activity will not be productive if it is only efficient but not effective, or effective but not efficient. Productivity in economic position is defined as the relation between output and input. Input element in an organization consists of resources used in the product creation process, such as labour, materials, energy. Output consists of a given product, service and the amount of both. Productivity is

the measure of the relationship between the outputs of a hospital and the health system inputs that have gone into producing those outputs. An increase in productivity occurs when output per health worker hour is raised and/or there is use of more and/ or better health technology.

Amongst the goals of every competitive firm is an increase in productivity. Therefore, measurements in efficiency and productivity gains provide information about the firm's performance. These measurements can be considered as non-financial performance indicators as they consider all of the contributors to the firm's performance. In any organization, whether it is profit-oriented or not, measurements of productivity help to analyze the efficiency of resource use in the organization. Moreover, productivity indices help to set realistic targets for monitoring activities during an organizational development process by highlighting bottle-necks and barriers to performance (Kamau, 2011).

2.2.9 Measurement of Changes in Productivity

The DEA has three alternatives for measuring the productivity changes; Fisher index, Tornqvist index and the Malmquist Index.

The Malmquist Productivity Index (MPI)

The Malmquist Productivity Index was introduced by Caves et al (1982). It is mostly used due to its relative advantages over the others. Some the advantages of the Malmquist index are that; ➢ it does not require the profit maximization or the cost minimization assumption; ➢ it does not require information on the input and output prices; ➢ it allows for the decomposition of productivity changes into two components when using a panel data i.e. efficiency change and technological change.

Malmquist DEA is applied to panel data to calculate indices of changes in Total Factor Productivity (TFP), technology, technical efficiency and scale efficiency. The MPI takes a value of more than

one for productivity growth, a value of one for stagnation and a value of less than one for productivity decline. The output-oriented MPI is defined as the geometric mean of two periods' productivity indices, subsequently broken down into various sources of productivity change (Tlotlego et al, 2010).

2.3.0 Empirical Review

There have been a vast body of literature examining the efficiency and productivity in the hospitals most of them using Data Envelopment Analysis model.

The efficiency and productivity of hospitals was examined in Vietnam from 1998 to 2006 by Pham (2011), in using DEA model. During this period it was found out that. There was an improvement in the overall technical efficiency from 65 percent in 1998 to 76 percent in 2006. Hospital productivity increased by 1.4 percent year, due improvement in technical efficiency.

Also, hospitals in the provinces were more efficient than hospitals in other areas.

Gannon (2008) assessed the total factor productivity growth of hospitals in Ireland by applying Malmquist DEA model. Samples of 6 regional, 8 general and 22 country hospitals were used from 1995 to 1998. Number of beds and full-time equivalent people employed were used as inputs with output being the number of discharges and deaths, outpatient attendances, and day cases. The study revealed that regional hospitals had Malmquist total factor productivity change (MTFP) score of 1.028, efficiency change (EFFCH) score of 0.994, and technical change (TECH) score of 1.034. The

general hospitals had EFFCH equal to 0.999, TECH equal to 1.013 and MTFP equal to 1.012. The country hospitals had EFFCH of 1.005, TECH of 0.992 and MTFP of 0.997. T_hgrefore, on average the productivity of both regional and general hospitals

improved while that of county ospitals declined between 1995 and 1998.

In South Africa, Zere et al (2001) measured hospitals' efficiency with a sample size of 86 public hospitals, using Data Envelopment Analysis and Malmquist productivity index. A tobit regression was used to estimate factors influencing efficiency. Hospital were classified into three levels; community hospitals with emergency services only as level I community hospitals without patient services as level Il and non-academic secondary and tertiary as level Ill. Inputs used were recurrent expenditure and number of beds in the hospitals. Outputs were inpatients days and outpatients visits. From the findings, there were some amounts of variation of performance among in each group. The overall technical efficiency on the average was 0.74,

0.68 and 0.70 for levels I, Il, and Ill hospital respectively. Further inefficiency hospitals consume 35 to 47 percent more of resources. The total regression showed that factors such as bed occupancy rate, outpatient visits average length of stay impact positively on hospital efficiency level. In conclusion 87 percent of hospitals were inefficient, in which the level of pure technical efficiency was the same whilst the degree of scale efficiency was different across size-groups of hospitals.

Barros et al assessed productivity change of 51 hospitals in Portugal using both the Luenberger indicators and the Malmquist index during the years 1997 to 2004. The inputs included number of beds, number of full-time equivalent personnel, and total variable costs. The outputs included case flows (number of persons that leave the hospital), length of stay, number of consultations, and number of emergency cases. The Luenberger indicator was 0.008, EFFCH was -0.001 and TECH was 0.009. on the other hand, the MTFP was 1.042, EFFCH was 1.036 and TECH was

0.995. The Malmqúist DEA results imply that on average productivity of the hospitals under consideration grew mainly due to improvement in efficiency.

In Botswana, Tlotlego et al (2010) examined the productivity of hospital using DEA based Malmquist productivity index in 21 non-technical hospitals in Botswana from 2006 to 2008.The results revealed that, 16 of the hospitals run inefficiently in 2006, in 2007 and 13 in 2008, with averaF variable returns scores of 70.4 and 76.3 percent respectively There is an improvement in pure efficiency by 45 percent and decline in scale efficiency by 4.2 percent. In conclusion, inefficient hospitals needed to reduce inpatient days by 13percent. In efficiencies could also be reduced transferring 264 clinical staff and 39 beds to clinics and health posts.

Kirigia et al (2002) estimated the performance of Angolan's hospitals with DEA from 2000 to 2002. Number of physicians, number of beds and expenditures in pharmaceutical supplies were used as inputs. The outputs were the number of OPD visits and inpatient admissions. Productivity on Municipal hospital grew 4.5 percent, from the results. This was attributed to improvement of efficiency by 12.7 percent.

In Greece, Dimas examined the efficiency and productivity of hospital using DEA. 22 hospitals used were used from 2003 — 2005. Inputs used were number of beds, total personnel salary, total expenditure in pharmaceuticals. The outputs were number of emergency cases and inpatient days. There was 2 percent growth in 2003/2004 due to 5 percent growth in technology and I percent decline in efficiency.

Osei et al (2005) examined technical efficiency of public district hospitals and health centres in Ghana tn 17 public hospitals and 17 health centres using a DEA approach. 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 percent,

respectively. From the findings it was indicated that the hospitals could improve their efficiency by reducing their current number of medical officers/dentists, and beds, and also increasing number of maternal and child care visits, deliveries and discharges. Health centres could become more efficient by increasing maternal and child health visits, deliveries, fully-immunized children, and outpatient curative visit

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter outlines the methods and procedure for the study. These include scope of the study; sources of data; sampling techniques; data description; and methods of data analysis. It also discusses issues such as study type; study design; sampling technique; and method of data collection; data analysis method as well as the model specifications.

3.1.0 Background of the study area

Ashanti Region has a land size of 24,390sq km, which is about 10.2% of the land area of Ghana. The region share common boundaries, to the north with Brong Ahafo; to the south with Central Region, to the east with Eastern Region and to the west with Western Region. It lies approximately between longitude 0.15' to 2.25' west and latitude 5.50' to 7.40' north (0.15W and 2.25W, and latitudes 5.50N and 7.46N). The Ashanti Region is centrally located in the middle belt of Ghana. It is the most heavily populated region in Ghana, with a population of over 6 million (Population Census, 2010) with Kumasi having the highest of about 34% of the regional total. About 47% ofÉõGKð10ns are in the rural area. The region has a population ensity of 163.8 per sq. km. There are five hundred and thirty (530) health facilities in the region (Ghana Health Service). The Ghana Health Service operates about 32% of all health facilities in the region. Kumasi has the highest number of facilities of 38%.

3.1.1 Scope of study

Twenty-four (24) hospitals and health centres are selected across the country. The period of study is from 2008 to 2011. The health facilities include both private and public hospitals. The sample include; thirteen (13) district hospitals; four (4) private hospitals; and five (7) health centres. More district hospitals were selected for the sample because beyond offering outpatient and inpatient medical and surgical services, they also play important roles in health related information, communication, coordination and training, including: integration with other local health related services, such as water and sanitation; training of health workers; supervision and monitoring of health workers in the peripheral health centres; and managing health information systems English et al (2006).

3.1.2 Sources of data

The study includes both cross-sectional and time series data from. Both primary and secondary sources of data are used for the study. Primary data are obtained by interviews with administrators and administering of structured hospital efficiency questionnaires. Secondary data are obtained from the statistical department of various hospitals and health centres and also from the database of theMinistry of Health. The selection of the time period was necessitated because

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it is most recent period which has of available data.

3.1.3 Sampling techniques

Health facilities are selected using a simple random sampling. Quotas are assigned to each category

of health delivery centre based on their number in the country and also their level of delivery.

3.1.4 Data description

Inputs

This study used three inputs: The total number of beds (X 1), both used and unused by the health facility within a year; the total number of full-time physicians and non-physicians (facility personnel) (X2). Health facility's personnel (staff) include the number of physicians (doctors, nurses, midwives, medical assistants, laboratories technicians etc) and non-physicians (administrators, secretaries, accountants, caterers, cleaners, security personnel, etc). The third output is the total expenditures (this includes expenditures on pharmaceuticals, nonpharmaceutical supplies, utilities i.e. water, electricity, telephone, etc.) 00).

Inputs used in measuring health facility's efficiency are put into two categories: recurrent resources and capital resources (Ferrari, 2006 and Chen, 2006). The numbers of personnel and total expenditures are considerÆ>ELes-for recurrent resources, while number of beds is considered as proxy for capital resources. These three variables were used as inputs because they are common among almost all healthcare facilities in the country. Availability of data is therefore not a problem.

Outputs

The outputs used are; total number of outpatient visits to the hospitals and health centres within a year (Y 1). This includes both the scheduled visits to physicians and the unscheduled visits to the OPD of the facility; total number of days that inpatients stayed in the facility within a year (Y2); and the total inpatient days; and total child deliveries made by the hospitals and health centres within a year (Y3). These variables were used as outputs for the study because they are the widely observed and common output indicators among all hospitals and health centres in Ghana and

therefore using them as outputs for the study is fair representation for every health care facility in the country. Hence data on these variables will be easily obtained.

3.1.5 Method of Analysis

Three models are used in the data analysis: The Data Envelopment Analysis (DEA);Malmquist Productivity Index; and Tobit regression model. The DEA is used in measuring relative efficiencies of various hospitals whereas the DEA based Malmquist Productivity Index is used in measuring productivity changes in each healthcare unit. The Tobit on the other hand is used to determine some of the factors that influence efficiency of hospitals.

The Data Envelopment Analysis is a linear programming method designed to measure the relative efficienciesof a set of Decision-Making Units (DMU) such as hospitals. It is based on a technique for measuring the relative performance of organizational units where presence of multiple-inputs and output. The DEA measure compares each of the hospital in that sample with the best practice in the sample. It tells the user which of the DMUs in the sample are efficient and which are not. The ability of the DEA to identify possible peers or role models as well as comparative simple efficiency scores gives it an edge over other methods. DEA measures the efficiency of a DMU relative to the efficiency of its peer group, with a notional production frontier representing optimal efficiency. All DMUs lay on or below the production frontier.

It was developed by Charnes, Cooper and Rhodes (1978) and applied to non-profit organizations where the objective of profit maximization and cost minimization may not be considered as the

vital factor and calculates the relative efficiency scores of the various DMUs in a particular sample. It solves as many linear programming problems as the number of the DMUs in the study sample. The efficiency of a hypothetical hospital producing one health service output from one health system input would be obtained by dividing the quantity of that output by the quantity of the input. However, real world hospitals use multiple inputs (e.g. clinical staff, medicines, nonmedical supplies, capital stock) to produce multiple outputs (e.g. deliveries, curative and rehabilitative services). With this, the efficiency of a hospital is expressed as the weighted sum of outputs divided by the weighted sum of inputs.

Productivity expresses the relationship between the outputs and inputs that have gone into producing those outputs in the hospital. In measuring productivity in hospitals and other firms, the output - oriented Malmquist Productivity Index is used to assess the changes in productivity over a period of timea

lmquist Productivity Index proposed by Caves et al (1982) measures the total factor productivity (TFP) change between data points in terms of ratios distance functions (Zere, 2000). It is defined as the geometric mean of two periods' productivity indices, subsequently broken down into various sources of productivity change. It is used because it requires information solely on quantities of inputs and outputs and not on their prices and does not require the imposition of functional form on the structure of production technology. It easily accommodates multiple hospital inputs and outputs; and it can be broken down into the constituent sources of productivity change - i.e. efficiency changes (EFFCH) and technological changes (TECH) (Tlotlego et al, 2010). The MPI uses a distance function approach to measure productivity improvements. If

inefficiency does exist, movements in productivity of any given firm over time will depend on both its position relative to the corresponding frontier (technical efficiency) and the position of the frontier itself (Kamau, 2011).

The Tobit regression model is to analyze the relationship between efficiency score (6) and explanatory variables (Hoff, 2007). Regression equation can be estimated by Ordinary Least Squares(OLS), which minimizes the sum of squared distances between the observed responses in a set of data, and the fitted responses from the regression model (Greene, 2008). The Tobit model is rather suited for our work since efficiency scores is censored.

3.2.O The Models

3.2.1 Measurement of Efficiency

The Data Envelopment Analysis

The DEA method is based on the assumption of constant return to scale (CRS) and the alternative assumption of variable return to scale (VRS).According to Charnes et al (1978), efficiency (E) of a target hospital from the set "j" can then be obtained by solving a fractional programming model by dividing the quantity of that output by the quantity of the input. Health facilities use multiple inputs (e.g. health workforce, medicines, non-medical supplies, capital inputs) to produce multiple outputs (e.g. preventive, curative, rehabilitative services) and thus the efficiency is expressed as the weighted sum of outputs divided by the weighted sum of inputs used in the facility.

Max e = $UrYro / \sum_{i=1}^{m} ViXio \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$

Subject to EJKI, j=1, ….., n.

Where:

Ois the level of efficiency score

Yrjis the actual amount of health facility " j" output "r"(r = 1,..., s);

Xuis the actual amount of health facility 'j" used inputs "i" (i = m);

Uris the weight given to health service output r;

Vi is a weight given to health care input i; n is the number of

hospitals and health centres in the sample.

The relative efficiency score (9) lies between 0 (totally inefficient), and 1 (optimal technical efficiency) or 0 and 100%. The larger the score the more efficient a health facility is.

Charnes et al converted model (1) into a constant return to scale (CRS) linear programming model:

$\theta =$UrYro = 1……(2)

Subject to:

ViXio = 1,

$$\sum_{r=1}^{s} UrYrj - \text{ViXij O} \qquad j = 1, \ldots\ldots N$$

$$\sum_{r=1}^{s} UrYrj - \sum_{i=1}^{m} ViXij \leq 0 \qquad j = 1, \ldots\ldots N$$

$$Ur, Vi \geq 0$$

Model (2) assumes that hospitals and health centres are operating at an optimal scale of production, and hence, technical efficiency is equal to scale efficiency. The CRS model implies that increases in the amount of health system inputs will be matched by equal increases in outputs.

In the real world health facilities show either constant returns to scale (CRS), or variable returns to scale (VRS). The VRS could either be increasing returns to scale (IRS) i.e. economies of scale or decreasing returns to scale (DRS) i.e. diseconomies of scale.

In order to allow for the variability of returns to scale, the linear programming problem is estimated for each hospital and health centre in the sample:

θ =UrYro + Uo ... ...r=l

Subject to:

ViXij O $j = 1, \ldots \ldots . N$

$\sum_{r=1}^{s} UrYrj - \sum_{i=1}^{m} ViXij +$ + {Jo ≤ 0 $j = 1, \ldots \ldots . N,$O

(Jr, Viè O

3.2.2Measurement of Productivity

Malmquist Productivity Index

Färe et al (1994) defined the output-oriented Malmquist total factor productivity change between two periods, period t (base period) and period t+l as;

$Mo^{Ct+1}(y^t, x^t, y^{t+l}, x^{t+1}) = \left[\frac{D^t_o(y^{t+1}, x^{t+1})}{D^t_o(y^t, x^t)} \times \frac{D^t_o(y^{t+1}, x^{t+1})}{D_o^{t+1}(y^t, x^t)} \right]^{1/2}$ .....(4)

Where;

MO is the Malmquist productivity index of the most recent production point (y , x) using period t+l technology relative to the earlier production point (y^t, x^t) using period t technology;

D- represents the distance function (the maximum possible outputs that could be produced given inputs); y and x are outputs and inputs respectively;

Subscript 0 indicates the output orientation;

Färe et al showed that he MPI can be broken down further into two sources of productivity change; efficiency change and technological change.

$$M_o^{t,t+1}(y^t, x^t, y^{t+1}, x^{t+1}) = DO(y, x^{t+1}) X \left[\frac{D_o^t(y^{t+1}, x^{t+1})}{D_o^{t+1}(y^{t+1}, x^{t+1})} \times \frac{D_o^t(y^{t+1}, x^{t+1})}{D_o^{t+1}(y^t, x^t)} \right]^{1/2}$$

$$O^t(y^t, x^t)$$

The first term on the right hand side measures efficiency change and the second; technological change (frontier shift).According to Kamau (2011); Total productivity change —Efficiency change X Frontier shift.

MPI greater than one signifies growth in productivity; less than one shows a decline in productivity; and exactly one, means no change in productivity.

The Banxia Software Package is used to compute both the DEA technical efficiency scores and the Malmquist Productivity Index.

3.2.3 Econometric Analysis for the Determinants of Inefficiency

The Two-Stage DEA Analysis

In the Two-Stage DEA Analysis regression technique is used to explain the efficiency scores, which were measured at the first stage. Two-stage DEA aims at explaining the efficiency score 6 by a set of causal factors both discretionary and non-discretionary, some of which are beyond the control of managers (Marschall and Flessa, 2011). The Tobit linear regression model takes the form;

$$Y_i = \beta_0 + 13iXi + E. \quad \ldots\ldots (6)$$

Where; Y, is the dependent variable, explained by a vector of independent variables Xi. The Pi are regressioncoefficients,P0 represents a constant and e is the error term reflected in the residuals.

The DEA efficiency scores are transformed using the formula;

Efficiency Score (9 k) = (IDEA Score) — 1. (Zere, 2000; and Marschall and Flessa, 2011)

Equation (6) has to be adjusted accordingly. The censored Tobit model can thus be defined for

DMU k:

9 ßkXk+ε_k .....(7)

Where;

O*kis the observed efficiency score and Xk is a (row) vector of observation-specific variables for

DMU k that affect its efficiency score through the vector of parameters to be estimated.

The empirical model is therefore specified below:

¡= po + ¡ST+ ß2BD+ P3TC+ ß4ALS +ß5HL

Where;

9 i = Efficiency score of the ith hospital

ST = Average number ofhospitêl_staff———

BD = Average number of hospital beds

TC= Average expenditures of hospitals

ALS = Average length of days stayed in the hospital

HL= Level of health care facility/ type of hospital (Dummy variable)

HL=I, if facility is a district hospital, HL=O, if otherwise

3.2.4 A priori expectations

Efficiency and Average number of beds (BD)

Base on literature (Zere et al, 2000, Ozcan, 1996 and Brownell and Roos 1995), it is expected that technical efficiency and number of beds will be negatively related. Some will be in redundancy when they are in excess.

Efficiency and Average number of staff (ST)

It is expected that technical efficiency and staff-size will be negatively related. Some of the staff will be redundant when they are in excess.

Efficiency and Average total expenditure (TO

It is expected that technica efficiency and staff-size will be negatively related. High expenditures are likely to cause waste.

Efficiency and Average Length of Stay (ALS)

It is also expected that average length of stay will be negatively signed. More length of stay will lead to high cost of admission per admission (Zere et al, 2000) and thus causing inefficiency.

Efficiency and Level of hospital (HL)

Level of hospital is expected to be positively signed. It is expected that district hospitals with their high input endowment are likely to efficient.

STATA 11 statistical software package is used to perform the statistical analysis for the twostage analysis.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents and critically analyses of the information received from 24 health facilities.

The chapter has been put into three sections. The first part analyses efficiency in the various health facilities. It then narrows the discussion down to district hospitals, health centres and private hospitals. The second discusses the productivity changes of the hospitals and health centres between the period of 2008 and 2011. It also breaks down the analysis to district hospitals, health centres and private hospitals. The third section discusses the determinants of hospitals' and health centres' efficiency.

4.1.0 Discussion on Efficiency in Health Facilities

Tables la and 1b present the average amount of inputs used by hospitals and health centres and the amount of output produced by these hospitals. Between 2008 and 2011, an average of 1735 working staff (both physicians and non-physicians), 1102 beds (used and unused) GH¢18,365,646.82 were used as by the 24 health facilities selected. District hospitals used trice as much inputs as health centres. With these inputs, an average of 921,542 outpatient visits, 150,407 inpatients and 17931 maternal births were recorded between the periods of study.

Table la: Average inputs used

Years	Number of Staff	Number of Beds	Total Expenditure
2008	1400	1050	12,453,593.3
2009	1664	1107	15,061,406.16
2010	1875	1124	20,695,260.14
2011	1999	1126	25,252,327.66

Total	6938	4407	73,462,587.26
Mean	1735	1102	18,365,646.82

Source: Database ofvarious healthfacilities

Table 1b: Average outputs

Years	Outpatients	Inpatients	Child Deliveries
2008	802,207	129,473	14,981
2009	876,638	148,062	17,443
2010	959,156	153,926	18,322
2011	1,048,165	170,164	20,975
Total	3,686, 166	601,625	71,721
Mean	921,542	150407	17931

Source: Database ofvarious healthfacilities

Between 2008 and 201 1, an average of 921,542 patients visited the outpatient department (OPD),

150,407 patients admitted and 17, 931 children were delivered in the selected health facilities.

Table 2a: Individual healthfacility 's technical efficiency scoresfrom 2008 to 2011

DMU/ Hospital	2008	2009	2010	2011
A o o Presb Hos ital	86.3	82.3	73.7	77.6
A ona Gov't Hos ital	100.0	100.0	100.0	100
Asaman SDA Hos ital	86.3	86.3	100.0	96.3
Efflduase Gov't Hos ital	99.5	100	100.0	100.0
Visu Gov't Hos ital	89.2	92.8	100.0	100.0
Juaben Gov't Hos ital	67.0	68.0	100.0	100.0
Kokofu Gov't Hos ital	68.9	81.8	95.2	100.0
Konon 0-0dumasi Gov't ital Hos	100.0	100.0	100.0	100.0
Kuntanse Gov't Hos ital	49.6	100.0	85.7	100.0
Mankranso Gov't Hos ital	100	100.0	100.0	100.0

Pramso St.Michael Hos ital	96.7	85.4	85.7	92.1
Banko Health Centre	100.0	100.0	100.0	100.0
Bomso Clinic	18.0	28.6	26.0	24.6
JaachieHealth Centre	81.2	100.0	100.0	100.0
Juaso Gov't Hos ital	100.0	100.0	100.0	100.0
Kumawu Health Centre	100.0	100.0	82.0	89.1
Nsuta Health Centre	100.0	100.0	100.0	100.0
Woraso Health Centre	100.0	100.0	100.0	100.0
Allen Clinic	29.3	23.6	24.0	38.3
B ant Hos ital	100	70.5	97.7	77.2
Divine Grace Hos ital	77.5	49.3	63.7	54.9
Drobonso Health Centre	100.0	100.0	100.0	100.0
Juansa Health Centre	85.9	91.4	81.2	92.0
Christ the Kin Hos ital	37.3	28.0	59.4	33.2
Mean	91.8	82.8	80.2	86.5

Source: Author 'sfield work

The-resulting technical efficiency scores of 24 health facilities are presented in Table 2a. It is worthy to note that scores of 100% represent technical efficiency. On the other hand scores less than 100% signifies an existence of inefficiency. From 2008 to 2011, all hospitals and health centres sampled on the average recorded a relative technical efficiency (TE) score of 85% with 52% of the health facilities being inefficient. Overall, hospitals and health centres experienced a downward trend in technical efficiency during the sample period 2008-2011. This implies that the levels of hospital efficiency scores worsened over time. It was 91.8% in 2008, 82.8% in 2009, 80.2% in 2010 and 86.5% in 2011.

In 2008, 63% of the health facilities were seen to be inefficient having TE score less than 100%. Bomso Clinic had the lowest score of 18%. Agona, Konongo-Odumasi, Juaso, Bryant hospitals and Nsuta, Kumawu, Woraso, Banko health centres were all efficient, having TE scores 100%.

In 2009, Agogo Presby, Asamang SDA, Ejisu, Juaben, Kokofu, Pramso St. Michael, Bomso, Allen, Divine Grace, Christ the King, Bryant hospitals and Juansa Health Centre were all inefficient representing 54% of the hospitals. Allen Clinic recorded the lowest score of 23.6%.

In 2010 and 2011, 42% of all hospitals studied were inefficient. Allen Clinic was the most inefficient in 2010 with TE score of 24% and in 2011, Bomso Clinic also had the lowest the score of 24.6%.

Between the periods of study, some hospitals improved upon their levels of efficiency. Effiduase, Ejisu, Juaben and Kuntanase Government Hospitals who recorded scores less than 100% in 2008 became efficient in 2011.

Agoñï, Konongo-Odumasi Government hospitals and Banko, Nsuta, Drobonso Health Centres maintained 100% efficiency levels for all the years. On the hand, Agogo Presby, Pramso St. Michael, Asamang SDA showed leyels of inefficiency for all the years of study. Bryant Hospital was efficient, recording 100% TE score in 2008 but became inefficient recording scores of

70.5%, 97.7% and 77.2% respectively for the subsequent years.

9 hospitals (38%) showed constant returns to scale. Among these hospitals, the doubling of health system inputs led to a doubling of health service outputs. In other words the size of these hospitals did not affect productivity. The average and marginal productivity of these hospitals remained constant regardless of the size of the hospital. In short, they were operating at their most productive scale. These hospitals were Agona, Mankranso, Konongo-Odumasi, Bomso, Juaso, Nsuta, Woraso, Drobonso and Juansa hospitals

8 hospitals (33%) manifested increasing returns to scale (IRS). This may have arisen because the larger scale of a particular operation allowed health managers and workers to specialize in their

tasks and make use of more sophisticated health technologies. They were Agogo Presbyterian, Pramso St. Michael, Kumawu, Allen, Bryant Divine Grace and Christ the King hospitals.

7 hospitals (29%) experienced decreasing returns to scale (DRS) which may be associated with the problems of coordinating tasks and maintaining lines of communication between management and workers. They were Asamang SDA, Effiduase, Ejisu, Kokofu, Kuntanase, Jaachie and Juaben hospitals.

4.1.1Efficiency of District Hospital

Table 2b: District hospitals' technical efficiency scoresfrom 2008 to 2011

DMU/ Hospital	2008	2009	2010	2011
A o o Presb Hos ital	86.3	82.3	73.7	77.6
A ona Gov't Hos ital	100.0	100.0	100.0	100
Asaman SDA Hos ital	86.3	86.3	100.0	96.3
Effiduase Gov't Hos ital	99.5	100.0	100.0	100.0
Bisu Gov't Hos ital	89.2	92.8	100.0	100.0
Juaben Gov't Hos ital	67.0	68.0	100.0	100.0
Kokofu Gov't Hos ital	68.9	81.8	95.2	100.0
Konon 0-0dumasi Gov't ital Hos	100.0	100.0	100.0	100.0
Kuntanse Gov't Hos ital	49.6	100.0	85.7	100.0
Mankranso Gov't Hos ital	100	100.0	100.0	100.0
Pramso St.Michael Hos ital	96.7	85.4	85.7	92.1
Juaso Gov't Hos ital	100.0	100.0	100.0	100.0
B ant Hos ital	100.0	70.5	97.7	77.2
Mean	80.3	89.8	88.6	95.6

Source: Author 'sfield work

Between 2008 and 2011, 44% of all district hospitals selected were inefficient with an average score of 88.6%.In 2008, out of the 13 district hospitals surveyed, 4 (31%) were found to be efficient.Agona, Konongo-Odumasi, Mankranso, Juaso and Bryant hospitals had 100% TE score. Agona, Konongo-Odumasi, Kuntanse, Mankranso and Juaso were the efficient hospitals amongst 13 districts hospitals in 2009. This represents 38% of all district hospitals in the sample. In 2010,

46% of district hospitals were efficient. Agogo Presby, Kokofu, Kuntanase and Pramso St. Michael hospitalywere the inefficient according to scores. Agogo Presby Hospital had the lowest

score of 73.7%. 4 (31%) hospitals were found to be inefficient among the district hospitals sat*cf] 4 (31%) district hospitals experienced constant returns to scale. 6 (46%) of showed an increasing return to scale and 3 (23%) manifested a decreasing return to scale.

31% of district hospitals were inefficient in 2011. They were Agogo Presbyterian Hospital (77.6%), Asamang SDA Hospital (96.3%), Pramso St.Michael Hospital (92.1%) and Bryant Hospital (77.2%).

4.1.2 Efficiency of Health Centres

Table 2c: Health Centres ' technical efficiency scoresfrom 2008 to 2011

DMU/ Hospital	2008	2009	2010	201 1
Banko Health Centre	100.0	100.0	100.0	100.0
Jaachie Health Centre	81.2	100.0	100.0	100.0
Kumawu Health Centre	100.0	100.0	82.0	89.1
Nsuta Health Centre	100.0	100.0	100.0	100.0
Woraso Health Centre	100.0	100.0	100.0	100.0
Drobonso Health Centre	100.0	100.0	100.0	100.0
Juansa Health Centre	85.9	91.4	81.2	92.0
Mean	95.3	98.8	94.7	97.3

Source: Author 'sfield work

7 seven health centres were sampled, out of which 5 centres (71%) were efficient with TE scores of 100% in 2008. Jaachie and Juansa Health Centres were the facilities which were inefficient with scores of 81.2% and 85.9% respectively. The level of efficiency improved in 2009 to 86% with only Juansa Health Centre remaining inefficientwith a score of 91.4%. The level of efficiency reduced in 2010 and 2011 to 71% in both years. In both years, Kumawu and Juansa Health Centres-

Were vere inefficient. Kumawu had 82% and 89.1% in 2010 and 2011 respectively. Juansa Health Centre on the other hand had 81.2% and 92% in 2010 and 2011 respectively. 5 health centres (71%)

showed constant returns to scale. One health centre each experienced decreasing returns to scale and increasing returns to scale.

On the average only 25% of all health centres selected were inefficient between the sampling period with an average score of 96.5%, which is lower than that of district hospitals.

4.1.3 Efficiency of Private Hospitals

Table 2d: Private Hospitals ' technical efficiency scoresfrom 2008 to 2011

DMU/ Hospital	2008	2009	2010	2011
Bomso Clinic	18.0	28.6	26.0	24.6
Allen Clinic	29.3	23.6	24.0	38.3
Divine Grace Hos ital	77.5	49.3	63.7	54.9
Christ the Kin Hos ital	37.3	28.0	59.4	33.2
Mean	40.5	32.3	43.3	37.8

Source: Author 'sfield work

All private hospitals sampled for the study recorded scores less than 100% for all the study period. From the 2008 to 2011, they recorded an average technical efficiency score of 38%. In 2008, Bomso Clinic had 18% which was the lowest among the private hospitals. Divine Grace Hospital had the highest with 77.5%.

Divine Grace again recorded the highest score in 2009, 2010 and 2011 with scores of 49.3%, 63.7% and 54.9 % in the respective years. Allen Clinic recorded the lowest score both in 2009 and 2010 with-2316% and 24%-iïÝffiúCéóective years, whereas Bomso Clinic in 2011 recorded the score with 26%. The average TE score in 2008 was 40%; 32.4% in 2009; 42.3% in 2010; and 37.6% in 2011. All private hospitals selected experienced constant returns to scale.

4.1.4 Total Output Increases and/or Input Reductions needed to make Inefficient Health Facilities Efficient

For Agogo Presbyterian Hospital to operate efficiently in 2008, it needed to have transferred 25 beds and reduce its staff by 52% with the level of output produced. It could also have been efficient with its inputs used, by increasing its inpatients by 16%, outpatients by 199% and child deliveries by 495%.

Asamang SDA Hospital should have reduced beds by 49% and staff by 49% given its output level. It could on other hand have improved its efficiency level by increasing outpatients by and inpatients by 16% and child deliveries by 18%.

Pramso St. Michael Hospital should also have reduced its bed-size by 28 beds and staff by 70% to have been efficient with the level of output produced. With the same amount of inputs, it could have increased outpatients by 26% and inpatients by 3.5% and be efficient.

For Effiduase Hospital to have been efficient in 2008, it should have reduced staff by 4% for its level of outputs or increase inpatients by 4% given its inputs.

Ejisu Hospital could have operated efficiently, by reducing its beds by 16% and give out the same level ofoutput or increase its inpatients by 691%, outpatients by 47% and child deliveries by 12%.

Juaben Hospital should have reduced its staff-size by 27% for its output level or increase both inpatients and outpatients by 86% and 49% respectively and child deliveries by 49% based on its inputs to be efficient.

Kokofu Hospital could have transferred 13 beds in order to produce efficiently with its output level or increase its outpatients by 46%, inpatients and child deliveries by 45%.

Kuntanase also should have reduced beds by 3% with its state of outputs or with the same amount inputs increase child deliveries by 162%, inpatients by 143% and outpatients by 102% in order to record 100% efficiency score.

For Bomso Clinic to be efficient, it should have increase child deliveries, inpatients and outpatient by 457% based on inputs level. It could also have reduced staff by 39% and cut total expenditure by 25% and maintain the same level of output and be technically efficient.

Allen Clinic also could have been efficient by reducing expenditure by 30% and reduce bed-size by 9 beds and the give out the same amount of outputs or increase child deliveries by 4198%, inpatients and outpatients by 241%.

Divine Grace Hospital should have reduced beds and total expenditure by 32% and 31% respectively or increase child deliveries by 31% outpatients and inpatient by 29% given its amount of inputs and be efficient.

Christ the King Hospital needed to have reduced beds and expenditure by 20% and expenditure by 35% to produce the same outputs amount or increase deliveries by 938%, outpatients and inpatients by 168% for it to be efficient.

Jaachie Health Centre only had to be efficient in 2008 by increasing child deliveries and outpatients by 24% with its amount of inputs.

should reduced

Juansa Health Centre have beds by 30% and staff by 25% to give out the same output for it to be efficient, or with the same amount of input, increase outpatients and child deliveries by 47%.

In 2009, Agogo Presbyterian Hospital could have been efficient by reducing staff by 43% and total expenditure 13% with the same level of output or increase outpatients 145% and inpatients by 8% given its input level.

Pramso St. Michael Hospital should have increase child deliveries by 112%, outpatients by 41% and inpatients by 18% in order to record 100% efficiency score in 2009 based on its input level, or reduce staff by 57% with its output level.

Bomso Clinic, with a score of 28.6% should have reduce staff-size by 7% and expenditure by 2% given its output level or increase inpatients by 1309%, outpatients by 363% and deliveries by 1562% with same level of input.

Allen Clinic should reduce beds, staff and total expenditure by 77% and 83% respectively given its output level in order to be efficient or increase deliveries by 640%.

Christ the King Hospital should also have reduced beds by 72%, staff size by 73% and expenditure by 83%for it to be efficient for its level of output.

For Agogo Presbyterian Hospital to be efficient in 2010, it should have reduced staff by 20% and maintain the same output level or with the same input level increase inpatients by 36%, outpatients by 37% and child deliveries by 425%.

should reduced

Juaben Hospital have total expenditure by 18% with its level of output or increased inpatients and outpatients by 27% in order to be efficient.

Pramso St. Michael Hospital could have been efficient in 2010 if it had reduced staff and total expenditure by 57% and 18% respectively or increase deliveries by 82%, outpatients by 19% and inpatients by 17%.

In 2011, Agogo Presbyterian Hospital could have been efficient by reducing staff by 27% with the same level of output or increase child deliveries by 248%, inpatients by 28% and outpatients by 98% based on the same amount of input.

Asamang SDA Hospital given the same amount of inputs could have been efficient if it increased child deliveries by 71%, inpatients by 4% and outpatients by 6%. It could have recorded 100% efficiency score per its output level if reduced staff-size by 19% and expenditure by 22%.

Pramso St. Michael Hospital, if had reduced its staff and total expenditure by 45% and 30%, it would have been efficient given its level of output. It would also have had 100% TE score, if with its input level, increased inpatients by 7%, outpatients by 45% and child deliveries by 20%.

Kumawu Health Centre should have reduced beds by 3% and staff by 5% per its output or increase outpatient§and child deliveries by 12%.

Bornso Clinic could have reduced staff by 41% based on its output or with its output and inpatients by 306%.

Allen Clinic have beds by 34% and staff by 24% given its amount of output

should reduced
produced and become efficient. It could have also been efficient given its amount of inputs, by increasing outpatients by and inpatients by 162% and child deliveries by 673%.

Divine Grace Hospital could have recorded 100% efficiency score if had increase inpatients and outpatients by 82% with its given inputs or reduced beds by 20% and expenditure by 53% based its output and be efficient.

Christ the King should have reduced beds and total expenditure by 10% and 53% respectively per its output and be efficient. It could also have increased inpatients and outpatients by 201% and child deliveries by 989% and had 100% efficiency score given its inputs.

Bryant Hospital should have reduced staff by 16 % and expenditure by 11% based on its output or increased its child deliveries, inpatients and outpatients by 30%, 30% and 42% respectively, given its amount of inputs to in order to be efficient in 2011.

Juansa Health Centre could have been efficient if it had reduced it had bed-size by 33% and staff by 39% based on its amount of output. Alternatively, it could have recorded 100% efficiency score, if it increased outpatients by 9% and child deliveries by 40%.

4.2 Discussion on Productivity Changes

Table 3a: Malmquist index summary ofHealthfacilities

DMU/ Hospital	Efficiency change	Technical change	Total factor Productivity Change (MPI)
A o o Presb Hos ital	1.404167	0.686243	0.9636
A ona Gov't Hos ital	1.000	1.163	1.163
Asaman SDA Hos ital	1.000	1.000	1.000
Effiduase Gov't Hos ital	1.000	1.000	1.000
Bisu Gov't Hos ital	0.92553	1.000	0.92553
Juaben Gov't Hos ital	1.000	1.000	1 .ooo
Kokofu Gov't Hos ital	1.000	1.000	1.000
Konon 0-0dumasi Gov't ital Hos	1.000	1.000	1.000
Kuntanse Gov't Hos ital	1.000	1.000	1.000
Mankranso Gov't Hos ital	1.0107	1 .ooo	1.0107
Pramso St.Michael Hos ital	1.000	1.000	1.000
Banko Health Centre	0.9887	1.000	0.9887
Bomso Clinic	1.000	1.000	1.000
Jaachie Health Centre	1.000	1.000	1.000
Juaso Gov't Hos ital	1.000	1.000	1.00
Kumawu Health Centre	0.9857	1.000	0.9857
Nsuta Health Centre	1.0245	1.000	1.0245
Woraso Health Centre	0.9858	1.000	0.9858
Allen Clinic	1.000	1.000	1.000
B ant Hos ital	0.958619	1.028633	0.986067
Divine Grace Hos ital	1.000	1.000	1.000
Drobonso Health Centre	0.980933	1.000	0.980933
Juansa Health Centre	0.9385	0.957567	0.933
Christ the Kin Hos ital	0.863619	1.18833	1.026267
Mean	0.997919	1.000991	0.998908

Source: Author 'sfield work

The Malmquist Total Factor Productivity index (MPI) analyzes differences in productivity over time. It is worth-noting that aceordiffýfðthe index, a value of less than one denotes decline in productivity; values greater than one denote increases in productivity; and a value of one signifies no change in productivity.

Table 3a presents the Malmquist productivity index summary of the total productivity changes from 2008 to 2011. On the average, there was a decline in productivity by 1% in all the health facilities between the periods, basically due to decline in efficiency change by 1%. There was rather an in improvement in technical change (innovation) by 0.9%.

Between 2008 and 2011, 8 (33%) hospitals out of the sample, recorded MPI scores less than l. This implied a decline in performance in these hospitals. There was a decline in the productivity in Agogo Presbyterian Hospital, Ejisu Hospital, Banko Health Centre, Kumawu Health Centre, Bryant Hospital, Drobonso Health Centre and Juansa Health Centre. Ejisu Government Hospital had the greatest decline in productivity. It had 8% decrease in productivity.

4 (17%) hospitals out of the 24 sampled, had MPI scores greater 1, imply improvement in performance in these hospitals. Agona, Mankranso, Nsuta, and Christ the King hospitals had increases in productivity respectively within the period. Agona Government Hospital had an increase of 16% which was the highest.

Asamang, Effidua§e, Bomso, Juaben, Kokofu, Konongo-Odumasi, Kuntanse, Pramso St. Michael, Jaachie, Juaso, Allen, Divine Grace hospitals had MPI scores of 1. There was therefore no ctïãiige in the productivity level between 2008 and 2011 in these hospitals.

4.2.1 Productivity Changes in District Hospitals

Table 3b: Malmquist index summary ofDistrict Hospitals

DMU/ Hospital	Efficiency change	Technical Productivity	Total factor change (MPI)
A o o Presb Hos ital	1.404167	0.686243	0.9636
A ona Gov't Hos ital	1.000	1.163	1.163
Asaman SDA Hos ital	1.000	1.000	1.000
Effiduase Gov't Hos ital	1.000	1.000	1.000
Eisu Gov't Hos ital	0.92553	1.000	0.92553
Juaben Gov't Hos ital	.ooo	1.000	1.000
Kokofu Gov't Hos ital	1.000	1.000	1.000
Konon 0-0dumasi Gov't ital Hos	1.000	1.000	1.000
Kuntanse Gov't Hos ital	1.000	1.000	1.000
Mankranso Gov't Hos ital	1.0107	1.000	1.0107
Pramso St.Michael Hos ital	1.000	1.000	1.000
Juaso Gov't Hos ital	1.000	1 .ooo	1.00
B ant Hos ital	0.958619	1.028633	0.986067
Mean	0.990557	1.009704	1.000169

Source: Author 'sfield work

Between 2008 and 2011, district hospitals selected, increased in their overall performance. They increased by 0.1% on the average. Their increase was due to an improvement in technology by 0.9%. Efficiency change on the other hand decreased byl%. On the individual basis, Agogo Presby, Ejisu and Bryant hospitals had a decline in performance amongst the district hospitals selected within the period. They decreased in productivity by 4%, 8% and 2% respectively. Agona and Mankraí{so hospitals were the only district hospitals within the sample that had an improvement in productivity within the period. They increased by and 2% respectively. The restlíáðno change in their level of productivity.

4.2.2 Productivity Changes in Private Hospitals

Table 3c: Malmquist index summary ofPrivate Hospitals

DMU/ Hospital	Efficiency change	Technical change	Total factor Productivity Change (MPI)
Bomso Clinic	1.000	1.000	1.000
Allen Clinic	1.000	1.000	1.000
Divine Grace Hospital	1.000	1.000	1.000
Christ the King Hospital	0.863619	1.18833	1.026267
Mean	**0.965905**	**1.042097**	**1.006567**

Source: DMU/ change

Author 'sfield work

The overall productivity of private hospitals sampled increased by 0.6%. This was due to an improvement in technology by 4%. Efficiency change rather reduced by 4%. No private hospital declined in performance within the period. Christ the King Hospital was the only private hospital that improved upon its productivity level. It recorded 2% increase in productivity. The rest had no change in productivity.

4.2.3 Productivity Changes in Health Centres

Table 3d: Malmquist index summary of Health Centres

DMU/ Hospital	Efficiency change	Technical change	Total factor Productivity Change (MPI)
Banko Health Centre	0.9887	1.000	0.9887
Jaachie Health Centre	1.000	1.000	1.000
Kumawu Health Centre	0.9857	1.000	0.9857
Nsuta Health Centre	1.0245	1.000	1.0245
Woraso Health Centre	0.9858	1.000	0.9858
Drobonso Health Centre	0.980933	1.000	0.980933
Juansa Health Centre	0.9385	0.957567	0.933
Mean	**0.986305**	**0.993938**	**0.980326**

Source: Author 'sfield work

There was a decline in productivity in health centres selected by 2% from 2008 to 2011. Both technical change and efficiency change declined by 1% and 2% respectively.Nsuta had an improvement in its level of performance. Banko, Woraso, Drobonso, Juansa and Kumawu health centres, all declined in performance. Jaachie Health Centre maintained its level of productivity.

Nsuta Health Centre recorded productivity increase of 2%. Woraso, Juansa, Drobonso, and

Banko health centres decreased by in productivity. They all had a 2% decrease in performance.

4.2.4 Technological Changes

3 hospitals had a technological progress within the periods of study. Agona, Divine Grace and Christ the King hospitals had 16%, 2% and 18% increases in technological innovations, respectively. Agogo Presbyterian Hospital and Juansa Health Centre retrogressed in technological innovations by 32% and 5% respectively. The rest maintained the same level of technical innovation.

4.2.5 Efficiency Changes

8 health facilities had a decrease in efficiency change. Ejisu, Banko, Kumawu, Woraso, Drobonso, Juansa-and Christ the King all decreased in efficiency change. Christ the King Hospital had the greatest decline in efficiency change with 14%. Agogo Presby Hospital, Mankranso Government Hospital and Nsuta Health Centre increased in efficiency. They recorded 40%, 2% and l%respectively.

4.3 Discussion on Determinants of Efficiency

Regression results

Table 4: Tobit Regressionfor explanatory variables

	Coefficient	Std Error	t	p-value
Constant	-1.401242	0.412743	-3.39	0.003
BD	-0.0302963	0.0113723	2.66	0.015
ST	-0.0188952	0.02229	8.48	0.000
ALS	0.1979677	0.123262	1.61	0.125
HL	-0.368913	0.104899	-3.51	0.002
TC	-1.95e-06	-4.79e-07	-4.06	0.001

Source: Author 's field work

Number of obs= 24, Pseudo 1.2951. Chi-square (5) = 75.35

Average staff size (ST) had a sign consistent with our expectation. It was negatively related to efficiency level and also statistically significant. This meant that more working staff in a hospital given the same level of output is likely to reduce the efficiency level of a facility. This is due to

the fact that a lot of the working staff will be redundant. A sizeable number of staff should always be maintained. Average staff size is statistically significant.

Average lengthõfktay (ALS)haa-õFð4ÍGVe sign. This sign was inconsistent with our a priori expectation. It was expected that the more days a patient is kept on an admission at a hospital, the more the likelihood of the hospital being inefficient. This is because if a patient is admitted in a hospital for more days, it prevents the hospital from admitting more new inpatients. Inpatients will tend to be less which will affect the efficiency level. It was therefore expected that average length of stay should be negatively related with the level of efficiency of hospital. Average length of stay is statistically insignificant.

The average number of hospital beds (BD) with its negative sign was consistent with our expectation. Its implication is that if there are more beds in a facility relative to its output, there is a tendency for the facility to be inefficient. This is because most of the beds will be redundant causing waste. A required number of beds should always be maintained to reduce its level of wastage. Average number of beds was also statistically significant.

The average total cost (TC) was negatively signed and also consistent with our a priori expectation. Excessive spending on both drug and non drug items is most likely to produce waste (technical inefficiency). It is expedient on every hospital to cut down on unnecessary expenditure to be efficient. It is also statistically significant.

The level of health facility (HL) had a negative which was inconsistent with our expectation. It expected that district hospitals with their high input endowment are more likely to be technically efficient since it could give out more output. It is with a fact that health facilities have more staff (both clinicals and non-clinicals), and more beds (both used and unused). They also have high expenditures on both drugs and non drug items. They are therefore expected to positively relateto efficiency since they have the tendency to implement new technologies and produce more. The level of hospital be district hospital or otherwise is statistically significant

Test for the overall significance

^{2} in the model were statistically significant Prob > chi 0.0000. This implied that the variables and thus the model is statistically significant.

CHAPTER FIVE

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study was conducted to measure the levels of efficiency and changes in productivity in hospitals and health centres in Ghana between 2008 and 2011, using the Ashanti Region as a study area. Twenty-four (24) were health facilities were selected. The study went ahead to estimate some of the determinants of efficiency in these health facilities. In doing so, the researcher employed secondary data to elicit information for the study. Secondary data was collected by from the database of the various hospitals and health centres. The empirical study used number of beds, number of hospital staff and total expenditure as its inputs; and used number of outpatients, number of inpatients and number of child deliveries of the hospitals as outputs for measurement of technical efficiency and productivity. The study brught out findings from all the health facilities sampled based on Data Envelopment Analysis. Technical efficiency scores and Malmquist Productivity Index were estimated and used for technical efficiency and productivity analysis respectively. The analysis also showed the amount of input decreases and output increases needed to make these health facilities efficient. Using a Tobit regression, the some factors that influence the efficiency level of hospitals were estimated.

5.2 Findings

It is often supposed, that health facilities in Africa are not very efficient. There was no contradiction between this statement and our findings. The findings showed a considerable room for the efficiency improvement in health facilities in Ghana. Overall 52% of hospitals were inefficient between 2008 and 2011, for the sample.

This finding was in line with the work by Osei et al (2005) which showed 47% level of inefficiency. The level of inefficiency is between 58% and 42% indicates that there significant amounts of resource waste in numerous hospitals and health centres. The findings also showed that efficiency had improved within the sample for the sampling period. 14(58%), 12(50%), 11(46%), and 10(42%) hospitals were inefficient in 2008, 2009, 2010 and 2011 respectively. This showed a downward trend in the inefficiency levels in hospitals. This improvement was due to increases in output of hospitals over the years due to the introduction of the NHIS in 2007. The NHIS motivated patients to visit various health facilities at a relatively cheaper cost. In addition, free maternal care was introduced in 2008 which increased the number of maternal deliveries in the subsequent years.

Efficiency estimates indicated that if the inefficient health facilities were to operate on the best frontier, recurrent expenditures could be reduced. The savings for operating efficiently could be used in expanding facilities in the hospital. With the current performance of the economy, it is always difficult for governments to continually increase resources at the health facilities and meet other demands from the health sectors. Efficiency savings could aid health facilities increase health coverage. It could also augment government in provision for the health sector.

Health centres weõ found to outperformed district hospitals and private hospitals. 54% of district hospitals sampled were found to be inefficient between the sampling periods. With exceÞfiðÑof Juansa Health Centre in all the years, and Kumawu Health Centre in 2010 and 2011, all health centres operated for the period. These health centres are in rural areas where there are no health facilities other than them. The tendency of more patients and maternal women to visit them is high.

Agogo Presbyterian and Pramso St. Michael's hospitals were inefficient for all the years. It was found out that facilities with large amounts of inputs could not match up with a corresponding large output. It was therefore realised that though having large amount of output compared with lower-input hospitals, they tend to be inefficient. This meant that there are a lot waste in bigger hospitals which needed to be attended to.

All private hospitals were inefficient from 2008 to 2011. The highest TE score recorded by a private hospital was 77% by Divine Grace Hospital in 2008. Most private were not enrolled under the NHIS for the period. Majority of patients and maternal women who found the use of the NHIS cheaper, preferred to visit public hospitals who are registered with the NHIS. For private hospitals to technically efficient they need to register under the National Health Insurance scheme to reduce the cost patients incur when they visit them.

The results indicated an existence of potential improving access to health care without injecting additional resources in the health facilities from any source; public or private. Most health facilities could be efficient by embarking programmes and policies that could induce more patients to the hospitals and health centres without necessarily increasing inputs. Improving

quality of care could attract more patients to the facilities. Hospitals could therefore save more by jasãót increasing their amount of inputs used and still produce more and be technically efficient. Bed-size in all inefficient hospitals tends to exceed what is required for the given level of output (this does not mean number of beds in exceed the number required by the population). Technical inefficiency tends increase with the number of beds. Therefore most hospitals with large bed-size tend to have relatively lower TE scores than low bed-size facilities.

District hospitals had more inputs in relation to their output levels. Bed-size and staff-size were very high which led to inefficiency. At least 30% of beds should be transferred from district hospitals and 25% at least of staff should be reduced in these district hospitals. This would lead to technical efficiency. In relation with their inputs, district hospitals should increase their outpatients and inpatients by at least 60%. Private hospitals should increase both outpatients and inpatients by more than five times to improve upon their efficiency levels.

Productivity over the years experienced fluctuations but increased on the average by 1%, between 2008 and 2011. The increase in productivity was due to an improvement in technology in the hospitals. Though health centres performed better than district hospitals, in terms of technical efficiency, district hospitals on the other hand outperformed health centres in terms of 'J increases in productivity. This was due to the fact that district hospitals are able to buy and implement new technologies, due to their high budgets. It is therefore necessary for hospitals to invest in new technologies. District hospitals also have more staff are able to perform more tasks to increase productivity. They are able to take care of more outpatients who visit them. These

hospitals also have more beds to take care of more inpatients. There are more midwives in matemity-wards of district hospitals than there are in health centres. There is a tendency for district hospitals to deliver more children in district hospitals than health centres. The decline in productivity in some hospitals is a major concern for government and other policy makers who seek to improve access and quality ofhealth care.

In the presence of increasing returns to scale, there is a need for the hospitals to keep on expanding operation. Increasing the scale of operation should not only be approached from the supply side where inputs will be increased. Economies of scale may occur as a result of staff being able to specialize in their areas of expertise, ability to spread overhead costs over large number of output

units and discounts from bulk (Zere et al, 2000). Also, hospitals facing decreasing returns should reduce bureaucracy and improve on labour relations. Scale of operation could also be reduced.

To confirm our findings, average total expenditure, bed-size and staff-size had negative impact on the level of technical efficiency based on the tobit regression. The implication is that in order for hospitals to be technically efficient, hospital should do away all levels of input wastage.

5.3 Conclusion

This study has measured the technical efficiency of 24 health facilities in Ghana; quantified the output (input) increases (reductions) necessary to make inefficient hospitals efficient. It has also measured changes in productivity levels over this period and estimated the sources of total factor productivity change within each hospital. This study has established the fact that there are many health facilities which are inefficient in Ghana.

There-al§o exist high levels of technical inefficiency in every hospitals and health centres in Ghana. This means that most of facilities are harbouring a lot waste in their operations and need to either reduce their amounts of inputs for the to be efficient or increase their output to match up their input levels. Facilities with large amounts of hospital beds and staff could transfer some to nearby facilities.

The findings also show that technological changes and efficiency changes are the main sources of productivity changes. Improvement in technological innovations and efficiency therefore, will increase productivity in health facilities.

5.4 Recommendations

This work has provided the basis for policy makers to approach the problem of efficiency in hospitals not only from the demand side but most importantly the supply-side. It has been shown that the efficiency can be improved without increasing inputs.

On the demand-side, hospitals should improve upon their services to induce more patients to the hospitals. First-time visitors and regular attendants always see the need to visits these hospitals for care. Again, hospitals and health centres with relatively lower outputs (outpatients, inpatients and child deliveries) should intensify programmes which will enable the general public be aware of some of the quality services which the hospitals have. Patients always see the need not to compromise on quality of care. Outreach programmes could also be undertaken to take hospitals closert6 the general public. User fees could be reduced to reduce cost incur by patients. This will increase both outpatients and inpatients.

Ghana Health Services and the Ministry of Health should to institutionalize health facility efficiency and productivity monitoring within the health management information systems in various health facilities.

Most private hospitals should get themselves enrolled on the National Health Insurance Scheme (NHIS). This will improve upon their number of clients who visit them, since most patients are registered with the NHIS.

Slashing of current budgets in the health sector is not recommended since there is a need to improve access and quality of care. Increment in budget is also not recommended. Hospitals and

health centres with their current budgets and other inputs should match up with corresponding output that will make them efficient.

Health facilities should invest more on new technology to improve upon their productivity levels.

5.5 Limitations of the study

The ultimate aim of every facility is to improve the health status of each patient who visits it. Quality of care is_therefore adhered rather than quantity of patients taken care after. In some cases, more personnel hours an more of other inputs are required to take care of fewer patients, for quality of care to be achieved. This study views a facility, who invests more inputs to achieve few quality of care, as inefficient.

The study assumes a similar case-mix for all health facilities whereby same number of hours and amount of inputs are needed to treat each case. However, hospitals and health centres are confronted with different case-mix and need different number of hours and amount of inputs for treatment.

Again, the unavailability of data on Quality-Adjusted Life Years (QALY) hampers the study. The study is incapacitated into looking into effectiveness of treatment after care. There is no proper basis for measuring efficiency of health facilities whose treatments are not known whether effective or not.

Also, DEA does not capture random noise (e.g. epidemics and other disasters), and attributes any deviation from frontier to inefficiency. The DEA, thus, may tend to overestimate the level of inefficiencies.

One important factor that makes the measurement of efficiency and productivity in the healthcare sector using the DEA approach a problematic is that some of the outputs in the hospitals e.g. outpatient visits are uncontrollable (difficult to adjust). Using these outputs, are not good indicators for the measurement of productivity.

Financial and time constraints prevented the researcher to work on more hospitals. Also the unwillingness of-some hospitêJ_administrators to release information hampered the progress of the work.

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APPENDIX 1

STRUCTURED QUESTIONNAIRE

Kwame Nkrumah University of Science and Technology (KNUST), Kumasi

Department of Economics

Topic: A Measurement of Efficiency and Productivity in Hospitals; A case of the Ashanti Region

This study is being conducted in partialfulfillment of the requirementsfor the award ofa Master of Arts Degree in Economics. All information received would be used solely for academic purposes and treated with strict confidentiality. Thankyou.

I. Name of Hospital/HeaIth centre: _____

2. Location:
.....

3. Type of hospital

a) District hospitals [J b) mission hospitals [ ] c) Private hospitals [ ]

d) Quasi government hospitals [J e) Health centres [ ]

4. Number of physicians (Doctors, nurses, midwives, medical assistants, laboratories technicians etc)

Year	Number
2008	
2009	
2010	
2011	

5. Number of non- physicians (Administrators, secretaries, accountants, caterers, cleaners, security personnel, etc)

Year	Number
2008	
2009	
2010	
2011	

6. Number of beds in the hospital (both used and unused).

Year	Number
2008	
2009	
2010	
2011	

7. Total expenditure (cost) incurred by the hospital. This include expenditures on pharmaceuticals, non-pharmaceutical supplies,utilities i.e. water, electricity, telephone, etc.

Year	Ex nditure GH
2008	
2009	
2010	
2011	

8. Total number of outpatients visits (total number of patients treated by physicians without being admitted).

Year	Number
2008	
2009	
2010	
2011	

9. Total number of inpatient days (total number of days all patients were admitted in the hospital).

Year	Number
2008	
2009	
2010	
2011	

10. Total number of child deliveries made by the hospital.

Year	Number
2008	
2009	
2010	
2011	

Appendix 2

Tobit regression

Number of obs =

LR chi2 (5) 75.35

Prob > chi2 0.0000

Log likelihood — 8.5838773 pseudo R2 1.2951

Eff	Coef.	Std. Err .	t	P>ltl	[95% Conf. Interval]	
BD	-.0302963	. 0113723	2.66	0.015	.0064938	. 0540988
ST I	-. 0188952	.002229	8.48	0.000	. 0142298	. 0235606
ALS I	.1979677	. 123262	1.61	0.125	-. 0600226	.455958
L	-.3686913	.1048999	-3.51	0.002	-.5882493	-.1491334
C	-1.95e-06	4.79e-07	-4.06	0.001	-2 .95e-06	-9.43e-07
cons	-1.401242	. 4127543	-3.39	0.003	-2 . 265147	-.5373376
/ s igma	. 1399524	.0243514			. 0889843	.1909206

Obs. summary : 8 left—censored observations at var1

16 uncensored observations

O right—censored observations