ประสิทธิภาพเชิงเทคนิคและเชิงขนาดของโรงพยาบาลการแพทย์แผนโบราณและ
โรงพยาบาลทั่วไปในเขตปกครองตนเองมองโกเลียใน ประเทศจีน

นางสาวลีลี่ กัง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ
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TECHNICAL AND SCALE EFFICIENCY OF TRADITIONAL MEDICINE HOSPITALS AND GENERAL HOSPITALS IN INNER MONGOLIA, CHINA

Miss Lili Kang

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Health Economics and Health Care Management
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Thesis Title	TECHINICAL AND SCALE EFFICIENCY OF TRADITIONAL MEDICINE HOSPITALS AND GENERAL HOSPITALS IN INNER MOGOLIA, CHINA
By	Miss Lili Kang
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Thesis Advisor	Associate Professor Paitoon Kraipornsak, Ph.D.

Accepted by the Faculty of Economics, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master's Degree

…………………………....Dean of the Faculty of Economics
(Associate Professor Chayodom Sabhasri, Ph.D.)

THESIS COMMITTEE

…………………………....Chairman
(Associate Professor Pongsa Pornchaiwiseskul, Ph.D.)

…………………………....Thesis Advisor
(Associate Professor Paitoon Kraipornsak, Ph.D.)

………………………….....Examiner
(Associate Professor Sothitorn Mallikamas, Ph.D.)

………………………….....External Examiner
(Professor Chitr Sitthi-amorn, MD, Ph.D.)

ประสิทธิภาพเชิงเทคนิคและเชิงขนาดของโรงพยาบาลการแพทย์แผนโบราณและโรงพยาบาลทั่วไปในเขตปกครองตนเองมองโกเลียใน ประเทศจีน (TECHNICAL AND SCALE EFFICIENCY OF TRADITIONAL MEDICINE HOSPITALS AND GENERAL HOSPITALS IN INNER MONGOLIA, CHINA) อ. ที่ปรึกษาวิทยานิพนธ์: รศ.ดร.ไพฑูรย์ ไกรพรศักดิ์, 103หน้า

โครงการวิจัยนี้มีวัตถุประสงค์เพื่อวัดประสิทธิภาพเชิงเทคนิคและเชิงขนาด(technical and scale efficiency) ของโรงพยาบาลทั่วไป(general hospitals) จำนวน 128 แห่งและโรงพยาบาลการแพทย์แผนโบราณ (traditional medicine hospital)69 แห่งเพื่อประเมินปัจจัยที่มีผลต่อประสิทธิภาพของโรงพยาบาลทั้งสองประเภทที่ตั้งอยู่ในเขตปกครองตนเองมองโกเลีย ประเทศจีน การวิเคราะห์ประสิทธิภาพด้วยวิธี Data Envelopment Analysis (DEA)ถูกใช้ในการคำนวณประสิทธิภาพเชิงเทคนิคของโรงพยาบาลการแพทย์แผนโบราณและโรงพยาบาลกลาง และใช้ แบบจำลอง (ordinary least square; OLS)ในการประเมินปัจจัยที่มีผลต่อประสิทธิภาพของโรงพยาบาล

ผลการวิเคราะห์DEA พบว่า 86.7% ของโรงพยาบาลทั่วไป และ 66.7% ของโรงพยาบาลการแพทย์แผนโบราณมีการดำเนินการอย่างไม่มีประสิทธิภาพในปี 2011ค่าเฉลี่ยของประสิทธิภาพทางเทคนิคภายใต้ข้อสมมติ average variable returns to scale (VRS) ของโรงพยาบาลดังกล่าวมีค่าเท่ากับ 50%และ 60% ตามลำดับแนวโน้มของการไม่มีประสิทธิภาพเชิงขนาดมีผลเพิ่มผลเพิ่มผลได้ต่อขนาด .ผลการวิเคราะห์ด้วยแบบจำลอง OLSพบว่า อัตราส่วนของจำนวนเจ้าหน้าที่อื่นๆต่อแพทย์ (other personal-physician ratio)มีความสัมพันธ์เชิงบวกต่อประสิทธิภาพเชิงเทคนิคของโรงพยาบาลทั้งสองประเภทอัตราส่วนจำนวนเตียงต่อแพทย์(bed physician ratio) จำนวนแพทย์ในรูปแบบของยกกำลังสอง(No. of doctor in the form of square)มีความสัมพันธ์เชิงบวกต่อประสิทธิภาพเชิงเทคนิคอัตราส่วนจำนวนพยาบาลต่อแพทย์(nurse physician ratio)มีความสัมพันธ์ในเชิงลบ อย่างไรก็ตาม ตัวแปรทั้ง 3 ตัวแปรที่กล่าวมาไม่มีนัยสำคัญทางสถิติสำหรับโรงพยาบาลการแพทย์แผนโบราณ อัตราการเข้าพัก (Bed occupancy) และพื้นที่ไม่มีนัยสำคัญทางสถิติต่อประสิทธิภาพของโรงพยาบาลทั้งสองประเภทผลการวิเคราะห์ระดับประสิทธิภาพเชิงขนาด(scale efficiency scores)พบว่าถ้าอัตราส่วนของจำนวนผู้ป่วยนอกต่อแพทย์เพิ่มขึ้น(outpatient visits-physician ratio)ประสิทธิภาพเชิงขนาดของโรงพยาบาลทั้งสองประเภทจะเพิ่มขึ้น ในขณะที่จำนวนเตียง(no of bed)ให้ผลในทางตรงกันข้ามจำนวนวันพักโรงพยาบาลเฉลี่ย (Average of bed day)มีความสัมพันธ์ในเชิงลบต่อประสิทธิภาพเชิงขนาดในโรงพยาบาลทั่วไปแต่ไม่มีนัยสำคัญกับโรงพยาบาลการแพทย์แผนโบราณ โรงพยาบาลในบริเวณอื่นๆมีประสิทธิภาพเชิงขนาดต่ำกว่าโรงพยาบาลที่อยู่ในเมือง

สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต ....

ปีการศึกษา 2554 ลายมือชื่อ อที่ปรึกษาวิทยานิพนธ์หลัก . ...

5485666829: MAJOR HEALTH ECONOMICS AND HEALTH CARE MANAGEMENT
KEYWORDS: TECHNICAL EFFICIENCY/SCALE EFFICIENCY/GENERAL HOSPITAL/TRADITIONAL MEDICINE HOSPITAL/DATA ENVELOPMENT ANALYSIS/CHINA

LILI KANG: TECHNICAL AND SCALE EFFICIENCY OF TRADITIONAL MEDICINE HOSPITALS AND GENERAL HOSPITALS IN INNER MONGOLIA, CHINA. ADVISOR: ASSOC. PROF. PAITOON KRAIPOMSAK, Ph.D., 103 pp

The purpose of this study was to measure the technical and scale efficiency of 128 general hospitals and 69 traditional medicine hospitals and to estimate the possible factors influencing on the efficiency of both general hospitals and traditional hospitals in Inner Mongolia, China. In first part, Input-orientation Data Envelopment Analysis (DEA) was employed to compute technical efficiency and scale efficiency of both general hospital and traditional medicine hospital. In second part, ordinary least square (OLS) was used to determine the factors that affect the efficiency.

The DEA analysis showed 86.7% of general hospitals and 66.7% of traditional medicine hospitals were run inefficiency in 2011.Both the two types of hospital, the average variable return to scale (VRS) technical efficiency scores were about50%and 60%, respectively. The pattern of most general and traditional medicine hospitals scale inefficiency was increasing return to scale. The result of OLS revealed that other personal-physician ratio had a positive relationship with both types of hospital technical efficiency, bed physician ratio; number of doctor in the form of square had a positive relationship with the general hospital technical efficiency score, nurse physician ratio had a negative relationship with the general hospital technical efficiency score. However, all above three variables were insignificant for the traditional medicine hospital technical efficiency scores. Bed occupancy and geographic were insignificant for two types of hospitals' technical efficiency. For scale efficiency scores, if outpatient visits-physician ratio increase, both two types of hospital scale efficiency were influenced positively, on the contrary, number of beds was found negatively significant. Average of bed day had a negative relationship with the efficiency and significant for the general hospital scale efficiency, but insignificant for the traditional medicine hospital. Traditional medicine hospital in other region were less scale efficient than in the city area.

Field of Study: Health Economics and Health Care Management Student's Signature ....

Academic Year: 2011 Advisor's Signature ....

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Abbreviation

DEA	Data Envelopment Analysis
DMU	Decision Making Unit
TE	Technical Efficiency
SE	Scale Efficiency
AE	Allocative Efficiency
CRS	Constant returns to scale
VRS	Variable returns to scale
IRS	Increasing to scale
DRS	Decreasing to scale
DEAP	Date Envelopment Analysis Programme
MoH	Ministry of health
OLS	Ordinary least squares
TECRS	Technical efficiency under constant return to scale
TEVRS	Technical efficiency under variable return to scale

Chapter I

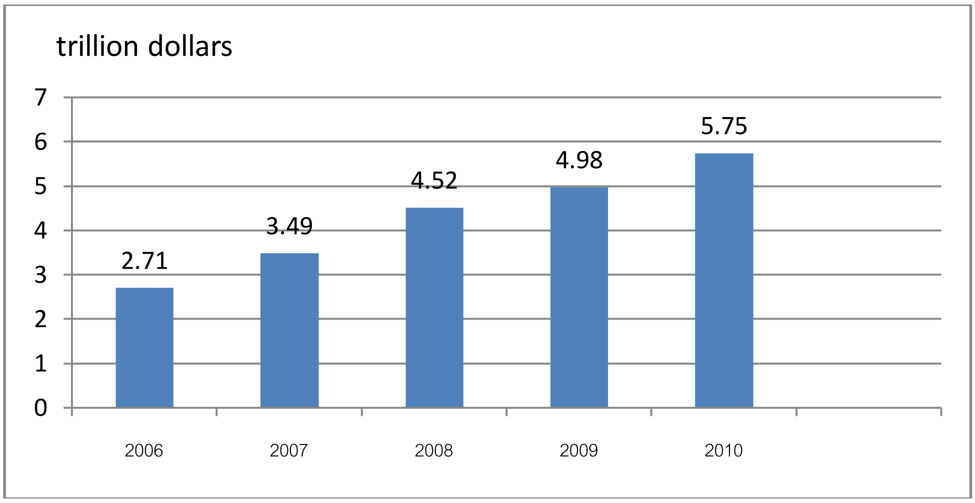
INTRODUCTION

1.1. Problem and Significance

1.1.1China Marco Economy and Healthcare Situation

China is experiencing a sharp growth in its economy now, according to the data from the National Bureau of Statistics of China, during the last seven years in China, the GDP is almost reach 5.75 trillion dollars in 2010 compared with 2.71 trillion dollars in 2002(figure11);

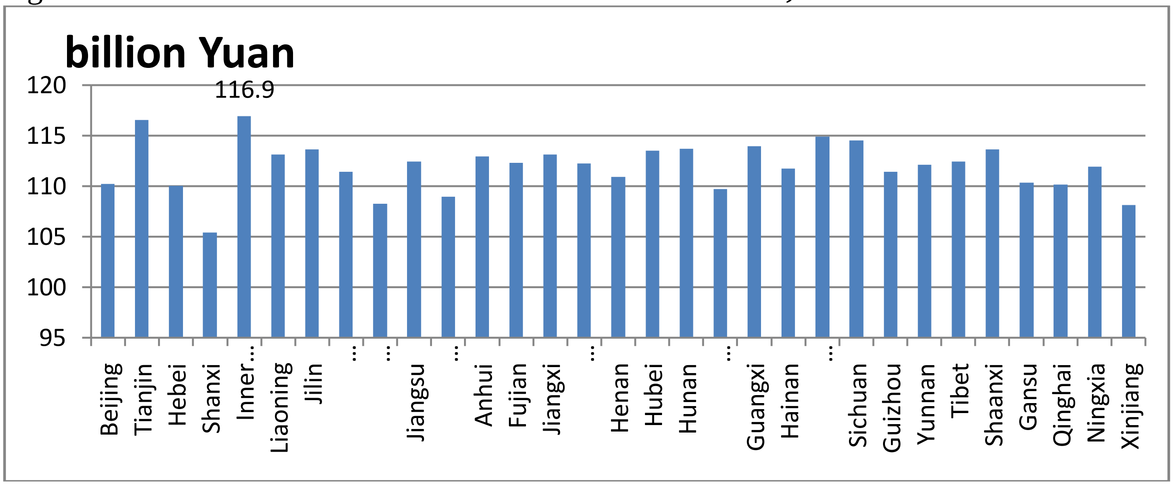
Figure 1-1 **GDP of China**



Sources: "National Bureau of Statistic of China"

China is a big country and made by 31 provinces and cities, and each of them has a good development in economy, from the data of 2009, we can see that, most of them have reach 100 billion Yuan per year, and Inner Mongolia got the No.1,the value was 116.9 billion Yuan. (1 dollar=6.2Yuan)

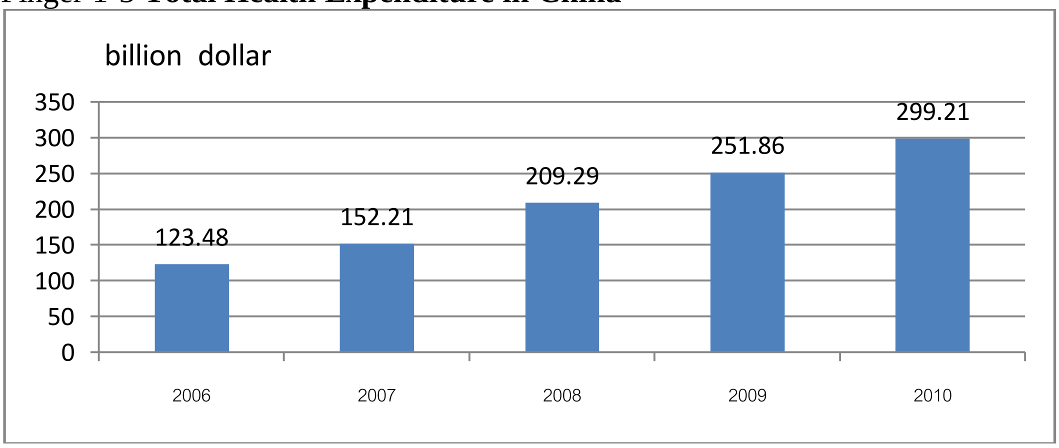
Figure1-2 **GDP Growth in 31 Cities and Provinces in 2009, China**



Sources: "National Bureau of Statistic of China"

Meanwhile along with economic development and improvement of people's living standards, people no matter in urban area or rural areas in China also make higher demands on bettering health care undertakings, from the total health expenditure during the years of 2006 to 2010 (figure 1-3) is also increasing sharply, we can see that more and more people would like to spend much more money on the healthcare part of their lives, and health problem had become the one of the most talked-about thing in both the government and people.

Finger 1-3 **Total Health Expenditure in China**

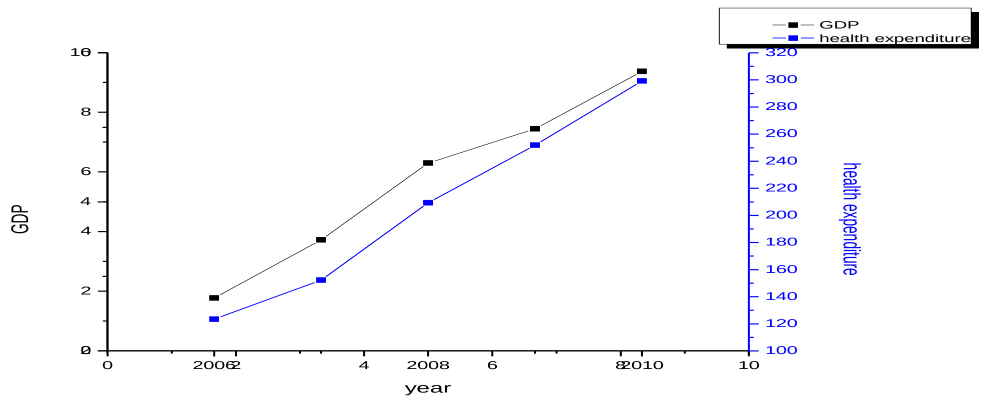


Sources: "Chinese Health Statistic Digest 2010"

Since the major victory won in combating SARS in 2003, the whole healthcare system in China has taken a great change. Until now China's health care sector has make remarkable achievements, as well as health science and technology level has rapidly risen. A health service system coving both urban and rural residents has come into being; the disease prevention and treatment capacity has been continuously strengthened. However, China has a large population, low per capita income, significant urban-rural and regional disparities, this make the Chinese government have to only through long and arduous endeavors and perseverant explorations on the basis of specified directions and framework can we progressively establish a health care system in line with the country's actual national conditions.

From the figure 1-4, although healthcare investment sharply increased and healthcare system have made a big progress over the last years, the trend of healthcare sector development is still now behind economic development in China.

Figure 1-4 **GDP and Health Expenditure in China**



Sources: "Chinese Health Statistic Digest 2010"

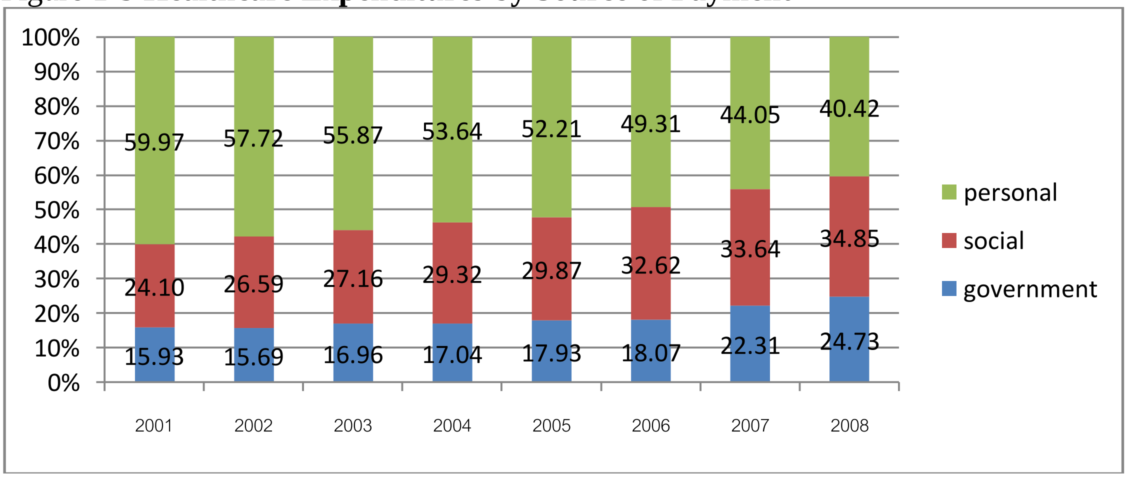
1.1.2The Basic Challenges Facing Current Healthcare System

Like many other counties, now china's health system is facing a great pressure to using the limited resources to provide a high quality service .When government implements the healthcare reform, there are many issues which require a thorough and comprehensive view to face and solve.

1.1.2.1 People Lack of Access to Affordable Healthcare

Due to the different economic levels in different provinces and autonomous regions in China, there is still a significant portion of China's urban and rural population without access to affordable healthcare. Especially, the rural residents are hard hit, many of the rural population are not able to afford professional medical treatment, and most of them indicated that they have not been hospitalized despite having been told they need to be. At the same time, for urban areas, this situation is not much better than the rural areas, along with more and more rural residents come to urban cities to find a job and live in the past two decades, there are also many urban residents find medical treatment prohibitively expensive. Healthcare expenditures, along with actual government funding, have been increasing steadily over the past decades, but the main part of health expenditure is still the out-of –pocket. As illustrated in Figure 1-5, the percentage of out-of-pocket health expenditures is the main resource of healthcare expenditure.

Figure 1-5 **Healthcare Expenditures by Source of Payment**



Sources: "National Bureau of Statistic of China"

1.1.2.2 Inefficiency Use of Healthcare Resources

The second problem is that current healthcare resources are often not allocated and used effectively by the segments of population that need them most. Hospitals as the main health care provider in China have played an important role in the utilization of health care resources. Although from 2003, the Central Government of China and Ministry of Health have embarked on a series of reforms to the hospitals**,** the variations of the geographic environments, demographic structure and other factors can lead to different results. This imbalance allocated of hospitals resources results in inefficiencies in the supply and demand of healthcare services. A disproportionate amount of China's healthcare resources have traditionally been concentrated on larger and big hospitals, particularly those in urban areas. This can be reflected in the number of hospital beds and healthcare personnel in rural and urban areas (Figure1-6).

Figure 1-6 **Distribution of Healthcare Beds and Personal In Urban Area and Rural Area (Per 1000 population)**

	1980	1990	2000	2003	2009
Number of beds					
Urban	4.47	4.18	3.49	3.67	4.31
rural	1.48	1.55	1.50	1.50	1.93
Number of health professions					
Urban	8.03	6.59	5.17	4.84	6.03
Rural	1.81	2.15	2.41	2.19	2.46

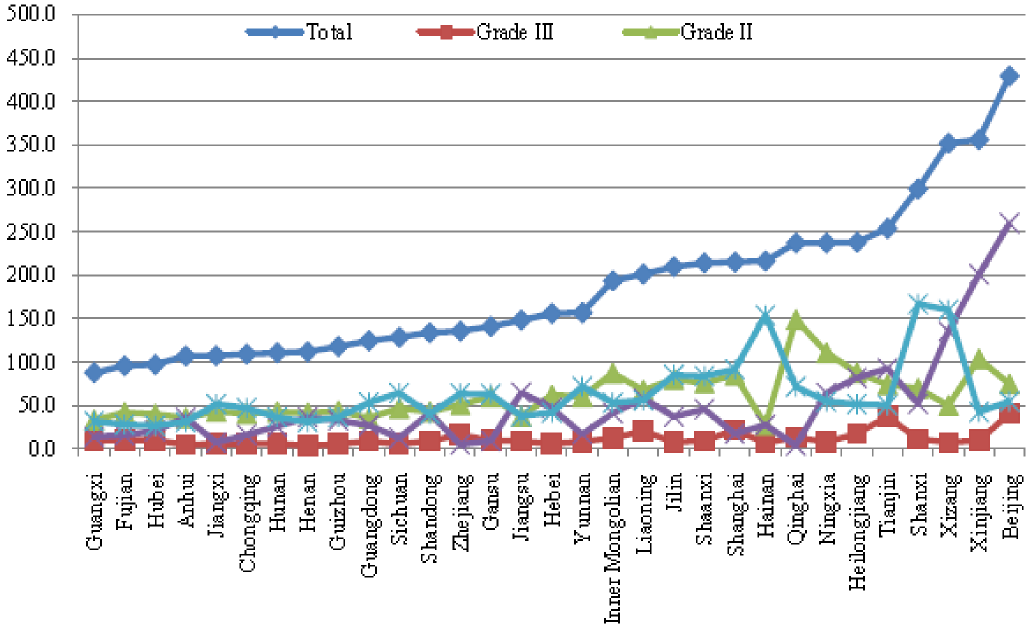
Sources: "National Bureau of Statistic of China"

From the figure, we can see that most of beds and professions are allocated around the urban areas, however, two thirds of population in China are peasants and living in the

rural area. Meanwhile, since the reforms of the hospitals have carried out, they got some unintended consequence; for instance, many hospitals have expanded infrastructure and high-technology equipment in a chaotic way. This results in a serious of no effective utilization situation and imbalance in the growth and distribution of hospital facilities.

Although in china now some provinces' and cities' economy grow quickly, such as Inner Mongolia, the number of hospitals are not that many than other provinces and regions, from figure 1-7, we can see that Beijing has five times more hospitals per capita than Inner Mongolia, and Inner Mongolia is in the Grade III level, but the economy growth No.1 in 2009(figure 1-7).

Figure1-7 **Hospitals per 10 million Populations, by Province and Administrative Level**



Source: World Bank of Fixing the Public Hospital System in China, 2010

What is more, some of inefficiency in resource utilization is mainly by the patients who are more likely to use larger and big hospitals in urban areas. Such disparity leads to "expensive medical bills and difficult access to quality medical services" issue in China in recent years. From the observation, we can see there is a long queue in the big and larger hospitals, and the most of small hospitals have to depend on the government support to survival.

1.1.2.3 Shortfall of High-quality Patient Care

There is common acknowledgement among healthcare system stakeholders that the quality of patient care has been compromised in China. This is reflected in three aspects: first aspect is the hospitals loss of focus on patient care, due to the financial pressures and without clear and strict government guidelines, lots of hospitals have lost the core competency of providing high-quality clinical care; second aspect is that most professionals are in low quality, there are more professionals in this time than before, however, current training and experience of healthcare personnel is relatively weak, more important is that there is no uniform definition exists to document the required qualifications of healthcare personnel, particularly in rural areas the problem of inconsistent and low quality of healthcare workers is a sever issue . The last aspect is the relative departments are unable to monitor the level of care, although almost 90% hospitals are managed by the government, the monitoring is a difficult part for the MoH, because the health system is quite complex as well as the provision and regulation of health service delivery is largely decentralized and managed by many of different stakeholders, including the MoH, provincial and city governments, military and so on. In conclusion, significant improvements are very necessary to solve these problems, especially in less developed place in China, such as Inner Mongolia. With respect to this issue, it is necessary to consider the situation individually.

1.1.2.4 Less Developed of Traditional Medicine Hospital

What is more, according to the “National health plan and priorities” (WHO, 2007), China government supports the development of Traditional Chinese Medicine and fostering a modern TCM industry, as traditional medicine development in China, there is more and more disease can be cured by traditional medicine, it is not only has a good treatment effect, but also reduce the cost of healthcare providers and patients, for example, chronic disease and prevention of disease. China is the only one country in the world where Western Medicine and Traditional Medicine are practiced alongside each other at every level of the healthcare system. Such as Traditional Chinese medicine has its own theoretical and practical way to the treatment of disease, which has already developed over thousands of years, therefore, they account for around 40% of all health care delivered in Chinanow. As the importance of traditional medicine development in China,the current government policy of expansion of traditional hospitals' facilities and manpower is being questioned because many hospitals using traditional Chinese medicine are underutilized and depend on government subsidies for survival. Improve the traditional hospitals efficiency is also an important part for developing and improving the traditional medicine.

All in all, the efficiency of these hospitals′ to be an important point for the policy makers and the process of monitor .From a managerial perspective, understanding the structure of hospitals and their inefficiency in utilizing resources is crucial for making health care policies and budgeting decisions. So improve the efficiency of hospitals not only take much conveniences to the residents but also relieve the pressure of "expensive medical bills and difficult access to quality medical services".

1.2. Research Questions

1. What are the levels of technical efficiency scores and scale efficiency scores of Traditional Medicine Hospitals, General Hospitals in Inner Mongolia region?

2. What factors affecting the efficiency of these two types of hospitals in Inner Mongolia region?

1.3. Research Objectives

General Objective

To calculate the technical and scale efficiency score of traditional medicine hospitals and general hospitals in Inner Mongolia and determine the geographic location and other variables that affect the efficiency score.

Specific Objectives

Calculate the technical and scale efficiency of each traditional medicine hospitals in Inner Mongolia region in terms of technical scores and scale scores.

Calculate the technical and scale efficiency of general hospitals in Inner Mongolia region in terms of technical scores and scale scores.

Find out the factors affecting on the efficiency of both types of hospitals in Inner Mongolia.

1.4. Scope of the Study

Inner Mongolia Autonomous Region locates in the North part of China and as the third-largest subdivision of China spanning about 1,200,000 km^2 (463,000 sq. mi) of China's total land area. It has a population of about 24 million as of 2009. The economy has taken a great change since twentieth century in Inner Mongolia. In 2009 the GDP growth got the first one compared with other provinces and cities in the country.

So the problems are generated by two main factors .On one hand, due to the development of the economy, most of people in Inner Mongolia are now living in a better life. When people have a rising material well-being, their demand of other aspects will increase as well, the health service in special. Although the government of Inner Mongolia has also been implemented various hospital reforms to improve efficiency in health care, as the greater people expectations for access to health services, and limits on the availability of health workers and government funding to support these higher expected levels of service. Quantifying the current level of inefficiency in the hospital system helps provide insight into the degree to which these pressures could be met by a more effective use of resources.

On the other hand, through these years there hardly can find any study on the efficiency of the hospitals in Inner Mongolia region.

What is more, compared with the other provinces and cities, Inner Mongolia as the minority autonomous region, they have their own traditional medicine which already developed for hundred years. The development of the traditional Chinese medicine and traditional minority medicine has become a new popular trend for the sake of implementing the policy of "*Notice of the State Council on Issuing the Plan on Recent Priorities in Carrying out the Reform of Health Care System*" concept(Ministry of health, 2009).In Inner Mongolia Autonomous Region, the main type of the hospital is general hospital, it will be one of the research objectives in this study, and the other objective is traditional hospital.

In conclusion, this study would focus on 197 observations, they were all the second level hospitals that distributed in 12 cities in Inner Mongolia region and the secondary cross-section data which was collected in 2011 from these hospitals in Inner Mongolia region was used.

1.5. Possible Benefits

From the results of the research: Firstly, efficiency measures may be used as background information in the allocation of resources to hospitals and find out the factors that affect the efficiency of the hospitals and to improve the efficiency of the hospitals.

Secondly, offer a good evidence for the reform of the public hospitals as well as identify and measure hospital inefficiency as a basis for directing management efforts toward increasing efficiency and reducing health care costs.

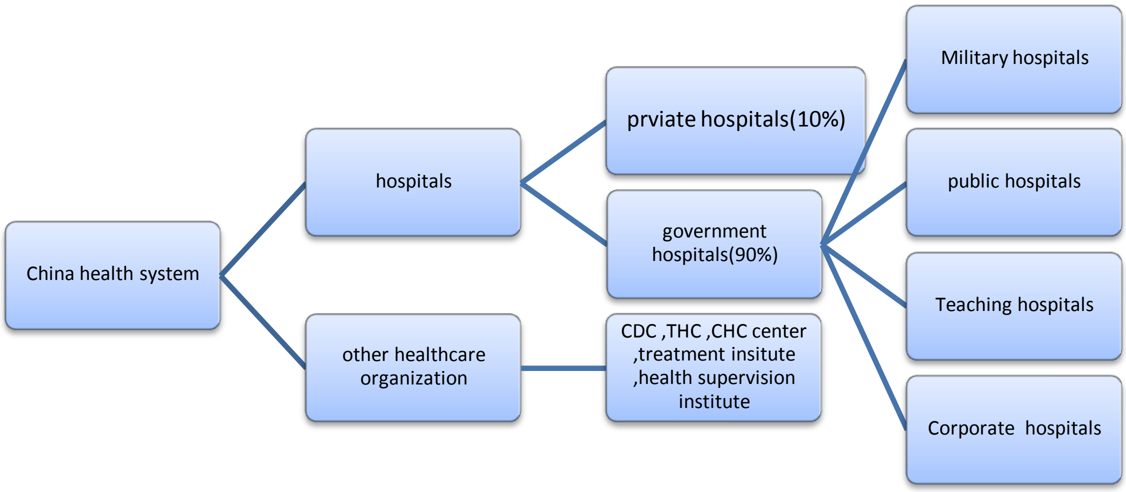
Chapter II

HEALTHCARE SYSTEM IN CHINA

2.1. China Healthcare System

Since the major victory won in combating SARS in 2003, the whole healthcare system in China has taken a great change, until now China's health care sector has made remarkable achievements, as well as health science and technology level have rapidly risen. A health service system coving both urban and rural residents has come into being; the disease prevention and treatment capacity has been continuously strengthened. China's health system is made up of hospitals, nursing homes, health centers, outpatient clinics, community health service centers, maternal and child care stations, and centers for disease control. There are two types of institutions: medical and other. Medical institutions are licensed to diagnosis and treat diseases. Other institutions include public health agencies (such as centers for disease control), blood stations, and teaching and training institutes. Along with deepening the health care system reform, the healthcare service are primarily based on the government managed the hospitals, and almost 90% of the public hospitals under the leadership of Ministry of Health or Health Bureaus of local governments at provincial or county level, in China. (Figure 2-1)

Figure2-1**Structure of the China Health System**



Sources: "Ministry of Health, China, 2010"

2.2. Overview of Public Hospital in China

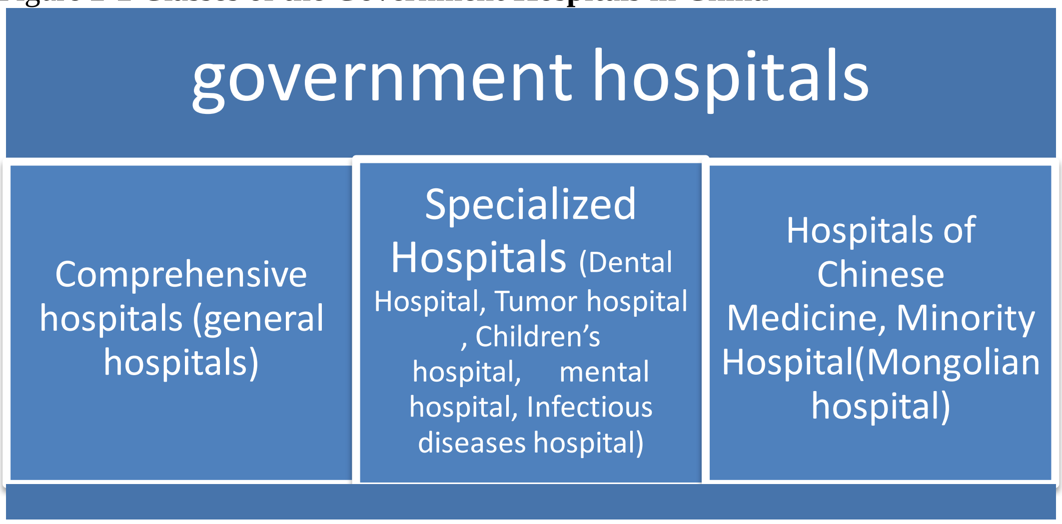
2.2.1Basic Information of Public Hospitals in China

Hospital is the main healthcare provider in China; it plays a great important role in the reform of Chinese healthcare system**.** The main functions of public hospital in China are save lives, prevent and cure diseases, and it is also the core of attaining government objectives for health and social stability. The Chinese government establishes the mechanism of labor division and work coordination between urban hospital and community health service institutions. The essential functions and responsibilities of these public hospitals contain the following aspects:

First is to providing regular medical services; second is to providing preventive health care, rehabilitation, and health education; third is to responding to public health accidents; forth is to supporting other government missions; and last is to conducting medical education and research.

What is more, there are many ways to distinct the hospitals in china**,** from the classes' perspective; According to functions, tasks and scopes of services it can be divided into the following classes. (Figure 2-2):

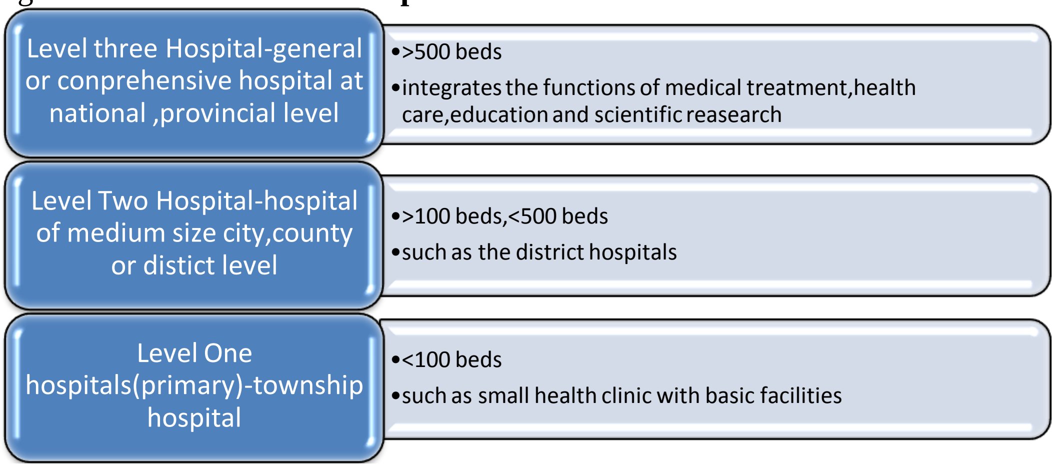
Figure 2-2 **Classes of the Government Hospitals in China**



Sources: "Ministry of Health, China, 2010"

According to the levels of the hospitals, different classifications have different Hospital level**;** there are mainly three levels of hospitals as follows (figure 2-3):

Figure 2-3**TheLevel of the Hospitals**



Sources: "Ministry of Health, China, 2010"

2.2.2 Reform of Hospital in China

Actually, hospital reform has experienced a long since last decades and the reform of public hospitals in China can be divided into three times:

- **Public hospital and reform before the Open Door Policy(1949-1980);**

At the beginning of China founded in1949, the main problem is to provide enough food and cloth, at that time the health services were provided by the Free Medical Service and Labor Health Insurance in urban areas and Cooperative Medical Scheme in rural areas, and there is also a Loan Fund for Patients helped make medical service affordable. The government subsidies to public-owned hospitals accounted for 15-35 percent of hospital budgets to ensure that needed social functions were carried out in thirty years before reform. Until 1957, a mature healthcare network was supplying the basic medical service and drugs. At that time most activities done to develop a good healthcare system, for example, the government sent the urban health teams to villages, the government provided financing to build or enlarge community health centers, and used the donations to build village-based cooperative health station, and trained barefoot doctors and so on through the policies which were typically carried out in the context of political activities.

During the 1966-1976, almost every community was equipped with health centers. This system was affordable and cost-effective, both urban and rural residents could receive medical services and health insurance with financial support from the government, the collective, and their units. The hospitals could get support from the government subsidies, but this also take a heavy burden to the government. Severe medical resource shortages resulted when government subsidies and reimbursement did not cover actual costs. The slow adoption of new technology and equipment, inadequate depreciation and replacement of buildings and medical equipment, inefficient use of available technology, failure to contain costs, little monitoring of service impacts, low patient satisfaction, and long waiting periods for some procedures are the main difficulties.

- **Alleviating fiscal burdens and influencing hospital behavior(1980-2003);**

Since 1980s, the main purpose of hospital reform has been to alleviate the government's financial burden. These reforms introduced market mechanisms and changed ownership to a state-owned enterprise (SOE) model. Since 1985, the MoH addressed the lack of medical inputs and proposed community-run hospitals as a way to mobilize social forces in launching health institutions. private capital entered the health sector by encouraging retired medical staff to pool funds to launch medical institutions were admitted, and charging for services was also permitted.

In 1989, the government of China developed the SOE reform by promoting various contracting systems for medical institutions. it permitted the public hospitals to earn profits from specialty medical services and to charge more for the higher-quality services, because of this reform the hospitals can get the new funds .in 1992,the MoH expanded the autonomy of medical institutions, including opportunities to increase revenues by "incentivizing" public hospitals and their employees. However, by allowing these incentives, most of the hospitals still kept the traditional model of the public model of public sector governance, and did not have and improvements in the management of the hospitals. From 1997 to 2000, the hospitals reform experienced a series changes,-specifying the government′s financial and management responsibilities to provide public health and basic medical services; defining the government's role; transforming public hospitals' operating mechanisms and classifying management models for medical institutions and the government specified management policies for finance, taxation, and price for services. During the past 20 years, the public hospitals have experimented with management models and internal governance, and management improved to some extent as a result, but the price-setting mechanism has not addressed the goals of equity and improved quality of medical services. And the medical services were more and more expensive, the high price caused most of poor people were not affordable the health services.

- **Addressing access and costs of services (2003-present).**

The SARS outbreak enabled the Chinese to propose a vision for developing the economy and constructing a harmonious society. As the hospital reform enters a new stage, the public, the government, and scholars have increasingly focused on the difficulty of accessing care and the high cost of medical treatment ,from 2006,according to the president Hu Jintao stressed the welfare nature of public medical and health activities ,and advanced health system reform, most hospital in different provinces and cities carried out the principles, and the first beginner is Jilin People Hospitals and it began form the following points:

Firstly, reassert the roles of public resources in hospitals; Secondly, Mobilize enthusiasm and innovation among medical staff; Thirdly, Improve hospital management and quality of services; Fourthly, Promote efficiency utilization of medicines and reduce patient′s expenses;

And lastly, Strengthen pharmaceutical supervision to guarantee pharmaceutical safety.

In 2008, another "common sense" reforms (Deepening Pharmaceutical and Health System Reform (draft)) were outlined to:

- Manage medical institutions in the larger context of regional planning and regulation
- Clarify functions of public hospitals

- Strengthen government′s responsibilities and input
- Regulate the levels of and methods of payment;
- Establish hospital management structure with governing boards;
- Separate hospital management and operation by government;
- Separate provision of medical service and drug sales;
- Separate profit and non-profit aspects of hospitals;
- Improve operations, incentives, and compensation of public medical institutions;
- Reform the practice of complementing medical insufficiency by selling medicines;
- Regulate expenditure and income management and strengthen social welfare;
- Implement a regional health development plan;
- Integrate medical and basic public health resources in the rural health service network;
- Strengthen a model of urban health service based on community health.

(World Bank, 2010)

According to above concepts, efficiency of the hospital could provide strong evidence for the policy makers and managers.

2.3. Basic Health Insurance in China

Due to the rapid economic growth of China in the past decades, it has caused fundamental demographic changes and for the sake of keeping the healthcare equity for the rural residents, The Chinese government not only in the effort to reform hospitals, but also enhance the development of health insurance of the Chinese people, according to the constitution of the people′s republic of China, “Citizens have the right to get support (such as material assistance)from the state and society when they are old, ill, or disabled. The state develops the social insurance, social relief, and medical and health services asked to enable citizens to enjoy this right." Social health insurance is undergoing a huge reform. Medical insurance has been developed into three structures, the first one is for urban employees, the second one is for rural citizens, and the last one is for the urban residents.

For the urban employees health insurance the new system employs a cost-sharing structure on which the government, employers and employees share the costs of healthcare and for the insurance the government is decided to mandatory to all employees in both public and private companies, with the exception of the self-employed. Meanwhile, the urban health employees insurance does cover retired and laid-off workers. In 2007, the State Council initiated pilots on the basic medical insurance for urban residents, including non-employed population in urban area.

In 2002,the central committee of the communist party of China and the state council planned to build a new rural cooperative medical system, and almost 96%of farmers are covered by this health insurance until now, moreover, in 2003,a rural medical relief system was initiated and an urban medical relief pilot program started in 2005,which replicated nationwide.

These two types of insurance are managed by the government, and they are the main health insurance in China now, except these there are also have some commercial health insurance, because the high expenditure of these insurance, only relative rich people buy such health insurance. Until now most of people in China have the health insurance, and health insurance system is combined with the public hospital system and some drug store.

Chapter III

LITERATUREREVIEW

From the previous literatures, there are many papers to talk about the measurements of the efficiency, and it is an old topic in the economic field. However, why we measure the efficiency? For this question, there are two main basic arguments; the most argued one is to recognition the gap between the theoretical assumption of full technical efficiency and empirical reality.

Through the literatures, it has been acknowledged that it truly exist a gap between a DMU's actual and potential levels of technical performance. This also brings lots of evidence and implications for understanding of efficiency.

3.1. Efficiency

Efficiency, *known as productive efficiency as well,* full (100%) efficiency is attained by any firm if and only if none of its inputs or outputs can be improved without worsening some of its other inputs and outputs. (Pareto-Koopmans Definition).

Relative Efficiency, A DMU is to be rated as fully (100%) efficient on the basis of available evidence if and only if the performances of other DMUs does not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs.

Following the Farrell (1957), economic efficiency, which occurs in various forms in economics, also is known as X-efficiency has two forms:

3.1.1Technical Efficiency (TE), where firms produce the most output possible with their current set of inputs.

3.1.2 Allocative Efficiency(AE), where firms' inputs' prices determine the least costly mix of inputs capable of run and both in the long run, as long as markets are unfettered.

3.1.3 Overall Efficiency (OE) is involved in both components which are put together in the relation as follows: (Afonso and Fernandes, 2008)

$$OE=TE*AE$$

What is more, the concept of technical efficiency is related to productive efficiency. Productive efficiency is concerned with producing at the lowest point on the short run average cost curve. Thus productive efficiency requires technical efficiency. (Joses, Emrouznejad and Luis, 2002)

The concept of technical efficiency is also related to x-inefficiency. X-inefficiency is said to occur when a firm fails to be technically efficient because of an absence of competitive pressures, e.g. a monopoly employs inefficient working practices because it has no incentive to cut costs. (Joses,Emrouznejad and Luis,2002)

3.2. Methods of Measuring Efficiency

Most papers related to the methods to measure the technical efficiency and scale efficiency of firms' ether on the parametric or on the non-parametric approach, and there were also some papers used both of the methods. These two kinds of approaches were shown in the following concept.

3.2.1. Parametric Frontier Approach

Parametric frontier function needs the definition of a specific functional from for the technology and for the inefficiency error term and it can be divided into two ways:

One is the deterministic model, another is stochastic model.

3.2.1.1Deterministic Frontier Production Function

The deterministic frontier production function model envelope all the observations, identifying the distance between the observed production and the maximum production, and it is defined by the frontier and the current technology level. For example, we assume the level of technology is given of the sample firms, the most interest thing is ascertaining the highest output got using the best practice technique at firm level. The output can be shown through the production function, which can be called the frontier production function (FPF), may estimate in a many ways, for example, one input and one output of a DMU, or two inputs and one output of a DMU and so forth

3.2.1.2 Stochastic Frontier Production Function (SFA)

Stochastic model has the capacity of capture the efforts from outside beyond the control of the analysis unit errors in the observations and in the measurement of output are also be considered in this model**.**

3.2.2. Non-Parametric Approach

Non-parametric approach does not require the specification of any particular functional from to describe the efficiency frontier or envelopment surface. (Luis, Juan, 2000).

The Data envelopment analysis (DEA) is the main non-parametric approach herein. DEA is a linear programming measurement which identifies the relationship between inputs to a production process (resources used in a hospital) and the outputs of that process. (Charnes, Cooper and Rhodes, 1978).

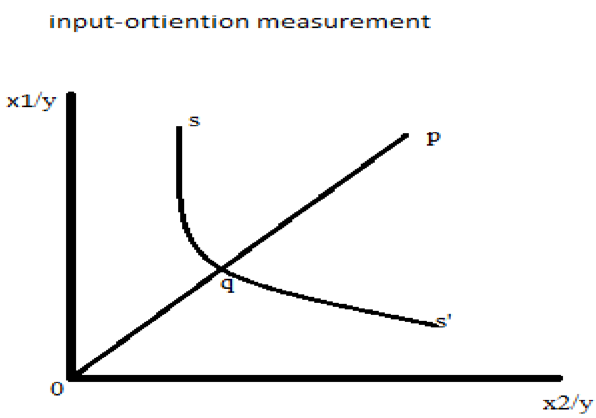
3.2.2.1 Input and Output-orientated Measurement

For the DEA approach, there are mainly two different measurements: input-orientated measures and output-orientated measures.

3.2.2.1.1 Input-orientated Measures

The input-orientated measures address on the question: “by how much can input quantities be proportionally reduced without changing the output quantities produced?”For this question a simple example relative to firms which used two inputs to produce a single output, under the assumption of constant returns to scale is given. Due to the unit isoquant of fully efficient firm, represented by RR′ in figure 1.if a given firm uses quantities of inputs. Defined by point S, to produce a unit of output, the technical inefficiency of the firm can be represented by the distance QS, which is the amount by which all inputs could be proportionally reduced without a reduction in output. This also can be written in percentage terms by the ratio QS/OS, and the technical efficiency equal to one minus QS/OS. It will take a value between zero and one, as well as provides and indicator of the degree of technical inefficiency of the firm. The value of one indicates the firm is fully technical efficient (Coelli, 1996).

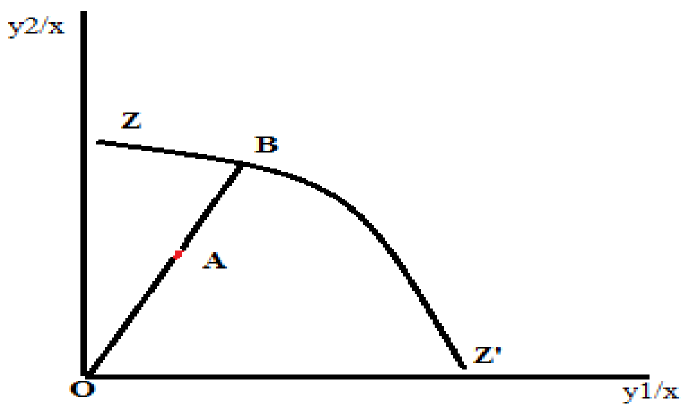
Figure 3-1 **Input-orientation Measurement**



3.2.2.1.2Output-orientated Measures

In contrast to the input-orientated measures, the output-orientated measure focus on the "by how much can output quantities be proportionally expanded without affecting the input quantities used?"same like the input-orientated measure, a simple example can be given in this measures, for example, a firm could produce two outputs and use a single input, under the constant return to scale, form figure 2, we can see the line ZZ′ is the unit production possibility curve and the point S represented a inefficient firm, we can see that the inefficient firm point A, lies below the curve in this case because ZZ′ assumes the upper bound of production possibilities. From the figure 2 the distance AB represents technical inefficiency. That is, the amount by which outputs could increase without requiring extra inputs. Hence a measure of output-orientated technical efficiency equal to 0A/0B (Coelli, 1996).

Figure 3-2 **Output-orientation Measurement**



3.2.2.2 DEA Models

For DEA, there are also have different models: at first, Charnes, Cooper and Rhodes (1978) created the input-oriented and output-oriented DEA models which is assumed in the constant return to scale (CRS), and few years later Banker, Chanes and

Cooper (1984) introduced this models assuming variable return to scale (VRS) referring to changing the economic scale for both input and output oriented.

3.2.2.2.1 The Constant Returns to Scale DEA Model

Assume there are N firms or DMU′s contain K inputs and M outputs, respectively, and there are two matrixes, one is X involving K*N input matrix, and the other one is M*N output matrix, Y. for the i-th DMU there are represented by the vectors x_i and y_i, respectively.DEA is aimed to construct a non-parametric envelopment frontier over the data points such that all observed points lie on or below the production frontier.(Hollingsworth,1999)

The Charnes, Cooper, and Rhodes introduced the ratio DEA. The ratio of all outputs over all inputs is used to measure the relative efficiency of the firms. This model is used to be as the reduction of the multiple-output/multiple-input situation for each DMU. In the mathematic way, it can be expressed as:

$$\text{Max} H_{\mu,\nu} = (\textstyle\sum_r \mu_r y_{r0})/(\textstyle\sum_i \nu_i \chi_{i0}) \tag{2.1}$$

Where μ is an M*1 vector of output weights and ν is the K*1 vector of input weights.

To looking for the appropriate weight, we can through the mathematic ways:

$$Max_{\mu,\nu}\left(\frac{\mu' y_i}{\nu' x_i}\right)$$

$$\text{St} \quad \mu' y_j / \nu' x_i \leq 1, \text{ j=1, 2, 3, 4……j}$$

$$\mu, \nu \geq 0 \tag{2.2}$$

from the above equation, we can calculate the μ and ν, the under the constraint that all efficiency measures must be less than or equal to one. However, there will be a problem with this ratio formulation is that it has an infinite number of solutions, for the sake of avoiding this problem, we can impose the constraint $\nu' x_i$ =1, which provide:

$$Max_{\mu,\nu}(\mu' y_i)$$

Subject to $\nu' x_i$=1,

$$\mu' y_i - \nu' x_i \leq 0, \; j=1, 2, 3\ldots\ldots, N,$$

$$\mu, \nu \geq 0 \qquad (2.3)$$

This form is regarded as multiplier form of the linear programming problem. What is more, a new kind of form can be brought out when using the duality in the linear programming, which is called the envelopment form, expressed in the following mathematic formulation:

$$Min_{\theta,\lambda}\theta$$

Subject to $-y_i$+Yλ≥0

$$\theta Xi - X\lambda \geq 0,$$

$$\lambda \geq 0 \qquad (2.4)$$

This envelopment form involves fewer constraints than multiplier form, and this is generally the popular one to be used. The value of θ will be the efficiency score for the i-th DMU and according to the Farrell(1957) definition ,it meet the θ≤1,when it equal to 1,it means that a point on the frontier and hence a technically efficient.(Coelli, 1996)

For the constant returns to scale DEA model, Cooper,Seiford,and Zhu (2004) proposed that it can be applied into the input and output –oriented versions, in the following table 3-1 and 3-2 shows the mathematic expression of the two different measurements, each in the form of a pair of dual linear programs.

Table 3-1 **Constant Returns to Scale DEA Model in Input-oriented**

Input-oriented	
Envelopment model	Multipliers model
Min_{θ}-ε($\sum_{i=1}^{m} s_i^{-}$+$\sum_{i=1}^{s} s_r^{+}$)	Max z=$\sum_{r=1}^{s} \square_r\, y_{ro}$
Subject to	*Subject to*
$\sum_{j=1}^{n} x_{ij}$ +s_i^{-}=θx_{i0}, i=1,2,…..m;	$\sum_{r=1}^{s} \square_r\, y_{rj}$-$\sum_{i=1}^{m} \nu_i\, x_{ij} \leq 0$
$\sum_{j=1}^{n} y_{rj}$ -s_r^{+}=y_{ro}, r=1,2,3…s;	$\sum_{i=1}^{m} \nu_i\, x_{i0}=1$
λ_j≥0,j=1,2,3….n	$\square_{r,}\nu_i \geq \lambda > 0$

Table 3-2 **Constant Returns to Scale DEA Model in Output-Oriented**

output-oriented	
Envelopment model	Multipliers model
Min_{ρ}+ε($\sum_{i=1}^{m} s_i^{-}$+$\sum_{i=1}^{s} s_r^{+}$)	MaxP=$\sum_{r=1}^{m} \nu_r\, x_{ro}$
Subject to	*Subject to*
$\sum_{j=1}^{n} x_{ij}$ +s_i^{-}=x_{i0}, i=1,2,…..m;$\sum_{i=1}^{m} \nu_i\, x_{ij}$	$\sum_{i=1}^{m} \nu_i\, x_{ij} - \sum_{r=1}^{s} \square_r\, y_{rj} \geq 0$
$\sum_{j=1}^{n} y_{rj}$ -s_r^{+}=ρy_{ro}, r=1,2,3…s;	$\sum_{i=1}^{m} \square_i\, y_{i0}=1$
λ_j≥0,j=1,2,3….n	$\square_{r,}\nu_i \geq \varepsilon > 0$

3.2.2.2.2 The Variable Returns to Scale Model DEA (VRS)

Due to the imperfect competition, constraints on finance, etc. such reasons may lead to the DMU to be not operating at optimal scale. So Banker, Charns and Cooper (1984) advised that an extension of the CRS DEA model to express variable returns to scale situation. In the CRS specification when some of DMUs are not operating at the optimal scale, will lead to measures of TE which are confound by the scale efficiencies (SE), and the VRS specification will permit the calculation of TE devoid of these SE impacts.

The VRS can be account for through the CRS linear programming by adding the convexity constraint: N1′λ=1to (2.4)

$Min_{\theta,\lambda}\,\theta,$

Subject to $-y_i$+ Yλ≥0

θXi- Xλ≥0,

$$N1'\lambda=1$$

$$\lambda\geq 0 \tag{2.5}$$

This approach forms a convex hull of interesting planes which envelop the data points more tightly than the CRS conical hull and thus provide technical efficiency scores which are greater than or equal to those obtained using the CRS model.

Then, under variable return to scale assumption, it is common to decompose measures technical efficiency into component measures of *purely technical efficiency, congestion, and scale efficiency.*

Scale Efficiency through DEA calculation, we can get the CCR score and BCC scores of a DMU, and we can use в^{*}_{CCR} and в^{*}_{BBR} represent the two kind of scores, respectively. The scale efficiency is defined by

$$SE= \text{в}^{*}_{CCR}/\ \text{в}^{*}_{BBR} \tag{2.6}$$

SE is not greater than one. From above concept we can calculate the

TE=pure technical eff. × scale eff.

From the economist or the manager perspective, the economic decision-making process can fail in two different ways. "The whole core of economic theory is concerned with the first of these-the marginal revenue products of some or all factors might be unequal to their marginal costs. If this is true the allocative decision is said to be inefficient. The second source of failure is the technical production function-a failure to produce the greatest possible output from a given set of inputs means the technical decision is inefficient".(Coelli, 1996).

3.2.3 Regression Analysis Used in DEA

There are also many ways to do the regression analysis, for example, Standard multiple regressions but it need to assume the normal and homoscedastic distribution of the disturbance and the dependent variable; and in the case of a limited dependent variable, the expected errors will not equal zero. Hence, standard regression will lead to a biased estimate. While, Logit models can also be used if the DEA scores are converted to abinary variable such as efficient/inefficient. However, the converting of scores < 1 to a categorical variable results in the loss of valuable information; consequently Logit is not recommended as a technique for exploring health care problems with DEA. At the same time, perhaps someone think that the Tobit model can also be used whenever there is a mass of observations at a limiting value. This truly works well with DEA scores which contain both a limiting value (health care providers: whose DEA scores are clustered at 1) and some continuous parts (health care providers: whose DEA scores fall into a wide variation of strictly positive values < 1). No information is lost and a Tobit model fits nicely with distribution of DEA scores as long as there are enough best practice providers. But, there are real have some limitations, for example, if in a sample of 200 providers less than 5 were on the frontier, a Tobit model would not be suitable.

3.3. Hospital Efficiency

A good use of the resource is become a very important part for the hospitals management and development, ***hospital technical efficiency*** is that technical efficiency is consistent with efficiency concepts in physics and engineering and Pareto-efficiency in economics**.** Here, Hospital efficiency addressed the hospital's use of resources (supplies, labor, and capital) to provide units of service (patient care, research, and teaching).

At first assume the returns hypothesis: constant returns to scale (DEAC) and variable returns to scale (DEAV), then considering a group of m DMU. There are j inputs and s outputs and each decision-making unit is characterized by an input-output (X, Y) vector. For the purpose of to determine the efficiency score of each DMU, these would like to be confronted with a similar group including a liner combination of efficient decision-making units. And the DEA method try to maximize the relative efficiency score of each DMU, subject to the constraint that the group of weights obtained in this manner for every DMU should be feasible for all the others included in the sample. So the efficiency score can be calculated by the following mathematical programming formulation where technical efficiency score will be determine by the optimum μ, and due to the assumption the technical score can be defined as TEC and TEV.

$$TEC = Max\beta \square^{0}$$

Subject to

$$\sum \beta_j \, y_{ij} \geq \mu y_i^0, \ i=1, 2, 3 \ldots. m$$

$$\sum \beta_j \, x_{rj} \leq x_r^0, \ r=1, 2, 3 \ldots s \qquad (2.7)$$

$$TEV = Max\beta \square^{0}$$

s.t.

$$\sum \beta_j \, y_{ij} \geq \mu y_i^0, \ i=1, 2, 3 \ldots. m$$

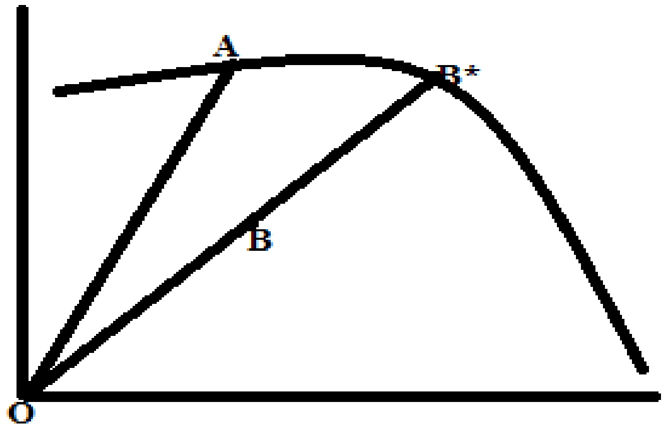
$$\sum \beta_j \, x_{rj} \leq x_r^0, \ r=1, 2, 3 \ldots s$$

$$\sum \beta_j = 1 \qquad (2.8)$$

Each unit should be efficient if only if this ration equals to one, otherwise it will be considered as relatively inefficient. (Sherman,1984).

Through DEA to calculate the technical and scale efficiency of the units, following figure 3-3 represents a production frontier with a given production process of DMUs and inputs. DMU A and B are plotted in the output space. In this graph, A is on the frontier but B is not. A cannot expand its production level, but B can expand its production level to point B* (Yoshikawa, 1996).

Figure 3-3 **Technical Efficiency and Technical Inefficiency of DMU A and B**



To do the hospital scale efficiency**,** the first step is to estimate technical efficiency measures for each hospital using Data Envelopment Analysis (DEA) under the assumption of constant returns to scale (CRS).The second step is to estimate technical efficiency measures assuming instead variable returns to scale (VRS).

Scale efficiency can then be calculated as the ratio of the CRS to VRS technical efficiency indexes.

3.4. Relevant Studies of DEA in Other Countries

Table 3-3 **Pervious Hospital Study**

Author	Paper Title	year
H. David Sherman	Hospital Efficiency Measurement and Evaluation: Empirical Test of a New Technique	1984
Thomas R. Nunamaker	Using Data Envelopment Analysis to Measure the Efficiency of Non-Profit Organizations: A Critical Evaluation	1985
M. C. A. S. Portela and E. Thanassoulis	Developing a Decomposable Measure of Profit Efficiency Using DEA	2007
R. D Banker, A..Charnes, W. W. Cooper	Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis	1984
Subhash C. Ray	Comparing Input- and Output-Oriented Measures of Technical Efficiency to Determine Local Returns to Scale in DEA Models	2008
AntónioAfonso&SóniaFernandes	Assessing Hospital Efficiency: Non-parametric Evidence for Portugal	2008
HSI-HUI CHANG	Determinants of Hospital Efficiency: the Case of Central Government-owned Hospitals in Taiwan	1998
Joses M. Kirigia,AliEmrouznejad, and Luis G. Sambo	Measurement of Technical Efficiency of Public Hospitals in Kenya: Using Data Envelopment Analysis	2002
ROWENA JACOBS	Alternative Methods to Examine Hospital Efficiency: Data Envelopment Analysis and Stochastic Frontier Analysis	2001

3.5 Previous Studies on Hospital Efficiency in China

The data envelopment analysis (DEA) model was use to assess technical efficiency index of tertiary hospitals in Harbin in 2006 and there were 13 hospitals which ran in the relative efficiency, account for 65.5%.from the result, it represented that most of hospital in Harbin were good, but there still many problems such as low efficient utilization of the equipment and the inefficient of workers in the hospital (Wan, Li, LiandLi, 2006).

The data envelopment analysis (DEA) was used unempirical analysis of relative efficiency of Chinese public acute hospitals and the sample was randomly stratified into three levels of hospitals, this study chosen an output-oriented DEA approach to achieve its objectives. The estimation procedures include decomposition of the technical efficiency obtained as scale efficiency and ′pure′ technical efficiency under the assumption of variable returns to scale. The finding suggested that on average the general level two hospital are least inefficient. (Li, Wang, 2008)

Chapter IV

RESEARCH METHODOLOGY

4.1 Research Design

This was a descriptive study using econometric techniques for its analysis. Secondary cross-section data was applied to a cross section model for data envelopment analysis (DEA) and regression analysis employing ordinary least squares (OLS).

4.2 Population & Sample

This target population contained the all secondary level of traditional and general hospitals in Inner Mongolia region. There are 128 general hospitals and 69traditional hospitals in the year 2011 in Inner Mongolia region and all of them were included in this study. Private hospitals and other health service centers were not included in this study due to they were not the main health service providers. Geographic location was as the dummy variable for regression analysis to identify the factors affecting on the efficiency of the traditional and general hospitals.

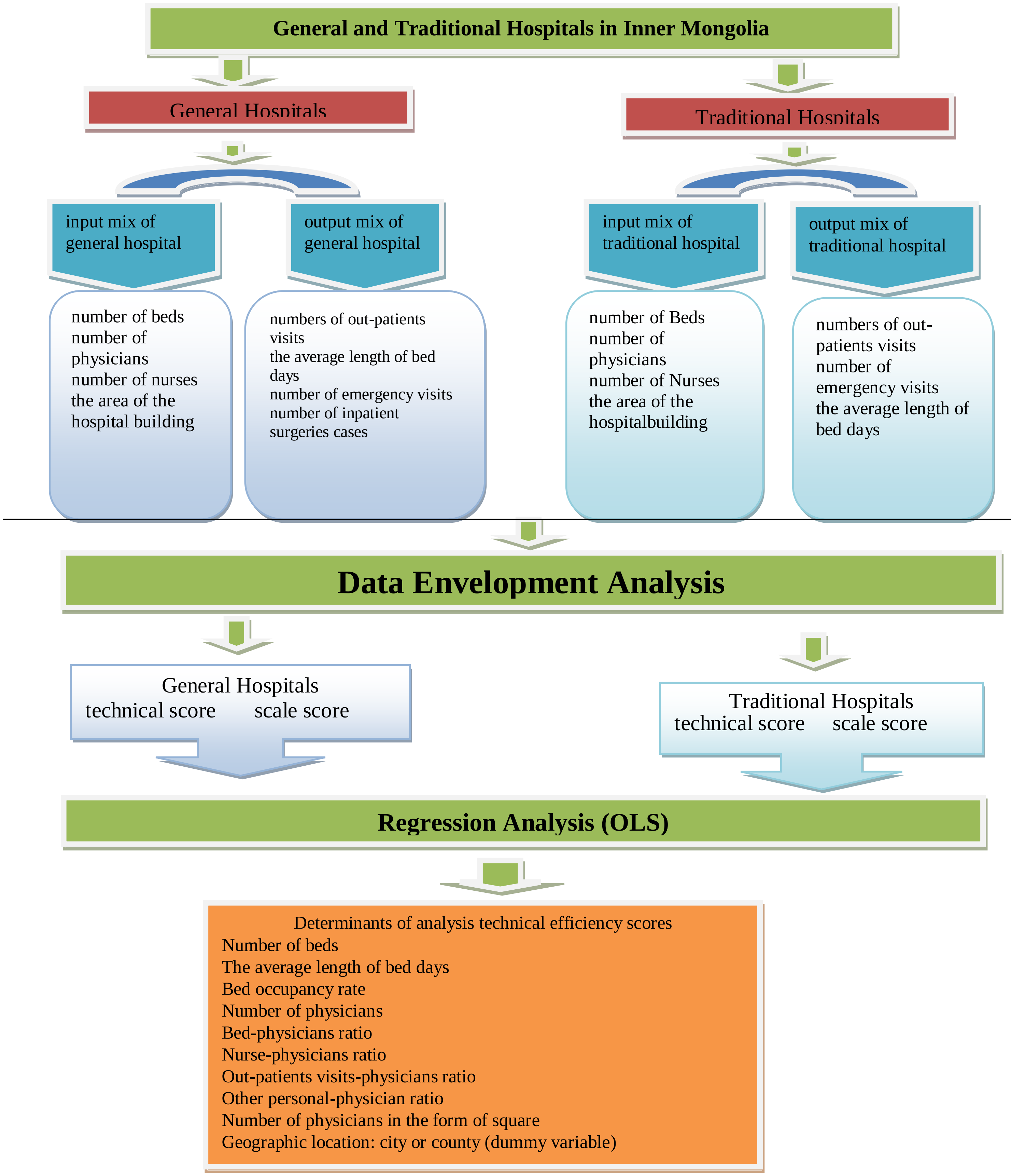
For in this study the all traditional and general hospitals of secondary level in Inner Mongolia region were used, the sample was the same as the population, and there were no exclusion criterion.

4.3 Conceptual Framework

The specific data was used from traditional and general hospitals in 12 cities in 2011, Inner Mongolia region. This calculation has two sections. The first section including two steps, the first step is to calculate the general hospitals' technical efficiency score and scale efficiency score individually; the second step is to calculate the traditional hospitals' technical efficiency and scale efficiency score individually. And the results of DEA showed technical efficiency score (TE) and scale efficiency score (SE), respectively. The second section is to identify the factors that which may have an impact on the efficiency of these two types of hospital under the regression analysis using ordinary least squares (OLS). technical efficiency under variables to scale assumption (TEVRS) and scale efficiency (SE) were the dependent variables and 9 independent variables were estimated the magnitude and direction of their relation.

The methods used in this study were concluded in conceptual framework in the following table.

Figure 4-1 **Conceptual Framework**



4.4 Source of Data

Secondary data were collected in 2011 from 197 hospitals distributed in 12 cities in Inner Mongolia region. Table 4-1 showed the observations in different cities and league cities.

Table4-1**Distribution of Observations by Hospital Type and City (2011)**

Name of City	General hospital	Traditional hospital	Total
Hohhot city	8	5	13
BaoTou city	12	7	22
Chi Feng city	12	14	26
Tong Liao city	11	8	17
Erdos city	10	7	17
Wu Lan Cha Bu city	11	14	25
Hulunbuir League City	34	7	22
A Meng League City	3	3	6
Xing an League City	5	10	15
Xi linguo le League City	13	11	24
Bayannaoer League City	7	6	13
Wuhai city	5	1	6
Total	128	69	198

4.5 Data Required

To do the data envelopment analysis of the hospitals the performance involved in identifying appropriate inputs and outputs and selecting inputs and outputs which may bring out many questions, for example ,which inputs and outputs should the units be held accountable? What is the product of health care provider? And so on. There were some problems about selecting the inputs and outputs, and especially finding the suitable concept of product or service, for these problems, the Cooper and Serford gave some suggestions. When this study chose the inputs and outputs mainly depended on the production function of the hospitals, but at the same time this study should not only consider to defining models form the stakeholder views and the internal factors, but also the environmental factors and the geographic location and so forth as the external factors should be considered, in conclusion, from many other studies of the application of DEA, the inputs and outputs can be split up into different categories, respectively. The inputs can be divided into the following concepts:

- Beds

The number of fully hospital beds was most often used as a proxy for hospital size and capital investment. Some studies included the number of beds as an input category. Also, several studies resolved hospital beds into acute beds, long-term beds, and the number of beds, number of bed-days available, pediatric beds, obstetric beds, psychiatric beds, other special beds, and so on.

- Staff

This include two parts: one was the clinical staff and the other one was the non-clinical staff .Hospital clinical staff was made of physicians, nurses, and other health or medical personnel, such physicians′ assistant, pharmacist. There were several studies disaggregated ‘physicians’ into ‘specialist’ and ‘generalist physicians’, ‘medical residents’, and the ‘surgeons’. The nursing category had been further divided into ‘registered nurses’, and ‘licensed practical nurses’ in several studies. Some studies defined ‘number of personnel’ as a general labor input category. These included ‘trained, learning, and other nurses’, ‘junior and senior non-nursing medical and dental staff,’ and ‘professional, technical, administrative, and clerical staff’. Another one was non-clinical staff; some studies included the number of ‘non-clinical staff’ as a hospital input. This category included ‘technical, managerial, and other staff’.

- Services Offered

The number of hospital services had also been used as a proxy for capital investment. But in China, most of the hospitals provide the similar health service except some national hospital in Beijing; this was most common for studies of US hospitals since the necessary data were published in the American Hospital Association (AHA) annual survey. Therefore, this category was generally not included as input herein.

- Atypical and Other Input Categories

Atypical input categories were found such as the area cubic of the hospital building, type of ownership, labor hours per average daily census, cost index, revolving funds expenditure, and number of full-time-equivalents excluding physicians, physicians and dentists on salary, physicians on the medical staff, and teaching fulltime-equivalents.

There was a general consensus that the measure of output should improve in the quantity and quality of life, however, change in the health outcome cannot all contribute to the health care in the hospital ,there are also many other social-economic factors, From the this side, output of the hospital includes such concepts:

- Medical visits, cases, Patients, and Surgeries

The abundant of studies included outpatient visits as the proxy of output of the hospitals and some studies disaggregated outpatient visits into ‘emergency’ and ‘non-emergency’. Some studies included ‘surgeries cases’ as an output factor, while some studies distinguished between ‘inpatient surgeries’ and ‘outpatient surgeries’. For this study the inpatient surgeries was used as one of the outputs.

- Inpatient Bed Days

The length of bed days were used wildly in many other precise studies, some studies included the total of bed days, while some studies used the average of the bed days.

- Admissions, Discharges, and Services

Only a handful of studies used the 'number of admissions' as an output factor. Several studies included DRG-adjusted discharges either as a single output category or as part of their larger output set. However, DRG was not wildly used in Inner Mongolia. A few studies used intermediate hospital products as outputs, such as ancillary services and laboratory examinations.

- Atypical, Teaching, and Other Output Categories

There were several US studies addressed the problem of how to compare teaching and non-teaching hospitals. Thus, hospital teaching can be viewed as both a labor input and a teaching and research output. Some studies included teaching sub-categories in their efficiency analyses as well.

To consider above concepts of inputs and outputs, this study will choose the different inputs and outputs for the general hospitals and traditional hospitals, they are shown in the following tables.

4.6 Analysis Technique

Due to the research questions, the data analysis will divide into two parts. First step was the data envelopment analysis and second part was the ordinary regression analysis.

4.6.1 DEA Model Specification

Data envelopment analysis had been used to analyze the efficiency of the health sector in the past several decades no matter china or other countries. In this study data envelopment analysis computer program(DEAP version 2.1) was used to calculate the TE score and SE score of both general hospitals and traditional hospitals, as a very strong technique in efficiency calculation, it has the following strength: First is DEA is a kind of handle multiple input and multiple output models. Second advantage is that it does not need an assumption of a functional form relating inputs to outputs. Third is that the Decision-making units are directly compared against a peer or combination of peers. And the last one is that inputs and outputs can have very different units. So in this paper DEA will be the best tool to calculate the hospital technical and scale efficiency.

When we use DEA, there are many approaches and models which suitable for different situations. The calculation process as follows:

Two behavioral ways can be counted in: Input-orientated measurement: A first assumption is that each hospital conserves inputs; then, the arithmetic evaluates the minimal use of various inputs, with outputs kept constant this was input-conserving orientation. Output-oriented measurement: A second assumption was that each hospital augments outputs; given a finite stock of input available, the hospital try to get the maximize outputs that can be generated with these. (Chapter 3, section 3.2)

Because hospital management generally has greater control over inputs than over outputs, and health production process were not linear in reality, so the input-orientated measurement of variable return to scale were more appropriate be used herein, this study different multiple inputs and multiple outputs of general hospitals, traditional hospitals being data for calculation using DEAP version 2.1; a data envelopment analysis (computer) program, designed by Coelli Tim.

4.6.1.1 Model

DEA weights model, input-oriented, VRS

$$\text{Eff.} = \text{Max} \sum_r \mu_r \, y_r j_0 + \mu_0$$

$$\text{Subject to} \quad \mu_{r,j} \, v_j$$

$$\sum_r \mu_r \, y_{rj} - \sum_i x_{ij} + \mu_0 \le 0$$

$$\sum_i v_i \, x_{ij\,0} = 1$$

$$\mu_0, \, v_i \ge 0$$

Where

$y_{r,j}$ = the amount of output r produced by hospital j,

$x_{i,j}$ = the amount of input i used by hospital j,

u_r = the weight given to output r, (r D 1, t and t was the number of outputs)

v_i = the weight given to input i, (i D 1: m and m was the number of inputs)

n = the number of hospital.

4.6.1.2 Inputs Mix and Output Mix

After choose the model of calculation, there were also many problems when we choose the inputs and outputs variables and especially finding a suitable concept of the product and service .for this issue, referring to many other literatures and the availability of data, there were different inputs and outputs were chosen to be used in this thesis.

To what concerns the inputs categories, here would use the number of doctors, number of nurses to measure the labor inputs, and number of beds and the area of the hospital building to be a proxy to the capital inputs. And there were a range of outputs such the number of out-patient visits, number of inpatient surgeries ,the number of emergency visits and the average lengths of the bed days which listed in the bellow table was used. Due to the hospitals characteristics, there did not have teaching school, so for the outputs were chosen through literature review. Different type of hospitals will choose different categories; they were showing in Table 4-2, and Table 4-3

Table 4-2**General Hospital Inputs and Definition**

Inputs	Abbr.	Definition	Units
Numbers of Beds	N.B.	The number of beds regularly maintained and staffed for the accommodation and full-time care of a succession of inpatients and which are situated in wards or a part of the hospital where continuous medical care for inpatients is provided. The total number of such beds constitutes the normally available bed complement of the hospital. Cribs and bassinets maintained for use by healthy newborn babies who do not require special care are not included.	beds
Numbers of Physicians	N.P.	Graduates of any faculty or school of medicine, licensed or registered to work in the country as medical doctors who apply preventive or curative measures and/or conduct research. Also expressed as number of physicians per 1000 population.	persons
Numbers of Nurses	N.N.	Persons who have completed a program of basic nursing education and are qualified and registered or authorized to provide responsible and competent service for the promotion of health, prevention of illness, care of the sick, and rehabilitation, and are actually working in the country. Also expressed as number of nurses per 1000 population	persons
Total area of the hospital	T.S.	The whole square of the hospital	Km2

Note: abbr. =abbreviation

Table 4-3**Traditional Hospitals' Inputs and Definition**

Inputs	Abbr.	Definition	Unit
Number of Beds	N.B.	The number of beds regularly maintained and staffed for the accommodation and full-time care of a succession of inpatients and which are situated in wards or a part of the hospital where continuous medical care for inpatients is provided. The total number of such beds constitutes the normally available bed complement of the hospital. Cribs and bassinets maintained for use by healthy newborn babies who do not require special care are not included.	beds
Number of physicians	N.P.	Graduates of any faculty or school of medicine, licensed or registered to work in the country as medical doctors who apply preventive or curative measures and/or conduct research. Also expressed as number of physicians per 1000 population.	persons
Number of Nurses	N.N.	Persons who have completed a program of basic nursing education and are qualified and registered or authorized to provide responsible and competent service for the promotion of health, prevention of illness, care of the sick, and rehabilitation, and are actually working in the country. Also expressed as number of nurses per 1000 population	persons
Total area of hospital	T.S.	The whole square of the hospital.	Km2

According to the production function of different type of hospital, the different outputs will be used in this study. They will see in table 4-4, and table 4-5.

Table4-4 **Outputs of General Hospitals and Definition**

Outputs	Abbr.	Definition	Units
Numbers of out-patients visits in hospital	OPD	Counted for every visit in the out-patient department for the whole year in each general and traditional medicine hospitals in year 2011.	visits
Average length of bed days	l.B.D	This number is an indicator of the efficiency of hospitalization. To calculate this indicator, take the sum of the duration of hospitalization for all patients who were discharged during the month and divide it by the total number of patients discharged during that month.	days
Number of surgeries	N.S	Counted for number of inpatient surgeries for the whole year in each general and traditional medicine hospitals in year 2011.	cases
Number of emergency visits	N.E.	counted for the number of emergency episodes for the whole year in each general and traditional medicine hospitals in year 2011	visits

Note: abbr. =abbreviation

Table 4-5**Outputs of Traditional Hospitals and Definition**

Outputs	Abbr.	Definition	Unit
Numbers of out-patients visits in hospital	OPD	Counted for every visit in the out-patient department for the whole year in each general and traditional medicine hospitals in year 2011.	visits
Number of emergency visits	N.E.	counted for the number of emergency episodes for the whole year in each general and traditional medicine hospitals in year 2011	visits
The length of inpatient bed days	I.B.D.	This number is an indicator of the efficiency of hospitalization. To calculate this indicator, take the sum of the duration of hospitalization for all patients who were discharged during the month and divide it by the total number of patients discharged during that month	days

Note: abbr. =abbreviation

4.6.2 Regression Analysis Using Ordinary Least Squares (OLS)

To find out the factors that would affect the TE score and SE score, simple linear regression model would be used, there were many methods to do the regression analysis, and OLS would be employed to the main method herein. The TE score and SE score which obtained from the DEA computation would be as dependent variable, and a many of hospitals operating characteristics would be as the independent variables. In regression analysis, this study would like to use the same independent variables representing the factors likely to impact on efficiency performance of both general hospitals and traditional hospitals in Inner Mongolia region due to both types of hospital under the same health management system.

The regression models were estimated by Eviews 6.0 and the results of OLS regression analysis revealed the estimation models which provided the magnitude and direction of the factors affecting on the efficiency scores of these two types of hospitals .A brief description of expected impact of the eight operating characteristics on the efficiency scores was as follows.

Determinates of Technical Efficiency (TE)

- Bed-Physicians Ratio**:** the proportion of numbers of beds and numbers of physicians (beds/physicians) was a proxy for size determination of input combination between capital and labour**,** if one physicians could manage more beds, it may increase the hospital efficiency, but it may also have some negative impact such as the service quality, so this explanatory variable was expected to have both a positive or negative relationship with the dependent variable. In this study, assumed that bed-physician ratio may have a positive relationship with the dependent variable. This assumption was supported from the technical efficiency study of WichianThianjaruwatthana (2009).
- Nurse-Physicians Ratio**:** the proportion of numbers of nurses and numbers of physicians (nurses/physicians) was a proxy for size determination of input combination of labour resource; the nurse sometimes could play a complimentary role in some health service, and in some other heath service

they also to be the supplementary for the physicians. The ratio of nurse and physicians could affect the hospital efficiency .this explanatory variable was expected to have a positive relationship with the dependent variable**.** This assumption was supported from the technical and scale efficiency study of PrabhaBaral (2010).

- Other Personal-Physician Ratio: the proportion of numbers of other personal and numbers of physicians(other personal /physicians) was a proxy for size determination of input combination of the labor, other personal including the chemist, lab, and other skilled personals. The other personal-physicians ratio could have an impact on the hospital efficiency, so this explanatory variable was expected to have a positive relationship with dependent variable. This assumption was supported from the technical efficiency study of WichianThianjaruwatthana (2009).
- Number of physicians in the form of square: This form of square in equation used to find out the maximum of physicians to provide TEVRS scores. This explanatory variable was expected to have a positive relationship with the dependent variable. This assumption was supported from the finding of WichianThianjaruwatthana (2009).
- Bed occupancy rate: The occupancy rate can be assuming as the measure of the demand of the hospitals services. it was reasonable to assume that the hospital with larger bed occupancy rate means better utilization of resource according to their capacity, it also showed that hospital was producing higher output form available inputs. This explanatory variable was expected to have a

positive relationship with the dependent variable. This assumption was supported from the technical and scale efficiency study of PrabhaBaral (2010).

- Geographic Location: There might have difference in hospital performance in different geographic location because in the city center level, availability of the facilities and infrastructure. Hospital located in hill or in rural area less efficient than hospital in city level. This assumption was supported from the finding of Farrier and Valdmanis;(Colli,Rao and Battese,1998).

The model relation between TE score and the explanatory variables were showed as below

$TE=\beta_0\beta_0+\beta_1$ BP $+\beta_2$ NP $+\beta_3$ OPP $+\beta_4$PS $+\beta_5$BC $+\beta_6$Dum GL$+\mu$

β_0=constant β_2=coefficient of NPR β_3= coefficient of OPPR β_4= coefficient of NPSβ_5= coefficient of SP β_6= coefficient of Dum GL

BP=Bed-Physicians Ratio

NP=Nurse-Physicians Ratio

OPP=Other Personal-Physician Ratio

PS=Number of physicians in the form of square

BC= Bed occupancy ratio

GL= location of the hospital, city=1, other=0

Determinates of Scale Efficiency (SE)

- Out-patients visits-physicians ratio: the proportion of numbers of Out-patients and numbers of physicians (Out-patients /physicians) was a proxy for size determination of input combination between Out-patients and physician. This explanatory variable was expected to have a positive relationship with the scale efficiency.

- Number of beds: The number of beds regularly maintained and staffed for the accommodation and full-time care of a succession of inpatients and which are situated in wards or a part of the hospital where continuous medical care for inpatients is provided. It was taken as a proxy of hospital size, the inappropriate size of the hospitals could result in the inefficiency of the hospital scale efficiency. Hence, the number of beds was expected to have a positive relationship with the scale efficiency.
- The average length of bed days: This number is an indicator of the efficiency of hospitalization. To calculate this indicator, take the sum of the duration of hospitalization for all patients who were discharged during the month and divide it by the total number of patients discharged during that month. The average lengths of bed days indicate the utilization of the bed. This explanatory variable hope to be has a positive relationship with the dependent variable.
- Geographic location: There might have difference in hospital performance in different geographic location because in the city center level, availability of the facilities and infrastructure. Hospital located in hill or in rural area less efficient than hospital in city level. This assumption was supported from the finding of Farrier and Valdmanis;(Colli,Rao and Battese,1998)

$SE=\beta_0+\beta_1NB+\beta_2OPPR+\beta_3BD+\beta_4Dum\ GL+\mu$

β_0=constant β_1=coefficient of NB β_2= coefficient of OPDR β_3= coefficient of BD

OPP=Out-patients visits-physicians ratio

B=Number of Beds

BD=Average Length of Bed Day

GL=Geographic Location, city level=1,other=0

Hypothesis:

H_1: Bed/physician ratio was expected to have negative relationship on the technical efficiency of hospital

H_2: Nurse/physician ratio was expected to have positive relationship on the technical efficiency of hospital

H_3: Other personal-physician ratio was expected to have positive relationship on the technical efficiency of hospital

H_4: Number of physicians in the form of square was expected to have positive relationship on the technical efficiency of hospital

H_5: Bed occupancy rate was hope to be positively association with technical efficiency

H_6: Number of bed should be positively association with scale efficiency

H_7: Out-patients visits-physicians ratio was expected to have a positive relationship with the scale efficiency

H_8: The average length of bed days was expected to have a positive relationship with the scale efficiency

H_9: The geographic location has a positive impact on the hospital both technical efficiency and scale efficiency

Then do the regression analysis to find out the reasons whether the factors have an impact on the technical efficiency and scale efficiency of the hospitals

Chapter V

RESULT ANDDISCUSSION

5.1 General Description of the Inputs Mix and Output Mix of DEA Data

The data used in this study was collected in 128 general hospitals and 69 traditional hospitals in 2011 under the department of Health Inner Mongolia, and all the hospitals are distributing in 12 cities and alliance cities in Inner Mongolia region, there were a short descriptive of data in the following concepts.

Descriptive statistic of general hospital input data of DEA shows the numbers, mean, standard deviation, minimum, maximum and the sum. There were four multiple inputs presented in table 5-1 such as beds, total physicians number, nursed and the area of the hospital, the total number of beds of general hospital in Inner Mongolia region in 2011 were 26031, and the mean was approximately 210, the minimum was only 17, the maximum was 1400, and 29 hospitals had lower 100 beds and two hospital had over 1,000 beds. There were four multiple outputs showed in table 5-1such as the outpatient visits, the average length of bed days, the number of inpatient surgeries and the emergency visits. Descriptive statistic of general hospital output data of DEA showed the hospital numbers, mean, standard deviation, minimum, maximum and sum. None of them were teaching school. There were 129 general hospitals in 2011.

Table 5-1**Descriptive Statistic of General Hospital Inputs Data and Output Data of DEA**

Descriptive statistic	Input mix				Output mix			
	Beds	Physician	Nurse	Area of hospital	Outpatient visits	Average bed days	Inpatient surgeries	Emergency visits
Number	128	128	128	128	128	128	128	128
Mean	208.11	83.83	85.01	16375.87	71763.37	9.28	1925.69	7687.06
Standard deviation	211.73	69.69	81.43	19449.61	81451.77	3.10	8429.99	12320.55
minimum	17	4	2	910	4628	3	8	6
Maximum	1400	409	570	115079	674147	22	95075	93248

Just like the general hospital, the descriptive statistic of traditional medicine hospital input data of DEA showed the numbers, mean, standard deviation, minimum, maximum and the sum as well. There were four multiple inputs presented in table 5-2 such as total number of beds, total physicians number, total number of nurses and the area of the hospital. The total number of beds of traditional medicine hospital in Inner Mongolia region in 2011 were 7143, and the mean was about 105, the minimum was only 10, the maximum was 461,and 55 of 69 traditional medicine hospitals had lower 100 beds and no one had over 1,000 beds. According to the main production function of traditional medicine hospitals in China was different from general hospital, so only three outputs were chosen as the output of traditional medicine hospitals', they were number of outpatient visits, the average of bed days and the emergency visits.

The descriptive statistic of tradition medicine hospitals' output data of DEA as presented in table 5-4. The hospital numbers, mean, standard deviation, minimum, maximum and sum. There were 69 traditional hospitals in 2011 in Inner Mongolia region; all these data were one year cross-section data. DEA was used to compute each DMU's technical efficiency.

Table 5-2 **Descriptive Statistic of Traditional Hospital Input Mix and Outputs Mix of DEA**

Descriptive Statistic	Input mix				Output mix		
	Bed	Physician	Nurse	Area of hospital	Outpatient visits	Average of bed days	Emergency visits
Number	69	69	69	69	69	69	69
Mean	104.4	51.82	35.13	8314.87	52395.52	9.92	4506.47
Standard	88.44	38.93	40.57	12212.79	46959.52	3.78	11745.96
Minimum	10	7	2	89268	4715	4.7	10
maximum	461	217	153	573726.17	251902	21	86897

5.2 Results of Input-Orientated DEA

Three types of technical efficiency scores and one pattern of scale inefficiency were shown in this study by DEA program: The first one was technical efficiency under constant return to scale assumption (CRSTE); second was technical efficiency under variable return to scale assumption score (VRSTE), the third was scale efficiency score. The pattern of scale efficiency can be divided into two types which were: increasing return to scale (IRS) and decreasing return to scale (DRS).

5.2.1 Result of General Hospitals Input-Orientated DEA

Input-orientated measurement of DEA: the number of beds, number of physicians, number of nurse and the area of the hospital were used as the inputs; the outputs were also made up by the outpatient visits, inpatient surgeries, emergency visits and average of bed day. The relative efficiency of the general hospital was computed by the input-orientation VRS models of DEA.

From the DEA result, findings when came in to our discussion that there were only 14 hospitals from 128 general hospitals which had all three types of efficiency scores (TECRS, TEVRS and SE scores all equal to 1) such as hospital number 5,31,43,44,45,48,51,52,76,82,84,106,109,123.There were 100 from128 general hospitals which had all three types of efficiency scores(TECRS, TEVRS and SE scores less than 1) such as hospital number1,2,4,6,7,23,25….124 represented in the table 5-3. And most of general hospitals' pattern of scale inefficiency in this group was an increasing return to scale pattern. From the pattern of inefficiency of the general hospital, most of the inefficiency hospital should expand both theirs outputs and inputs.

Table 5-3**Input-Orientated Measurement DEA: General Hospital Technical Efficiency Scores**

Hospital number	CRSTE	Hospital number	CRSTE	Hospital number	CRSTE	Hospital Number	CRSTE
1	0.356	33	0.273	65	0.339	97	0.572
2	0.656	34	0.57	66	0.291	98	0.553
3	0.638	35	0.336	67	0.548	99	0.398
4	0.211	36	0.453	68	0.777	100	0.392
5	0.159	37	0.524	69	0.137	101	0.412
6	0.343	38	0.42	70	0.478	102	0.53
7	0.226	39	0.791	71	0.324	103	0.48
8	0.629	40	0.593	72	0.305	104	0.352
9	0.437	41	0.765	73	0.384	105	0.747
10	0.417	42	1	74	0.22	106	0.463
11	0.306	43	1	75	1	107	0.645
12	0.499	44	1	76	0.45	108	1
13	0.253	45	0.841	77	0.707	109	0.404
14	0.526	46	0.5	78	0.321	110	0.277
15	0.799	47	0.28	79	0.773	111	0.679
16	0.364	48	0.293	80	0.365	112	0.453
17	0.347	49	0.607	81	1	113	0.604
18	0.352	50	0.772	82	0.381	114	0.732
19	0.384	51	0.646	83	1	115	0.63
20	0.618	52	0.356	84	0.863	116	0.509
21	0.313	53	0.255	85	1	117	0.374
22	0.378	54	0.357	86	1	118	0.402
23	0.725	55	0.304	87	0.273	119	1
24	0.29	56	0.32	88	0.411	120	0.37
25	0.163	57	0.283	89	0.115	121	0.391
26	0.241	58	0.377	90	0.214	122	1
27	0.432	59	0.33	91	0.184	123	0.463
28	0.39	60	0.44	92	0.088	124	0.414
29	0.437	61	0.814	93	0.771	125	0.305
30	0.482	62	0.372	94	0.544	126	0.875
31	0.322	63	0.284	95	0.571	127	0.424
32	0.332	64	0.422	96	0.139	128	1
		Mean=0.495516					

The average of CRSTE scores of general hospital equal to 0.496.only 12 of 128 general hospitals' CRSTE equal to 1, most of CRSTE score below the average score.

Hospital number	VRSTE	Hospital number	VRSTE	Hospital number	VRSTE	Hospital number	VRSTE
1	0.375	33	0.348	65	0.968	97	0.579
2	0.697	34	0.578	66	0.988	98	0.622
3	0.673	35	0.358	67	0.982	99	0.416
4	0.212	36	0.475	68	0.98	100	0.397
5	0.17	37	0.555	69	0.137	101	0.418
6	0.363	38	0.494	70	0.933	102	0.513
7	0.268	39	0.797	71	0.884	103	0.576
8	0.641	40	0.685	72	0.999	104	0.37
9	0.463	41	0.782	73	0.948	105	0.771
10	0.443	42	1	74	0.891	106	0.491
11	0.672	43	1	75	1	107	0.669
12	0.453	44	1	76	0.991	108	1
13	0.257	45	0.845	77	0.999	109	0.423
14	0.559	46	0.508	78	0.969	110	0.314
15	0.801	47	0.281	79	0.927	111	0.777
16	0.372	48	0.323	80	0.793	112	0.864
17	0.349	49	1	81	1	113	0.622
18	0.373	50	0.775	82	0.98	114	0.857
19	0.404	51	0.652	83	1	115	0.632
20	0.632	52	0.361	84	0.863	116	0.55
21	0.372	53	0.298	85	1	117	0.396
22	0.386	54	0.377	86	1	118	0.412
23	0.729	55	0.327	87	0.97	119	1
24	0.413	56	0.369	88	0.993	120	0.414
25	0.168	57	0.298	89	0.661	121	0.452
26	0.245	58	0.393	90	0.875	122	1
27	0.455	59	0.336	91	0.957	123	0.464
28	0.545	60	0.483	92	0.43	124	0.454
29	0.445	61	0.834	93	0.771	125	0.386
30	0.511	62	0.385	94	0.994	126	1
31	0.322	63	0.294	95	0.963	127	0.439
32	0.363	64	0.443	96	0.927	128	1
Mean=0.538063							

The average of general hospital VRSTE=0.538, it meat that if the inefficiency hospitals expected to become efficiency ones, it at least produced average 47%more output in the current level of endowment. Thus, only 14 of 128 general hospitals' VRSTE equal to 1, most of the VRSTE score below the average score.

Hospital number	SE	Hospital Number	SE	Hospital number	SE	Hospital Number	SE
1	0.948	33	0.784	65	0.968	97	0.987
2	0.941	34	0.985	66	0.988	98	0.889
3	0.948	35	0.938	67	0.982	99	0.957
4	0.996	36	0.953	68	0.98	100	0.986
5	0.936	37	0.943	69	0.137	101	0.984
6	0.943	38	0.85	70	0.933	102	0.997
7	0.841	39	0.993	71	0.884	103	0.833
8	0.98	40	0.866	72	0.999	104	0.951
9	0.945	41	0.977	73	0.948	105	0.969
10	0.943	42	1	74	0.891	106	0.944
11	0.455	43	1	75	1	107	0.964
12	0.99	44	1	76	0.991	108	1
13	0.983	45	0.996	77	0.999	109	0.953
14	0.942	46	0.985	78	0.969	110	0.883
15	0.998	47	0.996	79	0.927	111	0.874
16	0.977	48	0.908	80	0.793	112	0.524
17	0.993	49	0.607	81	1	113	0.972
18	0.944	50	0.997	82	0.98	114	0.854
19	0.951	51	0.99	83	1	115	0.996
20	0.978	52	0.985	84	0.863	116	0.926
21	0.843	53	0.854	85	1	117	0.944
22	0.978	54	0.947	86	1	118	0.977
23	0.995	55	0.931	87	0.97	119	1
24	0.702	56	0.867	88	0.993	120	0.894
25	0.968	57	0.95	89	0.661	121	0.864
26	0.984	58	0.96	90	0.875	122	1
27	0.95	59	0.984	91	0.957	123	0.996
28	0.716	60	0.911	92	0.43	124	0.912
29	0.981	61	0.976	93	0.771	125	0.788
30	0.944	62	0.966	94	0.994	126	0.875
31	0.999	63	0.964	95	0.963	127	0.966
32	0.914	64	0.952	96	0.927	128	1
Mean=0.92289							

The average of general hospital SE=0.922, it indicated that the inefficiency hospital could reduce the size by 8% without influencing the current output level or they could also increase 8% output to make the scale inefficiency to scale efficiency.

5.2.2 Result of Traditional Hospitals Input-orientated DEA

Input-orientated measurement of DEA: there were 20 hospitals from 69 general hospitals which had all three efficiency scores (TECRS, TEVRS and SE scores equal to 1) such as hospital number 1, 4, 6, 34, 46, 47, 69 as table 5-6 below. There were 42 from68 general hospitals which had all three inefficiency scores(TECRS, TEVRS and

SE scores less than 1) such as hospitalnumber7, 9, 10, 11, 12, 13, 24, 25….69represented in the table 5-6. And the pattern of scale inefficiency in this group was a decreasing return to scale pattern, from the DEA result of the traditional hospital, most of the hospital were exhibiting DRS, it meant that the relative inefficiency traditional hospital should scale down both theirs inputs and outputs.

In the table5-4, the CRSTE, VRSTE and SE were listed respectively.

Table 5-4 **Input-Orientated Measurement DEA: Traditional Hospital Technical Efficiency Scores**

Hospital number	CRSTE	Hospital number	CRSTE	Hospital Number	CRSTE
1	1	24	0.651	47	1
2	0.959	25	0.736	48	0.519
3	0.847	26	0.422	49	0.331
4	1	27	0.497	50	1
5	0.226	28	0.293	51	0.226
6	1	29	0.358	52	0.628
7	0.59	30	0.767	53	0.955
8	0.459	31	0.708	54	0.618
9	0.242	32	0.186	55	0.275
10	0.242	33	0.732	56	1
11	0.289	34	1	57	0.839
12	0.393	35	0.454	58	0.48
13	0.498	36	0.827	59	1
14	0.322	37	0.75	60	1
15	0.202	38	0.375	61	0.593
16	0.495	39	0.658	62	1
17	0.135	40	0.547	63	1
18	1	41	0.365	64	1
19	0.352	42	0.993	65	0.698
20	0.231	43	0.443	66	0.652
21	0.964	44	0.25	67	1
22	0.466	45	0.376	68	0.383
23	0.652	46	1	69	1
			Mean=0.625		

The result also implied that the average of CRS technical efficiency was 0.625 in 2011. There were 16 of 69 traditional medicine hospitals' CRSTE=1 and most of the CRSTE scores were above the average score of traditional medicine hospital.

Hospital number	VRSTE	Hospital number	VRSTE	Hospital Number	VRSTE
1	1	24	0.661	47	1
2	1	25	0.767	48	1
3	1	26	0.428	49	0.332
4	1	27	0.501	50	1
5	0.462	28	0.331	51	0.238
6	1	29	0.417	52	0.628
7	1	30	1	53	0.959
8	0.518	31	0.822	54	0.67
9	0.261	32	0.368	55	0.311
10	0.261	33	0.733	56	1
11	0.306	34	1	57	1
12	0.396	35	0.548	58	0.721
13	0.602	36	0.848	59	1
14	0.413	37	0.948	60	1
15	0.209	38	0.475	61	0.779
16	0.495	39	0.659	62	1
17	0.137	40	0.575	63	1
18	1	41	0.681	64	1
19	0.359	42	1	65	0.765
20	0.254	43	0.458	66	0.695
21	0.969	44	0.26	67	1
22	0.499	45	0.413	68	0.415
23	0.749	46	1	69	1
			Mean=0.685		

The average of the VRS technical efficiency score was 0.685; these findings indicated that if the hospitals were operating efficient, they should produce average 31% more output using their current level. What is more, more than half of traditional medicine hospitals' VRSTE score were over the average level.

From the following table ,the findings were the average of scale efficiency score was 0.905 in 2011, this figured out that this inefficiency hospital should reduce the size by about 10% to get the efficiency level without reduce their current output level.

Hospital number	SE	Hospital number	SE	Hospital Number	SE
1	1	24	0.984	47	1
2	0.959	25	0.961	48	0.519
3	0.847	26	0.985	49	0.998
4	1	27	0.922	50	1
5	0.49	28	0.885	51	0.949
6	1	29	0.859	52	1
7	0.59	30	0.767	53	0.995
8	0.886	31	0.862	54	0.924
9	0.929	32	0.505	55	0.883
10	0.965	33	0.999	56	1
11	0.942	34	1	57	0.839
12	0.922	35	0.828	58	0.665
13	0.827	36	0.975	59	1
14	0.78	37	0.79	60	1
15	0.965	38	0.789	61	0.761
16	0.999	39	0.999	62	1
17	0.987	40	0.95	63	1
18	1	41	0.536	64	1
19	0.982	42	0.933	65	0.913
20	0.908	43	0.966	66	0.937
21	0.995	44	0.961	67	1
22	0.935	45	0.909	68	0.924
23	0.87	46	1	69	1
			Mean=0.905		

5.2.3 Descriptive Statistic of Technical Efficiency Scores and Scale Efficiency Scores of Both General Hospital and Traditional Hospital

Descriptive Statistic of Technical Efficiency Scores and Scale Efficiency Scores

Descriptive statistic of technical efficiency score and traditional efficiency score of DEA, both general hospital and traditional hospital showed the number, mean, minimum, maximum, 25thpercentiles, 75th percentile in the following table. The mean of general hospital TEVRS is lower than the traditional hospitals'. The TEVRS and SE score of traditional hospital in 25th and 75th percentiles and minimum were higher than the general hospitals'

Table 5-5 **Descriptive of General Hospital and Traditional Hospital VRSTE and SE**

Descriptive statistic	General hospital		Traditional hospital	
	VRSTE	SE	VRSTE	SE
Number	128	128	69	69
mean	0.538	0.922	0.685	0.905
minimum	0.149	0.137	0.173	0.490
maximum	1	1	1	1
Percentile25th	0.36	0.91	0.42	0.86
Percentile75th	0.69	0.98	1	0.99

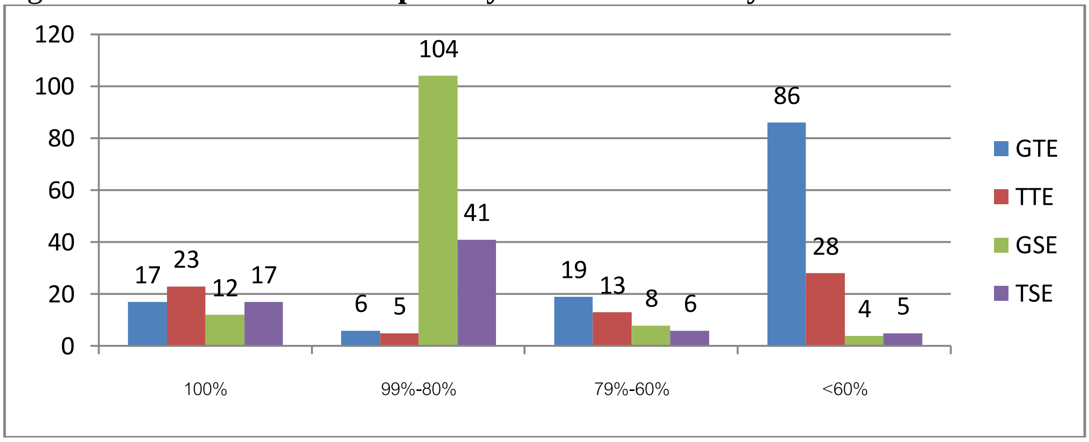
Ranking of Efficiency Level

The frequency of technical efficiency and scale efficiency level in both general hospital and scale hospital were showed in the table 5-6.for the general hospital ,only 17 (13.3%)hospitals were technical efficient since they had a relative technical efficiency score of 1,and most of them, out of 128 general hospitals ,86 hospitals(62.7%) technical efficient score even below 0.6,its almost 4 times larger than the efficient DMUs, and the left hospitals '(14.8%)efficient score between 0.9999 and 0.6.on the contrary, the traditional hospital ,out of the 68 hospitals,23(33.3%)were technical efficient and they got the 1 efficient score, among the inefficient hospital,5 hospitals(7.2%) had the TE score between 99%-80%.13 hospitals(18.8%) had efficiency score among 60%-79%,and 28 hospitals (40.6%)had the score less than 60%.Figure 5-1 showed the distribution of the efficiency level of both general hospitals and traditional hospitals.

Table5-6 **Ranking of the Two Type's Hospital Efficiency Level**

Level efficiency	General hospital				Traditional hospital			
	TE number	%	SE Number	%	TE number	%	SE number	%
100%	17	13.3	12	9.4	23	33.3	17	24.6
99%-80%	6	4.7	104	81.3	5	7.2	41	59.4
79%-60%	19	14.8	8	6.3	13	18.8	6	8.7
<60%	86	67.2	4	3.1	28	40.6	5	7.2

Figure5-1 **Distribution of Hospital by Level of Efficiency**



Pattern of Scale Inefficiency of DEA, Both General Hospital and Traditional Hospital

From the following table 5-7, showing the frequency of pattern of scale inefficiency, decreasing return to scale indicated that unit cost increase as output increase and thus the hospital was too large for the volume of activities that it runs. On the contrary, a hospital with increasing to scale meant, unit cost decrease as outputs increase, which was relatively small for its scale of operations. From the scale inefficiency pattern of the hospital, it could give some good implications to the manager and policy makers. So from the DEA results of the pattern of scale inefficiency of general hospital was same as the traditional hospital, both type of hospitals' the frequencies of increasing return to scale pattern were higher than the frequencies of decreasing return to scale pattern in general hospital.

Table 5-7 **Frequency of Pattern of Scale Inefficiency of Both General Hospital and Traditional Hospital**

items	General Hospital Pattern of Scale inefficiency				Traditional Hospital Pattern of Scale inefficiency			
	--	irs	drs	Total	--	irs	drs	Total
Frequency	14	77	37	128	18	38	13	69
%	11	60	29	100	26	55	19	100

Note: irs=increasing return to scale drs=decreasing return to scale

5.2.4 Excess Inputs and Shortfall Outputs

The technical efficiency scores implied the extent to which all the inputs have to be reduced in order to get 100% efficiency for the inefficient DMUs, so from the DEA calculated slacks which specify the amount by which an input or output should be increased in order for the unit to become efficient .the DMU produced on the efficient frontier define the best practice and thus could be treated as the models to the inefficient DMUs, the result of DEA can identify the efficient hospitals that as the comparators for the inefficient ones. and the inefficient ones should learn from the efficient ones by observing their production process, the efficient frontier and the slack variables for each of the inefficient hospitals were given in the table (Appendix).the information provided the magnitudes by which specific inputs per inefficient hospitals should reduce.table5-8 showed the summary of the excess inputs used by inefficient hospitals for the output the produced. The same categories of inputs were selected for both the general hospital and traditional hospital, so the inefficient of general hospital could become efficient hospital by reducing the current inputs such as the number of beds, number of physicians, number of nurse,and the area of the hospitals by1163,663,1186 and 2096110.95 , at the same time, for the same variables of the traditional hospitals should reduce by502,81,154 and 75214 individually.

Table 5-8 **Inputs Reductions Needed to Make Both Types Inefficient Hospital Efficient**

Variables	General	Hospital	Traditional	Hospital
	Actual	Excess	Actual	Excess
No. of beds	26383	1163	7204	502
No. of physicians	10731	663	3540	81
No. of nurse	10882	1186	2284	154
area of the hospital	2096110.95	28611	573726.17	75214

Table 5-9 showed the magnitude of output slacks for the inefficient hospitals. This indicated that the if inefficient hospitals become to efficient hospitals they should improve their current outputs of outpatients visits, average length of bed days ,number of emergency visits and number of inpatient surgeries for the general hospitals and outpatients visits, average length of bed days ,number of emergency visits for the traditional hospitals.

Table 5-9**Total Outputs Needed to Increase to Make the Inefficient Traditional Hospital and General Hospitals Efficient**

Variables	General	Hospital	Traditional	Hospital
	Actual	Excess	Actual	Excess
Outpatient visits	9185711	48536	3615291	78732
Average of bed days	1187	270	685	83
Emergency visits	983944	103	33094	40986
Inpatient surgeries	246478	19153		

Through looked the input slacks and output slacks information of these hospitals', manager and policy makers can make strategies to improve the access of hospital service and invest the capital of the hospital.

5.2.5 Descriptive of Different Cities and League Cities

Because of the data came from 12 cities and league cities in Inner Mongolia, and there were also many external factors that may be influence the hospital efficiency, form the following table, we can see that the mean of technical and scale efficiency in different were quite different. most of general hospitals in 12 cities the average technical efficiency score were under 0.5,the range was from 0.405 to 0.738,and the average of scale efficiency were all over 0.9.

The traditional hospitals in 12 cities have higher average technical efficiency score than general hospital. In Chi Feng city the average of traditional hospital VRSTE was the lowest, below 0.5.on the contrary, the average of each cities' traditional hospital scale efficiency was lower than general hospitals' at the same city, and the traditional hospital scale efficiency in BaoTou city was 0.793 lower than others .

5-10 **Different Cities and League Cities Hospital VRCES and SE**

Name of City	General Hospital			Traditional Hospital		
	Number of Hospital	Mean		Number of Hospital	Mean	
		VRSTE	SE		VRSTE	SE
Hohhot city	8	0.424	0.941	3	1	0.935
BaoTou city	11	0.467	0.920	5	0.796	0.793
Chi Feng city	13	0.429	0.919	12	0.403	0.933
Tong Liao city	9	0.563	0.921	9	0.591	0.932
Erdos city	10	0.738	0.947	7	0.759	0.848
Wu Lan Cha Bu city	11	0.405	0.939	6	0.723	0.832
Hulunbuir League City	34	0.545	0.902	9	0.633	0.922
A Meng League City	3	0.539	0.944	2	0.793	0.997
Xing an League City	5	0.454	0.950	5	0.740	0.862
Xi linguo le League City	12	0.664	0.904	7	0.934	0.953
Bayannaoer League City	7	0.591	0.953	3	0.703	0.953
Wuhai city	5	0.656	0.908	1	1	1

5.3 Results of Regression Analysis of Traditional Medicine Hospital and General Hospital

This study used the simple linear regression model (OLS) to offer more details about the factor that influence the technical efficiency scores and scale efficiency score of both general hospital and traditional hospital. Technical efficiency under variable return to scale assumption (TEVRS) and scale efficiency (SE) from DEA were treated as the dependent variable in the regression analysis and ten variables to be the independent variables. There are four equations of OLS estimation for both general hospital and scale hospital.

General hospital

$$GTE=\beta_0+\beta_1 BP +\beta_2 NP +\beta_3 OPP +\beta_4 PS +\beta_5 BC +\beta_6 Dum\ GL+\mu \quad 5\text{-}1$$

$$GSE=\beta_0+\beta_1 NB+\beta_2 OPPR+\beta_3 BD+\mu \quad 5\text{-}2$$

Traditional hospital

$$TTE=\beta_0+\beta_1 BP +\beta_2 NP +\beta_3 OPP +\beta_4 PS +\beta_5 BC +\beta_6 Dum\ GL+\mu \quad 5\text{-}3$$

$$TSE=\beta_0+\beta_1 NB+\beta_2 OPPR+\beta_3 BD+\mu \quad 5\text{-}4$$

There were six variables in equation 1 and 3 for both general hospital and traditional hospital .the explanatory variables of TEVRS were bed-physicians ratio(BP),bed occupancy rate (BC),nurse-physician ratio(NP),number of physicians in form of square(PS),other personnel-physicians ratio(OPP) and an dummy variable geographic location of the hospital.

There were four variables in equation 2and 4.the the explanatory variables were out-patient visits per physician ratio (OPPR),number of bed(B),the average length of bed(BEDDAY),and the geographic location.

5.3.1 OLS of General Hospital and Traditional Medicine Hospital Technical Efficiency Score

Most independent variables of TEVRS scores significantly correlated to dependent variables but the bed occupancy (BC) and geographic location(GL) insignificantly correlated to TE scores because p-value of these two variables were more than 0.05 as Table 5-10 blew. There was one variable nurse-physicians ratio (NP) which reversely correlated to TE score because its coefficients had a negative sign. R-square value (R^2) of this equation was low (R^2=0.202941) because the selected explanatory variables may be not the good independent variables for the dependent variables. From the probability F-statistic=0.000099 meaning this equation was linear statistical model.

Then, the same independent variables was used for the traditional hospital, but from the following table5-10, most explanatory variables were not correlated to dependent variables, only other personal –physician ratio have an impact for the hospital technical efficiency, due to its p-value was less than 0.05.R-square value (R^2) of this equation was low (R^2=0.212477) for the selected explanatory variables may be not the good independent variables for the dependent variables. From the probability F-statistic=0.0018 meaning this equation was linear statistical model.

Table 5-11 **Result of Ordinary Least Square of Both General Hospital and Traditional Hospital Variable to Scale Technical Efficiency**

	General hospital				Traditional hospital			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.Error	t-Statistic	Prob.
C	0.328143	0.070526	4.652789	0.0000	0.596192	0.123745	4.817900	0.0000
BP	0.061179	0.020389	3.000579	0.0033	-0.003905	0.025944	-0.150510	0.8809
NP	-0.111516	0.055062	-2.025301	0.0450	-0.302750	0.158566	-1.909305	0.0609
OPP	0.084663	0.031231	2.710900	0.0077	0.149102	0.055875	2.668477	0.0097
PS	9.431265	3.089054	3.053124	0.0028	13.17527	7.038231	1.871957	0.0659
BC	-2.48E-06	2.69E-06	-0.922546	0.3581	0.000324	0.000544	0.594932	0.5541
L	-0.017702	0.040765	-0.434247	0.6649	-0.117437	0.086207	-1.362267	0.1780
R-squared=0.202941					R-squared=0.212477			
F-statistic =5.134679	Prob.(F-statistic)= 0.000099				F-statistic=2.787975		Prob.(F-statistic)= 0.018238	

From the hypothesis, the bed occupancy and the geographic location factors should have a positive relationship with the dependent variable, but, the OLS result in a decrease in the technical efficiency score and insignificant both in general hospital and traditional medicine hospital .

Form the labor factor group that included ratio of nurse-physician and other personal-physician, which were expected to have a positive relationship with the dependent variable of both traditional medicine hospital and general hospital. However, from the OLS results we can see that, the nurse-physician ration have a negative relationship with the general hospital VRSTE, and in traditional hospital it was insignificant. Then, the other personal-physician ratio had a positive relationship with the both the general hospital technical efficiency and traditional medicine hospital.

Next was the capital resource, the number of physicians in the form of square and the bed-physician ratio did not like what we expected that they had a positive relationship with the general hospital and traditional medicine hospital technical efficiency from the result we can see that both of them had a positive relationship with the general hospital technical efficiency but insignificant for the traditional hospital technical efficiency.

5.3.2 OLS of General Hospital and Traditional MedicineHospital Scale Efficiency

Most independent variables of SE scores significantly correlated to general hospital dependent variables only geographic location(GL) insignificantly correlated to SE scores because p-value were more than 0.05 as Table 5-11,. R-square value (R^2) of this equation was low (R^2=0.265367) because the selected explanatory variables may be not the good independent variables for the dependent variables. From the probability F-statistic=0.0000 meaning this equation was linear statistical model. For the traditional medicine hospital, the number of bed, outpatient-visits –physician's ratio and the dummy variable geographic location have an impact on the scale efficiency on the traditional hospital. R-square value (R^2) of this equation was low (R^2=0.219724) since the selected explanatory variables may be not the appropriate independent variables for the dependent variables. From the probability F-statistic=0.00286 meaning this equation was linear statistical model.

Table 5-12 **Result of Ordinary Least Square of Both General Hospital and Traditional Hospital Scale Efficiency**

	General hospital				Traditional hospital			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.Error	t-Statistic	Prob.
C	0.993380	0.034526	28.77230	0.0000	0.849994	0.051604	16.47141	0.0000
B	-0.000233	4.56E-05	-5.104540	0.0000	-0.000338	0.000164	-2.060437	0.0434
OPPR	5.65E-05	1.63E-05	3.472527	0.0007	4.57E-05	2.03E-05	2.254772	0.0276
BEDDAY	-0.008984	0.003797	-2.366488	0.0195	0.005841	0.004105	1.422737	0.1597
L	0.023864	0.023820	1.001836	0.3184	-0.077173	0.035761	-2.158054	0.0347
R-squared=0.265367					R-squared=0.219724			
F-statistic =11.10765		Prob(F-statistic)=0.00000			F-statistic=4.505575		Prob(F-statistic)= 0.002862	

From the hypnosis, the variable outpatient-visit-Physicians ratio (OPPR) which was expected to have a positive correlation to SE score of both general hospital and traditional medicine hospital ,the OLS result showed that the OPPR have an impact on both types hospitals and it was a kind of positive relationship.

From the hypnoses, the number of beds should have an positive effect on the hospital scale efficiency of both types hospital, but, the result of the OLS reversely different as we expected ,the coefficient of the variable were negative sign, they had a negative relationship with the scale efficiency of general hospital and traditional hospital.

The average of bed days represented the utilization of the bed in the hospital; it was expected to have a positive relationship with the general hospital and traditional medicine hospital. However, the OLS result indicated that this variable had a negative sign of the coefficient and insignificant in the traditional medicine hospital scale efficiency equation.

For the dummy variable geographic location, it was expected to have a positive relationship with the dependent variable, however, it was insignificant for the general hospital scale efficiency and had a reverse relationship with the tradition al hospital, and it meant that in the city region the scale efficiency decreased.

5.3.3 The comparison between IRS group and DRS group in general hospital

From the DEA result, we can see that the patterns of inefficiency in 77 of 128 general hospital were increasing return to scale, which means that the output in at relatively low levels, and 37 of 128 general hospital were decreasing return to scale ,which stands for the output of these hospitals were in relatively high levels. According to the result of OLS of general hospital, from the whole picture there were 4 of 6 factors affecting the technical efficiency score and 3 of 4 factors affecting the scale efficiency score, for the sake of finding more details, this study would identify the influence between the increasing return to scale group and decreasing return to scale group of general hospitals.

Table 5-13 OLS of IRS group and DRS group of general hospital technical efficiency

	Increasing return to scale group				Decreasing return to scale			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.error	t-statistic	Prob.
C	0.333428	0.075893	4.393427	0.0000	0.375732	0.190320	1.974213	0.0576
BP	-0.014688	0.029447	-0.498786	0.6195	0.074324	0.035015	2.122619	0.0422
NP	0.015815	0.64465	0.245332	0.8069	-0.148229	0.118036	-1.25579	0.2189
OPP	0.104728	0.041893	2.499894	0.0148	0.004600	0.052414	0.087756	0.9666
PS	9.031159	5.101225	1.770390	0.0810	7.582729	7.582729	1.130313	0.9307
BC	-2.87E-06	2.34E-06	-1.227336	0.2238	-7.42E-06	-7.42E-06	-0.04224	0.2673
Location	-o.069112	0.045325	-1.524791	0.1318	0.080427	0.070423	1.142045	0.2625
R-squared=0.15 Number of observation=77					R-squared=0.215 Number of observation=37			
F-statistic=2.166					F-statistic=1.37			

According to the table 5-13, the other-personal physician ratio were significant in the increasing return to scale group, however, insignificant in the decreasing return to scale, it meant that these two factors could influence the hospital technical efficiency of the increasing return to scale group; meanwhile, from the OLS result, the bed-physician ratio was significant in the decreasing return to scale group and insignificant in the increasing return to scale group, so the bed-physician ratio affect the general hospital in the decreasing to scale group; for other factors that nurse-physician ratio, number of physicians in form of square ,bed occupancy and the geographic location were insignificant in neither IRS group and DRS group in this study.

For the general hospital scale efficiency can also be composed by the IRS group and DRS group, from the OLS result of IRS group and DRS group (table 5-14),we can see that, the factors number of beds ,the average of bed day were significant in both IRS group and DRS group, it meant that these two factors had an impact on the hospitals scale efficiency no matter the pattern was IRS or DRS, then from the value of the outpatient-physician ratio in both group, the increasing return to scale group was influenced by the OOPR and decreasing return to scale group was not. The geographic location never had an effect on the IRS group and DRS group.

Table 5-14 OLS of IRS and DRS of general hospital scale efficiency

	Increasing return to scale group				Decreasing return to scale			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.error	t-statistic	Prob.
C	0.657184	0.049748	13.21039	0.0000	1.261873	0.085093	14.82933	0.0000
BEDS	0.000455	0.000124	3.676879	0.0024	-0.00035	6.45E-05	-5.415888	0.0000
OPPR	0.000105	2.19E-05	4.816042	0.0005	2.77E-05	4.66E-05	0.593756	0.5568
BEDDAY	0.016669	0.005298	3.146279	0.0000	-0.029831	0.006352	-4.696621	0.0000
Location	-0.046809	0.023099	0.424818	0.6722	0.089086	0.049061	1.815819	0.0788
R-squared=0.371 Number of observation=77					R-squared=0.617 Number of observation=37			
F-statistic=10.646					F-statistic=12.916			

In conclusion, according to the above parts, we can see that the pattern of inefficiency hospitals can be divided into two groups: IRS group and DRS group. To find the factors that effect on these two groups' hospitals, this study used OLS to identify the influence, from OLS results, for the technical efficiency of these two group general hospitals, 4 of 6 factors were insignificant in both two group hospitals, and OPP was significant in IRS group and BP was significant in DRS group. When it comes to the scale efficiency, the number of bed and average of bed day influence these two group hospitals, and the OPPR was insignificant in the DRS group, the geographic location did not have influence on these two group hospitals' scale efficiency.

5.3.4The comparison between IRS group and DRS group in traditional medicine hospital

The same way was use for the traditional medicine hospital, from table 5-15, we can find that only the bed-physician ratio was significant in the increasing return to scale group, other variables were insignificant ,meanwhile, in the decreasing return to scale group ,none of these were significant.

Table 5-15 **OLS of IRS group and DRS group of tradition medicine hospital technical efficiency**

	Increasing return to scale group				Decreasing return to scale			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.error	t-statistic	Prob.
C	0.525919	0.119128	4.414752	0.0001	0.477200	0.380105	1.255443	0.2560
BP	0.057069	0.018599	3.068368	0.0044	0.279490	0.117890	2.370764	0.0555
NP	-0.088429	0.140066	-0.601813	0.5517	-0.676376	0.345511	-1.957608	0.0980
OPP	0.014034	0.042804	0.327864	0.7452	-0.027338	0.157984	-0.173041	0.8683
PS	15.18532	8.081683	1.878980	0.0697	32.74656	27.10423	1.208172	0.2724
BC	-0.000312	0.000690	-0.451554	0.6547	0.000888	0.000659	1.347110	0.2266
Location	-0.163489	0.088550	-1.846289	0.0744	-0.041268	0.153832	-0.268264	0.7975
R-squared=0.466 Number of observation=38					R-squared=0.541 Number of observation=13			
F-statistic=4.523					F-statistic=1.18			

According to table 5-16, in the increasing return to scale group the number of beds and the outpatient-physician ratio factors had an impact on the hospitals scale efficiency ,the other two factors were insignificant .However, in the decreasing return to scale group, none of the factors were significant.

Table 5-16OLS of IRS and DRS of traditional medicine hospital scale efficiency

	Increasing return to scale group				Decreasing return to scale			
Variable	Coefficient	Std.Error	t-Statistic	Prob.	Coefficient	Std.error	t-statistic	Prob.
C	0.866555	0.073889	11.72776	0.0000	0.782870	0.326808	2.395502	0.0435
BEDS	-0.001046	0.000227	-4.600673	0.0001	-0.000162	0.000423	-0.382391	0.7121
OPPR	7.73E-05	3.01E-05	2.571396	0.0148	0.002148	0.019335	0.111086	0.9143
BEDDAY	0.002614	0.007073	0.369524	0.7141	-2.69E-06	0.000102	-0.026282	0.9797
Location	-0.046809	0.046804	-0.936003	0.3561	-0.214177	0.157319	-1.361414	0.2105
R-squared=0.466 Number of observation=38					R-squared=0.541 Number of observation=13			
F-statistic=4.523					F-statistic=1.18			

From the above concept, we can see that most of these factors were significant no matter for the increasing to scale group hospitals or decreasing to scale group hospitals in this study.

Chapter VI

CONCLUSIONAND RECOMMENDATION

6.1 Conclusions

6.1.1 Analysis of General Hospital and Traditional Hospital Efficiency

The purpose of this study were to identify the second level of both general hospitals and traditional hospitals efficiency in Inner Mongolia in the 2011.DEA and ordinary least square regression analysis were used in this study, DEA was used to calculate the technical and scale efficiency under variable return to scale and to identify the determinants of hospital efficiency using ordinary least square regression analysis. This study used the input-orientated measurement DEA.

This study provided a brief condition of the efficiency of general hospital and traditional hospital in Inner Mongolia, from the DEA results, we can see that the average constant return to scale technical efficiency score of both general hospital and traditional hospitals were 0.495,0.625 with S.D. of0.237,0.288, respectively; the average variable return to scale technical efficiency score were0.538and 0.685 with S.D. 0.244and 0.285, the average scale efficiency score were0.922and 0.905 with S.D.0.122 and 0.129 .These results figure that the level of technical and scale efficiency of the both the general hospital and traditional hospitals are very low. The traditional hospital had a slightly higher average technical efficiency score, more than9 % gained constant return to scale technical efficiency, about 33% and 24%got variable return to scale technical efficiency and scale efficiency, respectively.

In conclusion, the technical and scale efficiency score of both general hospital and traditional hospital in Inner Mongolia region were very low, all above concepts could provide a lot very useful information to the policy maker in health sector and managers of the hospital to enhance the inefficient regional hospital in proper direction by run the inefficient regional hospitals, through the appropriate way to assign the resources to the inefficient hospitals.

6.1.2 Analysis of Determinates of Both General Hospitals and Traditional Hospital

This study use the same determinates for the general hospital and traditional hospital ,form the result of the regression analysis, we can see that bed-physician ratio, other personal-physician ratio, number of physician in the form of square were positive correlated to the variable return to scale technical efficiency score, only nurse-physician ratio negatively correlated to variable return to scale technical efficiency score , and the bed occupancy and geographic location were insignificant to the variable return to scale technical efficiency score , on the contrary, for the traditional hospital, only other personal-physician ratio was significant and positive correlated to variable return to scale technical efficiency score, other variables were insignificant to the variable return to efficiency score.

For the scale efficiency, the same determinates, such as number of beds, out-patient-physicians ratio, the average of bed days and geographic location were used to the general hospital and traditional hospital, from the OLS result, number of bed, outpatient-physician ratio and average of bed day were significant and only outpatient-physician ratio was positive correlated to the scale efficiency score of the general hospital, the dummy variable geographic location was insignificant.

However, for the traditional hospital scale efficiency score, the average of bed day was insignificant, and the other three variables were significant, and the outpatient-physician ratio was positive correlate with the scale efficiency score, the number of bed and geographic location were negative correlated with the scale efficiency of the traditional hospital scale efficiency score.

All in all, the policy maker and managers of the hospitals could reduce the number of bed, the average of bed day and increase the outpatient-physician ratio improve the general hospital scale efficiency, for the traditional hospital could reduce the number of bed, increase the outpatient-physician ratio to improve the traditional hospital scale efficiency, what' more, for the traditional hospital, the geographic location had a negative correlated to the efficiency, so the location had impact on the traditional hospital.

6.2 Recommendation

From the result of this study, we can see it is not as good as we expected before ,the average of constant return to scale technical efficiency ,the variable return to scale technical efficiency and the scale efficiency were very low both in traditional Chinese hospital and general hospital, so there are some implications and recommendations can be derived:

1. There are lots of general hospitals and traditional hospital had the low level of technical efficiency, so it is better to use the resources related to the human resource and capital resource, such as number of doctors, number of nurse.
2. Due to the result most of general hospitals and traditional medicine hospitals' pattern of inefficiency are increasing pattern of scale, so the policy maker and the managers maybe consider the education of medicine students and training of the doctors and nurses; provide lots of professional test can be carried out to enhance the quality of the professionals.

3. From the results, policy maker can offer more good conditions to the professionals to avoiding brain drain.
4. Balance the development of general hospital and traditional medicine hospital; make these two types of hospital mutual cooperation, promotion and common development.

6.3Limitation of This Study

Firstly, DEA has already been used in health service since many years ago, and there are many types of inputs and outputs to calculation for evaluation of the technical efficiency or hospital efficiency. For this study Selection of inputs and outputs for DEA depends on the objective and limitation of the study.DEA is good at estimating“relative” efficiency of a DMU but it converges very slowly to “absolute” efficiency. In other words, it can tell you how well you are doing compared to your but not compared to a “theoretical maximum”.

Secondly, because this a one year Across-section data, so the and data availability is not very strong and some data sources cannot support.

6.4 Recommendations for Further Study

For further study, firstly, I think that allocative efficiency combining with technical efficiency study should be very helpful for policy maker in health sector and hospital managers to improve inefficient hospitals to efficient hospitals in the proper direction of each hospital.

Secondly, comparing the financial factors and non-financial factors may be a better way to find out the factors that affect the technical efficiency and scale efficiency.

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APPENDIX

A. Output slacks and input slacks of general hospital

SUMMARY OF OUTPUT SLACKS:

firm output:	1	2	3	4
1	0.000	4.182	0.000	0.000
2	0.000	0.483	0.000	7731.652
3	0.000	1.722	0.000	0.000
4	0.000	0.167	0.000	272.579
5	0.000	4.188	0.000	2965.628
6	0.000	5.003	0.000	414.324
7	1695.063	5.021	0.000	0.000
8	0.000	1.270	0.000	0.000
9	0.000	3.420	0.000	0.000
10	0.000	5.315	0.000	0.000
11	0.000	0.000	48734.437	0.000
12	0.000	0.000	310.553	3732.651
13	0.000	0.257	0.000	0.000
14	0.000	3.105	0.000	2475.217
15	0.000	0.055	0.000	601.357
16	0.000	2.410	0.000	2738.654
17	0.000	0.409	0.000	0.000
18	0.000	4.797	0.000	0.000
19	0.000	2.456	0.000	0.000
20	0.000	3.661	0.000	0.000
21	0.000	2.613	13793.081	6156.893
22	0.000	3.729	0.000	0.000
23	0.000	2.693	0.000	6368.539

24	0.000	0.000	31143.328	0.000
25	0.000	5.411	0.000	0.000
26	0.000	2.514	0.000	0.000
27	0.000	0.707	0.000	5013.216
28	0.000	0.000	0.000	1854.480
29	0.000	3.244	0.000	0.000
30	0.000	2.064	8639.989	0.000
31	0.000	0.000	0.000	0.000
32	0.000	0.122	12379.544	1375.358
33	8684.181	5.473	0.000	0.000
34	0.000	3.302	0.000	0.000
35	0.000	0.000	11073.932	0.000
36	0.000	6.019	0.000	0.000
37	0.000	5.758	0.000	0.000
38	0.000	3.249	30822.246	0.000
39	0.000	0.953	0.000	0.000
40	0.000	2.542	0.000	0.000
41	0.000	4.316	0.000	6423.585
42	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000
45	0.000	1.388	0.000	5504.156
46	0.000	1.717	0.000	0.000
47	0.000	1.308	0.000	4261.365

48	0.000	4.623	22813.974	0.000
49	0.000	0.000	0.000	0.000
50	0.000	1.228	356.961	1695.919
51	0.000	2.698	0.000	4175.395
52	0.000	4.921	0.000	880.614
53	0.000	0.817	0.000	63.557
54	0.000	6.355	0.000	785.285
55	0.000	2.966	0.000	0.000
56	0.000	7.145	0.000	193.069
57	0.000	3.646	0.000	43.810
58	0.000	2.913	0.000	0.000
59	0.000	5.006	0.000	878.358
60	0.000	4.764	0.000	3022.859
61	0.000	4.980	0.000	5285.054
62	0.000	2.729	0.000	1622.609
63	0.000	0.000	0.000	0.000
64	0.000	1.272	11137.294	5886.731
65	0.000	2.639	0.000	690.962
66	0.000	0.000	0.000	0.000
67	0.000	2.742	0.000	1204.103
68	0.000	0.795	0.000	0.000
69	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000
71	0.000	0.000	0.000	0.000

72	0.000	0.000	0.000	0.000
73	0.000	0.000	0.000	1346.968
74	0.000	0.000	0.000	0.000
75	0.000	0.000	0.000	0.000
76	0.000	0.654	0.000	0.000
77	0.000	0.463	0.000	0.000
78	0.000	1.989	0.000	0.000
79	0.000	0.000	0.000	116.711
80	3327.846	0.983	0.000	0.000
81	0.000	0.000	0.000	0.000
82	0.000	1.303	0.000	692.027
83	0.000	0.000	0.000	0.000
84	0.000	0.000	0.000	0.000
85	0.000	0.000	0.000	0.000
86	0.000	0.000	0.000	0.000
87	5941.132	0.312	20.212	0.000
88	0.000	0.000	0.000	437.969
89	4585.297	3.964	0.000	0.000
90	0.000	1.078	10.554	0.000
91	0.000	1.581	0.000	0.000
92	6506.990	7.498	0.000	0.000
93	0.000	0.000	0.000	0.000
94	0.000	0.000	0.000	0.000
95	0.000	0.000	1969.277	0.000

96	0.000	3.261	0.000	223.786
97	0.000	0.000	0.000	0.000
98	2910.195	0.618	4.647	0.000
99	0.000	3.894	11.337	67.394
100	0.000	3.395	0.000	0.000
101	0.000	3.761	0.000	0.000
102	0.000	0.364	0.000	0.000
103	0.000	0.000	0.000	0.000
104	0.000	1.465	0.000	0.000
105	0.000	3.202	0.000	749.397
106	0.000	3.751	0.000	0.000
107	0.000	5.968	0.000	3107.828
108	0.000	0.000	0.000	0.000
109	0.000	3.577	0.000	0.000
110	0.000	4.339	0.000	0.000
111	0.000	5.174	0.000	0.000
112	14885.845	4.785	0.000	3931.568
113	0.000	2.936	0.000	0.000
114	0.000	6.477	0.000	0.000
115	0.000	0.592	0.000	0.000
116	0.000	8.588	0.000	3211.755
117	0.000	0.306	8984.806	0.000
118	0.000	4.204	0.000	0.000
119	0.000	0.000	0.000	0.000

120	0.000	3.020	11032.021	1749.907
121	0.000	0.000	0.000	1152.237
122	0.000	0.000	0.000	0.000
123	0.000	1.247	0.000	0.000
124	0.000	3.378	0.000	0.000
125	0.000	0.000	5915.709	0.000
126	0.000	0.000	0.000	0.000
127	0.000	2.720	0.000	2360.037
128	0.000	0.000	0.000	0.000

SUMMARY OF INPUT SLACKS:

firm input:	1	2	3	4
1	0.000	0.000	1.502	361.768
2	98.834	2.517	46.359	0.000
3	22.712	0.000	11.430	0.000
4	0.000	0.000	3.263	0.000
5	1.568	0.000	12.143	1084.647
6	0.000	0.000	0.000	1655.754
7	0.000	1.492	2.155	0.000
8	0.000	15.584	33.494	0.000
9	0.000	0.000	8.902	871.223
10	0.000	0.000	0.000	4052.585
11	293.317	87.449	0.000	25383.726
12	0.000	28.036	56.074	1073.238

13	0.000	0.000	2.744	2454.984
14	5.270	0.000	18.112	0.000
15	10.015	0.000	12.798	1195.653
16	0.000	0.000	6.856	720.665
17	0.000	0.000	8.138	33382.262
18	0.000	10.246	13.362	1727.028
19	0.000	1.409	8.156	1175.785
20	0.000	0.000	36.332	18679.380
21	30.047	0.000	0.000	1497.869
22	0.000	0.000	1.531	395.623
23	0.000	0.178	8.077	0.000
24	161.678	43.704	32.659	0.000
25	0.000	0.000	2.640	810.654
26	0.000	0.000	4.876	2844.755
27	11.200	0.000	32.801	0.000
28	118.460	44.186	0.000	7299.126
29	0.000	11.807	34.905	0.000
30	0.000	0.000	48.289	1919.692
31	0.000	5.659	11.662	0.000
32	13.143	0.000	25.212	0.000
33	0.000	22.976	25.928	2333.220
34	0.000	11.778	3.595	4681.322
35	0.000	0.000	7.107	3319.405
36	0.000	0.000	5.755	2587.438

37	0.000	0.000	0.000	1109.890
38	51.439	0.000	0.000	7503.289
39	0.000	5.399	19.110	3036.600
40	53.841	0.838	0.000	0.000
41	0.000	28.660	1.252	0.000
42	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000
45	0.000	1.734	0.000	1312.829
46	0.000	8.646	14.431	7852.489
47	0.000	13.174	0.000	7570.070
48	0.000	0.000	22.589	5458.848
49	0.000	0.000	0.000	0.000
50	0.000	0.000	21.333	7850.249
51	0.000	1.771	0.000	280.165
52	0.000	15.009	3.784	0.000
53	0.000	0.449	0.000	272.505
54	0.000	0.000	4.329	1092.167
55	0.000	0.657	0.000	394.562
56	0.000	0.000	8.455	440.373
57	0.000	0.000	0.000	2827.362
58	0.000	0.000	1.375	746.772
59	0.000	0.000	24.955	0.000
60	34.412	11.802	0.000	0.000

61	0.000	12.292	45.007	0.000
62	0.000	5.458	0.000	2195.130
63	0.000	0.000	7.829	561.250
64	0.000	0.000	8.950	1226.524
65	0.000	0.000	2.660	1782.994
66	0.000	11.525	18.953	183.831
67	2.560	1.556	0.000	2711.197
68	0.000	7.284	21.615	2242.497
69	0.000	0.000	0.000	0.000
70	13.713	17.266	11.623	0.000
71	0.000	11.461	5.389	739.019
72	0.000	12.562	5.282	0.000
73	0.000	1.929	4.780	0.000
74	10.214	2.983	9.682	0.000
75	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	1412.100
77	0.000	7.439	0.000	6864.538
78	0.000	0.000	4.641	0.000
79	0.000	9.359	0.000	1122.270
80	0.000	1.054	0.000	0.000
81	0.000	0.000	0.000	0.000
82	0.000	0.000	7.592	2880.519
83	0.000	0.000	0.000	0.000
84	0.000	0.000	0.000	0.000

85	0.000	0.000	0.000	0.000
86	0.000	0.000	0.000	0.000
87	0.000	0.000	4.593	518.700
88	13.646	2.724	0.000	0.000
89	0.000	6.877	0.000	315.098
90	0.000	2.270	0.000	0.000
91	0.000	0.712	0.052	69.097
92	0.000	6.668	4.205	446.321
93	0.000	0.000	0.000	0.000
94	0.000	6.085	20.189	2211.507
95	0.000	0.000	11.945	10697.479
96	0.000	0.000	0.000	1006.248
97	0.000	14.926	5.837	3201.822
98	0.000	11.821	4.558	2601.781
99	0.000	0.000	0.000	593.112
100	0.000	11.693	23.738	0.000
101	0.000	3.072	12.879	0.000
102	0.000	5.496	11.529	0.000
103	71.650	48.842	77.379	0.000
104	0.000	9.626	36.048	0.000
105	0.000	1.916	3.919	2899.756
106	0.000	1.456	16.850	0.000
107	0.000	0.000	9.858	2495.396
108	0.000	0.000	0.000	0.000

109	0.000	0.000	10.348	5275.990
110	0.000	0.000	2.207	98.626
111	0.000	0.000	13.132	1417.723
112	20.304	0.000	35.348	0.000
113	0.000	0.000	0.000	6515.885
114	0.000	17.761	4.760	2867.771
115	0.000	4.707	6.647	0.000
116	2.003	0.000	10.633	2863.492
117	0.000	0.000	4.368	1981.818
118	0.000	0.000	2.373	4067.753
119	0.000	0.000	0.000	0.000
120	14.763	0.000	0.000	4284.616
121	105.997	14.316	22.335	0.000
122	0.000	0.000	0.000	0.000
123	0.000	0.000	1.581	181.464
124	0.000	3.385	6.580	1041.065
125	0.000	0.000	19.674	387.792
126	0.000	0.000	0.000	0.000
127	1.234	11.339	0.000	34929.550
128	0.000	0.000	0.000	0.000

B. Output slacks and input slacks of traditional medicine hospital

SUMMARY OF OUTPUT SLACKS:

firm output:	1	2	3
1	0.000	0.000	0.000
2	0.000	0.000	0.000
3	0.000	0.000	0.000
4	0.000	0.000	0.000
5	0.000	0.000	0.000
6	0.000	0.000	0.000
7	0.000	0.000	0.000
8	15899.798	0.058	2388.085
9	1669.372	0.000	0.000
10	0.000	0.000	1540.678
11	0.000	2.426	0.000
12	0.000	0.000	2.613
13	0.000	2.033	0.000
14	14587.020	0.000	18456.090
15	0.000	0.000	412.766
16	0.000	2.088	366.067
17	0.000	1.798	0.000
18	0.000	0.000	0.000
19	0.000	3.497	0.000
20	0.000	5.040	0.000
21	0.000	5.997	0.000
22	0.000	3.232	178.107
23	0.000	2.232	790.269
24	0.000	4.980	0.000
25	0.000	0.000	130.769
26	0.000	0.000	69.141
27	0.000	0.000	593.309
28	0.000	0.000	0.000
29	0.000	1.375	265.231
30	0.000	0.000	0.000
31	0.000	2.570	81.643
32	8488.551	6.762	17.349
33	0.000	0.000	3326.730
34	0.000	0.000	0.000
35	0.000	3.982	0.000
36	0.000	2.931	0.000
37	7286.086	0.085	2227.879
38	12574.862	0.762	1569.800
39	0.000	0.000	0.000
40	5819.109	0.000	921.566
41	6490.125	4.316	1517.193
42	0.000	0.000	0.000
43	0.000	5.426	0.000
44	0.000	0.050	0.000
45	0.000	0.639	0.000
46	0.000	0.000	0.000
47	0.000	0.000	0.000

48	0.000	0.000	0.000
49	0.000	0.000	0.000
50	0.000	0.000	0.000
51	0.000	0.000	0.000
52	0.000	0.000	1181.147
53	673.382	0.000	0.000
54	0.000	5.664	0.000
55	0.000	3.021	0.000
56	0.000	0.000	0.000
57	0.000	0.000	0.000
58	21122.406	0.000	1081.556
59	0.000	0.000	0.000
60	0.000	0.000	0.000
61	2751.921	2.684	771.504
62	0.000	0.000	0.000
63	0.000	0.000	0.000
64	0.000	0.000	0.000
65	0.000	2.467	0.000
66	0.000	7.061	0.000
67	0.000	0.000	0.000
68	0.000	0.000	3110.913
69	0.000	0.000	0.000

SUMMARY OF INPUT SLACKS:

firm input:	1	2	3	4
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000
5	80.980	0.000	12.874	963.184
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	11.321	0.000	0.000	0.000
9	2.416	2.491	0.000	0.000
10	12.553	0.000	4.100	1803.217

11	0.000	0.000	5.318	1322.176
12	0.000	0.000	0.000	1622.259
13	52.945	0.000	20.809	5376.905
14	9.679	23.176	17.547	0.000
15	4.559	0.000	1.284	753.040
16	0.000	0.393	0.000	468.678
17	0.000	0.000	0.206	3517.165
18	0.000	0.000	0.000	0.000
19	0.000	0.000	5.938	640.725
20	0.000	0.000	0.895	0.000
21	0.000	9.512	0.000	1224.472
22	0.000	0.000	0.000	745.593
23	11.323	0.000	0.000	0.000
24	0.000	0.000	2.753	706.520
25	10.244	0.000	0.000	952.976
26	0.000	0.000	3.196	0.000
27	0.000	1.254	0.000	0.000
28	35.298	8.344	23.442	0.000
29	0.000	0.000	2.357	378.424
30	0.000	0.000	0.000	0.000
31	0.000	0.000	2.570	123.329
32	0.000	0.000	0.914	0.000
33	135.452	0.000	0.000	12109.550
34	0.000	0.000	0.000	0.000

35	0.000	0.000	9.878	12735.627
36	0.000	0.000	0.000	1375.208
37	12.922	3.265	0.000	0.000
38	0.000	0.875	0.000	0.000
39	14.783	0.000	0.000	0.000
40	1.462	11.580	0.000	0.000
41	0.000	17.705	0.000	0.000
42	0.000	0.000	0.000	0.000
43	6.666	0.000	0.000	1947.350
44	0.000	0.000	5.896	20465.592
45	0.000	0.000	10.660	0.000
46	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	0.000
48	0.000	0.000	0.000	0.000
49	0.000	0.000	3.113	0.000
50	0.000	0.000	0.000	0.000
51	0.000	0.000	2.029	0.000
52	5.288	0.000	0.000	0.000
53	0.000	0.000	2.027	0.000
54	44.789	0.000	7.185	2484.820
55	0.000	0.000	0.518	133.825
56	0.000	0.000	0.000	0.000
57	0.000	0.000	0.000	0.000
58	0.000	0.000	6.446	664.132

59	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000
61	0.000	2.667	0.000	0.000
62	0.000	0.000	0.000	0.000
63	0.000	0.000	0.000	0.000
64	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	1063.219
66	44.935	0.000	3.042	1636.476
67	0.000	0.000	0.000	0.000
68	4.824	0.000	0.000	0.000
69	0.000	0.000	0.000	0.000

C. result of regression analysis of general hospital

General hospital

Dependent Variable: VRSTE

Method: Least Squares
Date: 03/31/12 Time: 20:17
Sample: 1 128
Included observations: 128

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.328143	0.070526	4.652789	0.0000
BP	0.061179	0.020389	3.000579	0.0033
NP	-0.111516	0.055062	-2.025301	0.0450
OPP	0.084663	0.031231	2.710900	0.0077
PS	9.431265	3.089054	3.053124	0.0028
BC	-2.48E-06	2.69E-06	-0.922546	0.3581
L	-0.017702	0.040765	-0.434247	0.6649

R-squared	0.202941	Mean dependent var	0.538063
Adjusted R-squared	0.163417	S.D. dependent var	0.244725
S.E. of regression	0.223837	Akaike info criterion	-0.102659
Sum squared resid	6.062482	Schwarz criterion	0.053311
Log likelihood	13.57017	Hannan-Quinn criter.	-0.039287
F-statistic	5.134679	Durbin-Watson stat	1.390247
Prob(F-statistic)	0.000099		

Dependent Variable: SE
Method: Least Squares
Date: 04/02/12 Time: 15:27
Sample: 1 128
Included observations: 128

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.993380	0.034526	28.77230	0.0000
B	-0.000233	4.56E-05	-5.104540	0.0000
OPPR	5.65E-05	1.63E-05	3.472527	0.0007
BEDDAY	-0.008984	0.003797	-2.366488	0.0195
L	0.023864	0.023820	1.001836	0.3184

R-squared	0.265367	Mean dependent var	0.922289
Adjusted R-squared	0.241477	S.D. dependent var	0.122991
S.E. of regression	0.107117	Akaike info criterion	-1.591515
Sum squared resid	1.411303	Schwarz criterion	-1.480107
Log likelihood	106.8569	Hannan-Quinn criter.	-1.546249
F-statistic	11.10765	Durbin-Watson stat	1.787494
Prob(F-statistic)	0.000000		

D.result of regression analysis of traditional hospital

Traditional hospital

Dependent Variable: VRSTE
Method: Least Squares
Date: 03/31/12 Time: 23:35
Sample (adjusted): 1 69
Included observations: 69 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.596192	0.123745	4.817900	0.0000
BP	-0.003905	0.025944	-0.150510	0.8809
NP	-0.302750	0.158566	-1.909305	0.0609
OPP	0.149102	0.055875	2.668477	0.0097
BC	0.000324	0.000544	0.594932	0.5541
PS	13.17527	7.038231	1.871957	0.0659
L	-0.117437	0.086207	-1.362267	0.1780

R-squared	0.212477	Mean dependent var	0.685449
Adjusted R-squared	0.136265	S.D. dependent var	0.285367
S.E. of regression	0.265213	Akaike info criterion	0.279359
Sum squared resid	4.360949	Schwarz criterion	0.506007
Log likelihood	-2.637882	Hannan-Quinn criter.	0.369278
F-statistic	2.787975	Durbin-Watson stat	1.774645
Prob(F-statistic)	0.018238		

Dependent Variable: SE
Method: Least Squares
Date: 03/31/12 Time: 23:35
Sample (adjusted): 1 69
Included observations: 69 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.849994	0.051604	16.47141	0.0000
B	-0.000338	0.000164	-2.060437	0.0434
OPPR	4.57E-05	2.03E-05	2.254772	0.0276
BEDDAY	0.005841	0.004105	1.422737	0.1597
L	-0.077173	0.035761	-2.158054	0.0347

R-squared	0.219724	Mean dependent var	0.905072
Adjusted R-squared	0.170957	S.D. dependent var	0.129907
S.E. of regression	0.118282	Akaike info criterion	-1.361782
Sum squared resid	0.895404	Schwarz criterion	-1.199890
Log likelihood	51.98148	Hannan-Quinn criter.	-1.297554
F-statistic	4.505575	Durbin-Watson stat	2.069683
Prob(F-statistic)	0.002862		

E. comparison of IRS and DRS factors in general hospital

Dependent Variable: VRSTE
Method: Least Squares
Date: 05/08/12 Time: 15:02
Sample (adjusted): 1 77
Included observations: 77 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.333428	0.075893	4.393427	0.0000
BP	-0.014688	0.029447	-0.498786	0.6195
NP	0.015815	0.064465	0.245332	0.8069
BC	-2.87E-06	2.34E-06	-1.227368	0.2238
OPP	0.104728	0.041893	2.499894	0.0148
PS	9.031159	5.101225	1.770390	0.0810
LOCATION	-0.069112	0.045325	-1.524791	0.1318

R-squared	0.156610	Mean dependent var	0.470844
Adjusted R-squared	0.084320	S.D. dependent var	0.197419
S.E. of regression	0.188913	Akaike info criterion	-0.408557
Sum squared resid	2.498156	Schwarz criterion	-0.195484
Log likelihood	22.72946	Hannan-Quinn criter.	-0.323330
F-statistic	2.166400	Durbin-Watson stat	1.808124
Prob(F-statistic)	0.056506		

Dependent Variable: VRSTE01
Method: Least Squares
Date: 05/08/12 Time: 15:10
Sample (adjusted): 1 37
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.375732	0.190320	1.974213	0.0576
BP01	0.074324	0.035015	2.122619	0.0422
NP01	-0.148229	0.118036	-1.255798	0.2189
BC01	-7.42E-06	0.000176	-0.042243	0.9666
OPP01	0.004600	0.052414	0.087756	0.9307
PS01	7.582729	6.708523	1.130313	0.2673
LOCATION01	0.080427	0.070423	1.142045	0.2625

R-squared	0.215532	Mean dependent var	0.540270
Adjusted R-squared	0.058639	S.D. dependent var	0.213066
S.E. of regression	0.206725	Akaike info criterion	-0.146201
Sum squared resid	1.282052	Schwarz criterion	0.158568
Log likelihood	9.704713	Hannan-Quinn criter.	-0.038756
F-statistic	1.373749	Durbin-Watson stat	2.468660
Prob(F-statistic)	0.257148		

Dependent Variable: SE
Method: Least Squares

Date: 05/08/12 Time: 15:05
Sample (adjusted): 1 77
Included observations: 77 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.657184	0.049748	13.21039	0.0000
SER01	0.016669	0.005298	3.146279	0.0024
BEDS	0.000455	0.000124	3.676879	0.0005
OPPR	0.000105	2.19E-05	4.816042	0.0000
LOCATION	0.009813	0.023099	0.424818	0.6722

R-squared	0.371660	Mean dependent var	0.934039
Adjusted R-squared	0.336752	S.D. dependent var	0.096642
S.E. of regression	0.078706	Akaike info criterion	-2.183474
Sum squared resid	0.446009	Schwarz criterion	-2.031279
Log likelihood	89.06376	Hannan-Quinn criter.	-2.122597
F-statistic	10.64690	Durbin-Watson stat	1.687098
Prob(F-statistic)	0.000001		

Dependent Variable: SE01
Method: Least Squares
Date: 05/08/12 Time: 15:13
Sample (adjusted): 1 37
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.261873	0.085093	14.82933	0.0000
SER02	-0.029831	0.006352	-4.696621	0.0000
BEDS01	-0.000350	6.45E-05	-5.415888	0.0000
OPPR01	2.77E-05	4.66E-05	0.593756	0.5568
LOCATION01	0.089086	0.049061	1.815819	0.0788

R-squared	0.617522	Mean dependent var	0.868486
Adjusted R-squared	0.569712	S.D. dependent var	0.167440
S.E. of regression	0.109835	Akaike info criterion	-1.454591
Sum squared resid	0.386038	Schwarz criterion	-1.236899
Log likelihood	31.90993	Hannan-Quinn criter.	-1.377844
F-statistic	12.91624	Durbin-Watson stat	1.718145
Prob(F-statistic)	0.000002		

F. comparison of IRS and DRS of traditional medicine hospital

Dependent Variable: VRSTE
Method: Least Squares
Date: 05/08/12 Time: 14:27
Sample: 1 38
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.525919	0.119128	4.414752	0.0001
BP	0.057069	0.018599	3.068368	0.0044
NP	-0.084294	0.140066	-0.601813	0.5517
LOCATION	-0.163489	0.088550	-1.846289	0.0744
OPP	0.014034	0.042804	0.327864	0.7452
PS	15.18532	8.081683	1.878980	0.0697
BC	-0.000312	0.000690	-0.451554	0.6547

R-squared	0.466839	Mean dependent var	0.705868
Adjusted R-squared	0.363647	S.D. dependent var	0.203965
S.E. of regression	0.162706	Akaike info criterion	-0.628917
Sum squared resid	0.820674	Schwarz criterion	-0.327257
Log likelihood	18.94943	Hannan-Quinn criter.	-0.521589
F-statistic	4.523971	Durbin-Watson stat	1.855053
Prob(F-statistic)	0.002108		

Dependent Variable: VRSTE01
Method: Least Squares
Date: 05/08/12 Time: 14:33
Sample (adjusted): 1 13
Included observations: 13 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.477200	0.380105	1.255443	0.2560
BP01	0.279490	0.117890	2.370764	0.0555
NP01	-0.676376	0.345511	-1.957608	0.0980
LOCATION01	-0.041268	0.153832	-0.268264	0.7975
OPP01	-0.027338	0.157984	-0.173041	0.8683
PS01	32.74656	27.10423	1.208172	0.2724
BC01	0.000888	0.000659	1.347110	0.2266

R-squared	0.541590	Mean dependent var	0.901154
Adjusted R-squared	0.083180	S.D. dependent var	0.153006
S.E. of regression	0.146504	Akaike info criterion	-0.699791
Sum squared resid	0.128781	Schwarz criterion	-0.395587
Log likelihood	11.54864	Hannan-Quinn criter.	-0.762318
F-statistic	1.181452	Durbin-Watson stat	2.051403
Prob(F-statistic)	0.422378		

Dependent Variable: SE
Method: Least Squares

Date: 05/08/12 Time: 14:41
Sample: 1 38
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.866555	0.073889	11.72776	0.0000
BEDS	-0.001046	0.000227	-4.600673	0.0001
OPPR	7.73E-05	3.01E-05	2.571396	0.0148
SER01	0.002614	0.007073	0.369524	0.7141
LOCATION	-0.043809	0.046804	-0.936003	0.3561

R-squared	0.516769	Mean dependent var	0.855553
Adjusted R-squared	0.458195	S.D. dependent var	0.138400
S.E. of regression	0.101873	Akaike info criterion	-1.608101
Sum squared resid	0.342477	Schwarz criterion	-1.392629
Log likelihood	35.55392	Hannan-Quinn criter.	-1.531438
F-statistic	8.822569	Durbin-Watson stat	1.985025
Prob(F-statistic)	0.000059		

Dependent Variable: SE01
Method: Least Squares
Date: 05/08/12 Time: 14:47
Sample (adjusted): 1 13
Included observations: 13 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.782870	0.326808	2.395502	0.0435
BEDS01	-0.000162	0.000423	-0.382391	0.7121
SER02	0.002148	0.019335	0.111086	0.9143
OPPR01	-2.69E-06	0.000102	-0.026282	0.9797
LOCATION01	-0.214177	0.157319	-1.361414	0.2105

R-squared	0.507913	Mean dependent var	0.689000
Adjusted R-squared	0.261870	S.D. dependent var	0.150859
S.E. of regression	0.129610	Akaike info criterion	-0.964852
Sum squared resid	0.134390	Schwarz criterion	-0.747564
Log likelihood	11.27154	Hannan-Quinn criter.	-1.009515
F-statistic	2.064326	Durbin-Watson stat	2.214030
Prob(F-statistic)	0.177765		

BIOGRAPHY

Name:	Lili Kang
Sex:	female
Nationality:	Chinese
Date of birth:	11 May 1987
Education:	Bachelor of Public Health Management
	Inner Mongolia Medical College