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The Influence of Fiscal Decentralization on the Efficiency of Social Security in China

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謝　詞

光陰似箭，歲月如梭，研究所念兩年真的不夠啊！在這兩年的歲月中，首先要感謝的就是我的指導教授，黃智聰老師，雖然老師在這兩年中十分地忙碌奔波，但是在每個禮拜的會面中，指導論文之餘，老師還是不會忘記要關心我們的近況，講講老師日常生活中發生的趣事，並不時地提醒我們留意待人處事的態度，也要謝謝老師提供豐沛的資源和舒適的環境讓我得以完成學業與論文，真的很高興也很榮幸能有這麼幽默風趣的老師來當我的指導教授，使我能夠更上一層樓。此外，還要感謝口試委員陳欽賢老師和陳國樑老師，謝謝老師提供珍貴的建議與對我的鼓勵，讓我更加完善我的論文。

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2011 年 7 月 12 日　於家中

Abstract

Title: The Influence of Fiscal Decentralization on the Efficiency of Social Security in China

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Key Words: Fiscal Decentralization, Social Security Efficiency, DEA, Tobit Model

The purpose of this study is to investigate the influence of fiscal decentralization on the efficiency of social security in China since the realization of social security was promoted and some relevant policies were implemented in 21 century. This study uses China's provincial-level data of 31 regions from 2000 to 2009 and uses two inputs and three outputs to calculate the efficiency scores as the dependent variables. The inputs are the proportions of expenditures for social security and employment effort to total public expenditures and the proportions of hygiene, social security, and social welfare employed people to total employed people. The outputs are the coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance, and the coverage rate of urban basic medical care insurance. Then, this study establishes four specifications of the Tobit model. Other factors, gross regional product per capita (*PGRP*), the degree of openness (*OPEN*), the scale of provincial government (*SOG*), the quadratic term of the former (*SOGSQ*), area dummy variables, and time dummy variables, are added into the Tobit model. The primary finding of this study is that fiscal decentralization has a positively non-monotonic influence on the efficiency of social security. This contributes positively to the efficiency of provincial government's social security, but this positive influence does not always exist.

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CHAPTER 1. INTRODUCTION

1.1 Research Background

Since the implementation of the "open door" policy in 1978, China's economy has grown rapidly. During 1978 to 2010, the growth of China's gross domestic product has increased on average by more than 9% each year. Even in the global financial crisis of 2008 and the Asian financial turmoil of 1997, China still has maintained high economic growth rates, which is 9.6% and 9.3% respectively.[1] Undoubtedly, the role that China has played in the global economic system has been more important and attracted worldwide attention. Furthermore, many economists have been interested in the issue that why China has enjoyed such good economic performance. They found that fiscal decentralization has been one of the important factors which have contributed to economic growth (Ma, 2000; Lin and Liu, 2000; Qiao et al., 2002).[2]

Besides, since the economic reform and opening to the world, China's fiscal reform has implemented a series of major fiscal reform in transforming from the highly concentrated fiscal system to a decentralized one. The fiscal system of China underwent three stages. The following are the simple introductions. At the beginning, before 1978, China's budgetary policy essentially consisted in generalized tax collection and profit remittances controlled by the central government and then redistributed as needed to the provinces. Then, during 1979 to 1993, China

[1] Data is based on the *China Statistical Yearbook* (State Statistical Bureau, SSB).

[2] Ma (1997) indicated that fiscal decentralization plays the important role of Chinese economic reforms and has a positive influence on economic developments. Lin and Liu (2000) also considered that fiscal decentralization, an important reform, is a key factor which contributed to such rapid economic growth. Similarly, Qiao et al. (2002) suggested that fiscal decentralization is the most important policy which accelerates the economy in China during the last three decades of economic reforms.

intentionally broke down its concentrated fiscal management system by various forms of "fiscal contracting systems (FCS, hereafter)". After 1994, China processed another fiscal reform that was relatively easy to identify revenues belonged to either the central or provincial governments through the "tax sharing system (TSS, hereafter)". The kind of fiscal systems that Chinese authority chose obviously affected the degree of fiscal decentralization.

According to Figure 1, the fiscal structures of the central and provincial governments have undergone tremendous change since 1994. In the year prior to the implementation of TSS in 1994, the shares of total fiscal revenue accounted for by the central and provincial governments were 22% and 78%, respectively. However, when TSS was implemented in 1994, these proportions became 55.7% and 44.3% respectively, and the share accounted for by the central government greatly increased by 33.7%. Following this reform in 1994, the proportion of the total national fiscal revenue accounted for by the central fiscal revenue rose rapidly, while the proportion of the total national fiscal revenue accounted for by the provincial fiscal revenue decreased by a large magnitude.

In the view of these changes in the fiscal revenues, the decentralization of fiscal power at the provincial government level most likely causes the provincial governments to suffer an insufficiency of tax revenue or a fiscal deficit. However, this does not imply that the degree of fiscal decentralization decreases because the degree of fiscal decentralization is expressed in terms of fiscal revenue autonomy.[3] In China's fiscal system, the provincial governments must pay amount of its fiscal revenues to the central government. When calculating the fiscal independence of each province, such payments should be deducted from the provincial total fiscal revenues

[3] According to Huang and Cheng (2005).

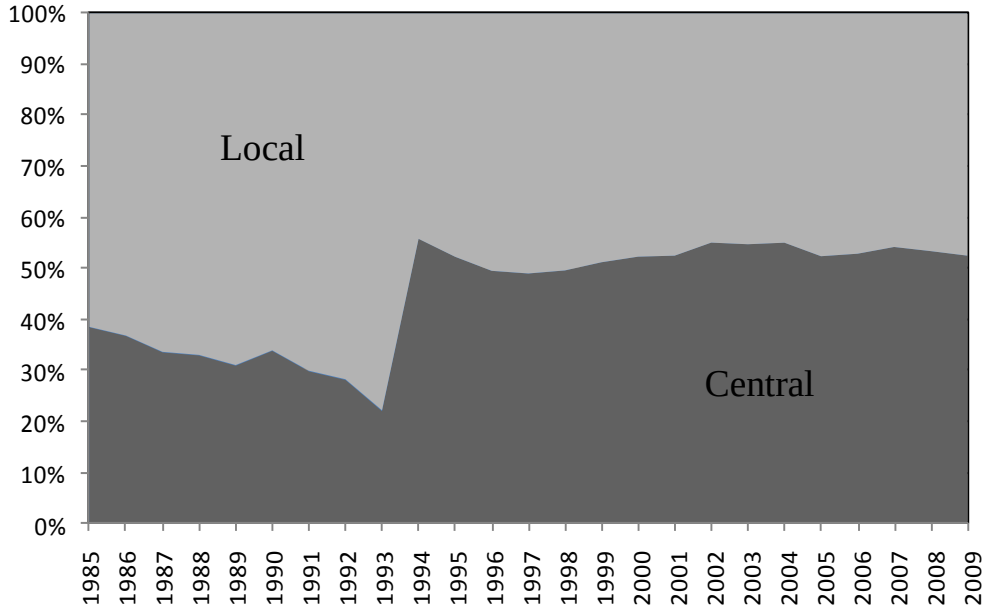

Figure 1: Share of Central and Local Fiscal Revenue

Source: Various years of the *China Statistical Yearbook* (State Statistical Bureau, SSB).
Note: The central and local revenues in this table represent the income from the central and local level governments themselves.

because the remainder is actually the amount that the provincial governments can use freely. Also, if the central government transfers some of subsidies to the provincial governments, these subsidies are the provincial fiscal revenues. As the provincial government can keep more of these provincial fiscal revenues for its own use, there is a higher degree of fiscal decentralization at the provincial government level.

Therefore, fiscal decentralization in China means that provincial governments must have an adequate level of revenues which are either raised by provincial governments or transferred from the central government and are deducted by payments from a province to the central government, so that the provincial authorities can make decisions about expenditures. As a provincial government has a higher degree of fiscal decentralization, which means that the provincial government has higher revenue autonomy.

However, while China enjoyed such great economic performance because of the

TSS and the higher revenue autonomy at provincial government level, highly developed economy also resulted in some problems about environments and social welfare. The aim which a country seeks for is not only economic development, but also other different issues, such as social welfare, the quality of living, environmental protection, hygiene, and health. As a provincial government has a higher degree of fiscal decentralization, does this improve the efficiency of social welfare, especially in the provincial social security side? The definition of efficiency here is the application of the Data Envelopment Analysis (DEA, hereafter), which is which is an approach of non parametric mathematical programming technique for estimating efficiency. Regarding the efficiency of local governments, many studies have addressed this issue and have concluded that fiscal decentralization increases the efficiency of local governments (Bahl and Linn, 1992; Bird and Wallich, 1993).[4] But, how is about the efficiency of social welfare, further social security?

Recently, several surveys have paid attention to the issues concerning the relationship between fiscal decentralization and the social welfare in China. Bardhan (2002) thought that the decentralization of fiscal power raises the social welfare level under the federal system. Comparing to the central government, local governments have more information about the preferences of local residents and the costs of providing public goods. Martinez-Vazquez et al. (2005) found that fiscal decentralization increases the proportion of educational and health expenditures to total public expenditures. In addition, this phenomenon is more obvious in developing countries than in developed countries. However, some scholars have had contrary considerations. West and Wong (1995) addressed that the public expenditures in

[4] Bahl and Linn (1992) addressed that fiscal decentralization or the release of fiscal power can improve the efficiency of public sector. Bird and Wallich (1993) also indicated that fiscal decentralization, or the devolution of fiscal power, is seen as a way to improve the efficiency of the public sector, cut the budget deficit and stimulate economic growth.

hygiene and education reduced is resulted from fiscal decentralization in China. Especially in some rural areas, the social welfare of local residents aggravates more obviously.

These above-mentioned literatures in the last paragraph are relevant to the social expenditures. However, after the realization of social welfare was promoted in China in 21 century, there were more policies about social welfare implemented, further social security, for example, urban basic pension insurance, unemployment insurance, and urban basic medical care insurance. Thus, the analysis between fiscal decentralization and social expenditures is not comprehensive. According to Acemoglu and Verdier (2000), even the best intervention of governments might appear corruption, and this corruption would result in the serious abuse and wrong distribution of social expenditures. Therefore, in order to increase the level of social welfare and improve the living quality of residents cannot simply depend on the incremental expenditures of social security, but the efficiency of social security.

After the “open door” policy in 1978 and the implementation of the TSS in 1994, China has developed its economy rapidly and prospered during the last ten years. Meanwhile, the issue about social welfare in China has been more important and notable since 21 century. Nationals in China have been richer and more conscious of their social welfare, even the efficiency of social welfare. Although many scholars indicated that fiscal decentralization had a positive impact on economic growth and improved the efficiency of local governments, as mentioned above, the influence of fiscal decentralization on the efficiency of social welfare in China is still questionable. Thus, the issue of the relationship between fiscal decentralization and the efficiency of social welfare in China is well worth studying. This research will focus on the influence of fiscal decentralization on the efficiency of social security.

1.2 Research Purpose

As mentioned above, the issue about social welfare and its efficiency is getting valuable and notable in China. The impact of fiscal decentralization on the efficiency of social security in China is still questionable as well, therefore, the primary purpose of this paper is to investigate the relationship between fiscal decentralization and the efficiency of social security after the realization of social welfare was promoted last ten years in China. Through the statements of theories, the researches of important literatures and the application of some appropriate empirical regression models, the purposes that this paper tries to complete are as follows.

First of all, according to Huang and Cheng (2005), this paper uses the revenue autonomy to measure the degree of fiscal decentralization of provincial governments in China. Second, this paper adopts the Data Envelopment Analysis (DEA, hereafter), which is an approach of non parametric mathematical programming technique for estimating efficiency, to estimate the efficiency of provincial governments' social security. Since the realization of social welfare was promoted last ten years, this paper adopts the official data of 31 provinces/cities during the 2000-2009 period. This paper uses the panel data from the *China Statistical Yearbooks* and the *Finance Yearbooks of China* to compress analysis and expects to understand the efficiency of social security in China. Finally, by establishing some empirical regression models, this paper expects to completely examine how fiscal decentralization influences the efficiency of social security. Meanwhile, this paper illustrates other factors that also affect the efficiency of social security. Moreover, this paper considers the time-specific effect and the regional-specific effect in order to investigate the change each year and observe the provincial characteristics.

This paper is not only an international academic discussion and practical

application, but also offers Taiwanese government and businessmen primary information about the efficiency of social security in China. The empirical analysis results can be references when other countries draw up relevant policy. Also, Taiwanese authorities can understand the situation of China more when they have interaction with Chinese authorities in economy or public finance.

1.3 Research Framework and Process

The primary issue of this study is how the degree of fiscal decentralization affects the efficiency of social security in China provincial governments after the realization of social welfare was promoted in 2000. Hence, after discussing the research background, purpose, and structure, this study generalizes the fiscal decentralization theory and the determinants of social security with the DEA approach. In addition, this study summarizes those literatures and introduces an estimation of social security with the DEA approach. Moreover, this study interprets the relationship between fiscal decentralization and social welfare in China.

After analyzing the literatures, this study introduces fiscal decentralization system and the circumstance of social security in China. Then, this study calculates degrees of fiscal decentralization of 31 provinces/cities from 2000 to 2008 and efficiency scores of social security from 2001 to 2009 with the DEA approach. Subsequently, this study constructs some specifications of the Tobit model to examine the role of fiscal decentralization playing in the efficiency of provincial government's social security in China.

Thus, this study collects research data and constructs some empirical models in terms of previous literature. This study uses a regressive approach and attempt to explain the estimated result in order to understand the role of fiscal decentralization playing in the efficiency of social security. Furthermore, this study uses the regional-specific and time-specific effects to illustrate whether the efficiency of social security is influenced by time and regional characteristics.

Last but not least, this study uses the conclusion to provide several policy implications. Hence, this offers Taiwanese authorities a reference to better evaluate

their interaction with China. Besides, Chinese authorities and other countries could draw up policies in terms of the conclusions. The following are the research framework.

This study is divided into six chapters. Chapter1 is the introduction of this study, and it is divided into three sections, which are research background, research purpose, and research framework and process. Then, Chapter 2 is literature review, and it is divided into three sections, which are fiscal decentralization theory, the influence of fiscal decentralization on social welfare, and the determinants of social security with the DEA approach. Subsequently, Chapter 3 is fiscal decentralization and social security in China, and it is also divided into three sections, which are the process of fiscal reform in China, the degree of fiscal decentralization, and the circumstance of social security. Chapter 4 is methodology and variables. It introduces the method and the meaning of variables that this study uses. It is separated into three sections, which are data envelopment analysis, Tobit model, and data and variables. Chapter 5 illustrates empirical results of this study, which is divided into the efficiency score of social security, determinants of the efficiency of social security, and the regional-specific and time-specific effects. Finally, Chapter 6 is separated into two sections, concluding remarks and policy implications. The research steps are illustrated in Figure 2.

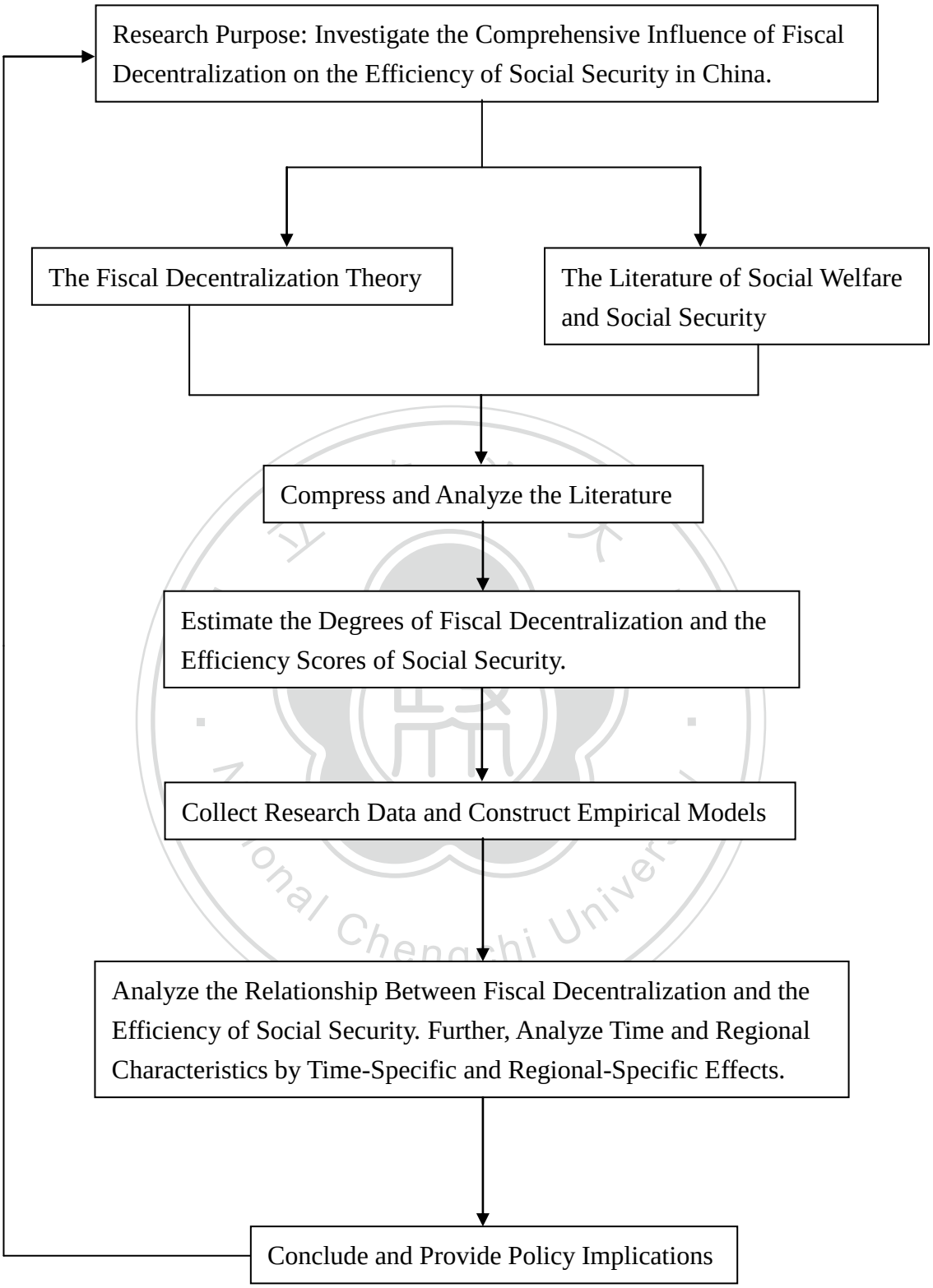

Figure 2: Research Framework

CHAPTER 2. LITERATURE REVIEW

As mentioned before, the purpose of this study is to investigate how the degree of fiscal decentralization influences the efficiency of social security in China's provincial governments. Hence, this chapter is separated into three parts. First of all, this study discusses the fiscal decentralization theory. Second, this study compresses the relevant literatures that illustrated the influence of fiscal decentralization on social welfare. Third, this study refers to the determinants of social security with the DEA approach.

2.1 Fiscal Decentralization Theory

If this study attempt to investigate the impact of fiscal decentralization on the efficiency of social security, it is necessary to briefly examine the fiscal decentralization theory. The fiscal decentralization theory is the foundation for the empirical analysis. Rational allocation among governments is the important issue of national politics and economic development. Basically, the adjustment of every fiscal relationship among governments is in centralization and decentralization. The history of fiscal decentralization has been highly developed for a long time, for example, the federal system of United States is the typical fiscal decentralization system. Since 1990, the world has flourished waves of fiscal decentralization, such as the implementation of TSS in China and the reform of fiscal decentralization in South America. In the earlier economic theory, the central government can provide public goods for residents to satisfy their demands and accomplish welfare maximum of the whole society. Multiple governments would not exist in countries under this framework. However, in reality, local governments have functions that the central government hard to possess. The theory of fiscal decentralization is the rational and

necessary explanation to the existence of local governments.

Initially, Hayek (1945) indicated that the local government is more effective than the central government in drawing up public policy because the local government can spend less cost to collect more information about local residents. This allows the local government to provide public goods and services that better match local preferences than the central government.

Based on Samuelson (1954), Tiebout (1956) addressed that fiscal decentralization leads to greater variety in the provision of public goods, which are modified to better suit local residents. Here is his conclusion under seven assumptions: "If citizens are faced with an array of communities that offer different types or levels of public goods and services, then each citizen will choose the community that best satisfies his or her own particular demands. In equilibrium, no individual can be made better off by moving, and the market is efficient. It does not require a political solution to provide the optimal level of public goods."[5] Individuals effectively reveal their preferences by "voting with their feet", which means that people could choose a local government that satisfies the local residents' preferences of public services and tax ratio by moving between areas.[6]

Subsequently, Stigler (1957) interpreted that the rationality of the local government existence could improve the resource allocation to achieve an efficient

[5] The seven assumptions are as follows: 1. Citizens are fully mobile, and will move to that community where their preference patterns, which are set, are best satisfied. 2. Citizens are assumed to have full knowledge of differences among revenue and expenditure patterns and to react to those differences. 3. There are a large number of communities in which the citizens may choose to live. 4. Restrictions due to employment opportunities are not considered. It may be assumed that all people are living on dividend income. 5. The public services supplied exhibit no external economies or diseconomies between communities. 6. For every pattern of community services set by, say, a city manager who follows the preferences of the older residents of the community, there is an optimal community size. 7. Communities below the optimum size seek to attract new residents to lower average costs. Those above optimum size do just the opposite. Those at an optimum try to keep their populations constant.

[6] If the local governments provide high quality and quantity public goods or services and impose a high tax ratio, local residents who need basic public goods or services will move to another area.

level. He used two principles to interpret the rationality, which are as follows. First, local governments are closer to their residents than the central government. Second, the residents have a right to choose by voting different kinds and quantities of public services. However, they did not consider what kind of public goods should be provided by the local or central governments.

Musgrave (1959) complemented this concept. He pointed out that different kinds of public goods should be provided by different levels of government. In other words, the central government should provide national public goods, such as national defense. He built a theory of fiscal federalism, stressing among other things the appropriate assignment of taxes and expenditures to the various levels of government to improve welfare. This solves the problems which are the supply of public goods and the finance of public expenditure. In addition, he thought the local government is efficient to treat regional public service.

Then, based on Tiebout (1956), Oates (1972) used a model of fiscal decentralization to prove that the local governments are more efficient than the central government and achieves the Pareto efficiency. From this moment on, the fiscal decentralization theory has a model basis. He suggested that local governments are better positioned than the central government to deliver public services and match local preferences and needs. In addition, Oates (1993) addressed that fiscal decentralization increases economic efficiency.[7]

The recent development in fiscal decentralization theory is mixed with the

[7] As mentioned in Oates (1993), "The basic economic case for fiscal decentralization is the enhancement of economic efficiency: the provision of local outputs that are differentiated according to local tastes and circumstances result in higher levels of social welfare than centrally determined and more uniform levels of outputs across all jurisdictions. There surely are strong reasons, in principle, to believe that policies formulated for the provision of infrastructure and even human capital that are sensitive to regional or local conditions are likely to be more effective in encouraging economic development than centrally determined policies that ignore these geographical differences."

concepts of more aspects and more mature. Tresch (1981) based on the economics of information to reinforce the fiscal decentralization theory. He pointed out that preferences of residents would be misunderstood to verify the importance of fiscal decentralization. Assume that the information in a country is symmetric and complete, then, whether public goods is provided by the central government or local governments is the same. However, in reality, there is some asymmetric information in social economic activities. Hence, in this condition, the central government would provide too much or less public goods. Generally, local governments have more information than the central government so that they understand the preferences of residents more. He further concluded that a risk-averse society tends to let local governments provide public goods.

In addition, Brennan and Buchanan (1980), who are the representatives of the Public Choice School, indicated that fiscal decentralization not only lets the power of the central government be effectively subjected to local governments, but also accelerates fiscal competitions among local governments to avoid abusing power in local governments. Therefore, even the fiscal power is divided between the central government and local governments, though the efficiency of resource allocation is not improved, fiscal decentralization between the central government and local governments still could exist. Since fiscal autonomy can be the balanced function among governments as a mechanism. However, this comment is under the assumption that the gain of fiscal decentralization is larger than the efficiency loss.

On the other hand, many fiscal analysts are worried about “the dangers of fiscal decentralization”. Musgrave (1959) and Oates (1972) suggested that inappropriate fiscal decentralization may induce a range of allocated distortions, regional inequality,

and fiscal instability. As mentioned by Bird and Vaillancourt (1998),[8] if people's preferences are unlikely to be reflected in budget outcomes and the institutional capacity of existing sub-national (state and local) governments is close to nil,[9] fiscal decentralization seems likely to result in increased costs, lessened efficiency in service delivery, and probably enlarges greater inequity and macroeconomic instability. Prud'Homme (1994) raised the experience of Tunisia, where the centralization of sewage services is proved to be more effective than delegating the provision of such services to local governments.

Besides, Prud'Homme (1995) stated that fiscal decentralization may lead to a welfare loss, due to lack of economies of scale that sometimes exists at the central government, and the provision for most local public goods and services in a given city is independent of the provision in other cities, thereby implying minimal welfare losses under fiscal decentralization. It may be further argued that corruption and inadequate capacities are likely to be more appeared at local governments rather than at the central government (Prud'Homme, 1995; Tanzi, 1996).[10] Moreover, Prud'Homme (1995) cited Brazil as an example of fiscal decentralization leading to macroeconomic instability.[11]

Today, the arguments about fiscal decentralization theory still exist. How to

[8] However, Bird and Vaillancourt (1998) also indicated that fiscal decentralization can help local development, strengthen the responsibility of local governments and residents, accelerate the efficiency of local expenditures, and prosper local economy.

[9] For example, with local politicians and bureaucrats likely to face increased pressure from local interest groups, then fiscal decentralization, under these or similar state of affairs, might undermine government efficiency.

[10] Prud'Homme (1995) and Tanzi (1996) argued that there are many imperfections in the local provision of services that may prevent the realization of benefits from fiscal decentralization. For example, local bureaucrats may be poorly trained and thus inefficient in delivering public goods and services.

[11] Fiscal decentralization leads to difficulty managing macroeconomic policy in Brazil due to the Centre's decreased role in tax revenue-raising, and increasing each state's discretion on tax rates. Therefore, based on arguments made by Prud'Homme (1995), the poor macroeconomic performance of Brazil in the 1990s is to be blamed on these fiscal decentralization measures.

divide the fiscal relationship between the central government and local governments as to reach the ideal fiscal system relies on more theories and practices. Because of different circumstances among countries, these theories could not apply to all. However, the understanding of these fiscal decentralization theories can make us know more about their advantages and disadvantages. Also, this can provide valuable and theoretical references about the fiscal relationship between the central government and local governments and the following survey.

2.2 The Influence of Fiscal Decentralization on Social Welfare

After the introduction of the fiscal decentralization theory, this paper turns into the relationship between fiscal decentralization and social welfare. From the relevant studies about fiscal decentralization, most results showed that fiscal decentralization and competitions among local governments can increase the expenditures of social welfare, such as educational and hygienic expenditures.

Bardhan (2002) thought that the decentralization of fiscal power raises the social welfare level under the federal system. Comparing to the central government, local governments have more information about the preferences of local residents and the costs of providing public goods. He also mentioned that the logic behind fiscal decentralization is not just about weakening the central authority, nor is it about preferring local elites to central authority, but it is fundamentally about making governance at the local level more responsive to the felt needs of the large majority of the population.

Martinez-Vazquez et al. (2005) used the unbalanced panel data of 45 developed and developing countries from 1972 to 2000. They measured degrees of fiscal decentralization by proportions of local governments' expenditures to the central government's expenditures and measured proportions of educational and health expenditures to total public expenditures as the dependent variables. Then, they adopted five different econometric models to illustrate the relationship between fiscal decentralization and social welfare. They found strong evidence that fiscal decentralization increases the proportion of educational and health expenditures to total public expenditures. In addition, this phenomenon is more obvious in developing countries than in developed countries.

In addition, Busemeyer (2008) used cross-section data and time-series data of OECD countries from 1980 to 2001 to survey the influence of fiscal decentralization on the public expenditures of education, pension and social welfare. He stated that public expenditures can be divided into two parts, which are national level and regional level, respectively. For example, the expenditures of education are regionally provisioned policies, and the expenditures of refund are nationally provisioned policies. As degrees of fiscal decentralization change, this has different effects on these two levels. The empirical results showed that fiscal decentralization has a positive effect on the expenditures of education and a negative effect on the expenditures of pension. Thus, he concluded that citizens in systems with an extensive provision of local policies are more willing to delegate more fiscal power to the lower levels of government.

However, some scholars have had contrary considerations. Under fiscal decentralization system, the competitions among governments probably increase the loss of total social welfare because of asymmetric information and the lack of economies of scale.

West and Wong (1995) addressed that the public expenditures in hygiene and education reduced are resulted from fiscal decentralization in China. Especially in some rural areas, the social welfare of local residents aggravates more obviously. They provided evidence in terms of the disparities between Shandong and Guizhou in the basic services provided by local governments and used it to confirm the view that fiscal decentralization results in very large and growing interregional inequalities in China. Regional disparities in the provision of these services not only directly affect the welfare and living standard of the populace, but also lower investment in human resources in the poor provinces, such as Guizhou.

Li and Zhou (2005) provided empirical evidence on the incentive role of personnel control in post-reform China. They used the turnover data of top provincial leaders in China from 1979 to 1995 and found that the likelihood of provincial leaders' promotion increases with their economic performance, while the likelihood of termination decreases with their economic performance. This finding also supported the view that the Chinese central government uses personnel control to motivate local officials to promote local economic growth. They also found that the turnover of provincial leaders is more sensitive to their tenure-averaged performance than to their annual performance. This showed that after the reform of fiscal decentralization, officials sought for good performance in economic growth which may lead to the underinvestment in social welfare.[12]

The above-mentioned literatures are relevant to fiscal decentralization and social welfare and are arranged in Table 1. Concerning social welfare, these literatures mostly use the measurement of public expenditures, such as educational, hygienic, and health expenditures. This study extends the concept of social welfare to the efficiency of social welfare. After all, whether fiscal decentralization increases or decreases the public expenditures of social welfare, residents still want to explore the efficiency of social welfare. This study focuses on the efficiency of social security in China and adopts the DEA approach to measure.

[12] Li and Zhou (2005) stated that different types of public expenditures have different impacts on regional economy. The investment of basic infrastructure can directly accelerate economy and appeal to capital, but the investment of social welfare, such as education, does not have obvious and short-run economic improvement.

Table 1: Literatures About the Relationship Between Fiscal Decentralization and Social Welfare

Author	Sample Period	Methodology	Conclusions
West and Wong (1995)	1982-1993 China	Ordinary Least Square	The public expenditures in hygiene and education reduced are resulted from fiscal decentralization in China.
Bardhan (2002)	1990-2000 China	Empirical Literature Review	The decentralization of fiscal power raises the social welfare level under the federal system.
Martinez-Vazquez et al. (2005)	1972-2001 45 countries	Ordinary Least Square, Fixed Effect, and Random Effect	Fiscal decentralization increases the proportion of educational and health expenditures to total public expenditures.
Li and Zhou (2005)	1979-1995 China	Maximum Likelihood Estimation with Ordered Probit Model	After the reform of fiscal decentralization, officials sought for good performance by economic growth and resulted in the investment of social welfare was overlooked.
Busemeyer (2008)	1980-2001 OECD countries	Ordinary Least Square	Fiscal decentralization has a positive effect on the expenditures of education and a negative effect on the expenditures of pension.

Source: this table is arranged by the author.
Note: the list of the literatures orders according to the publish year.

2.3 The Determinants of Social Security with the DEA Approach

Recently, using the Data Envelopment Analysis (DEA) approach to measure the efficiency of social welfare has been very popular and extensive. The reason why the DEA approach is extensive is that the good characteristics of this approach. It avoids setting problems of models; meanwhile, it could deal with the evaluation of the efficiency based on multiple inputs and multiple outputs. These characteristics conform to the economic efficiency evaluation and let analysis become easier. Therefore, from this trend, the issue of the efficiency of social welfare through the DEA approach is more noteworthy. This study specializes in the efficiency of social security in China after the realization of social welfare was promoted and some relevant policies about social security were implemented in 2000.

Yan and Hu (2009) used panel data of 31 provinces/cities in China from 2003 to 2007 to measure the efficiency of public services of social security. They chose pensions for the disabled or for the families of the bereaved and relief funds for social welfare per capita, expenditures on retirees per capita, and expenses on subsidies to social security system per capita as inputs, and chose the coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance, and the coverage rate of urban basic medical care insurance as outputs. The empirical result showed that though fiscal expenditures in social security increase every year, the operating efficiency of social security funds is not improved yet.

Wang and Qian (2009) researched the data of 30 provinces/cities in China in 2006.[13] They measured the efficiency of fiscal social security expenditures by using the ratio of pensions for the disabled or for the families of the bereaved and relief funds for social welfare to public expenditures, the ratio of expenditures on retirees to

[13] Expect Tibet.

public expenditures, the ratio of expenses on subsidies to social security system to public expenditures, and the ratio of earning of employed people in social security and social welfare to public expenditures as inputs, and using the ratio of numbers of convenience stores in urban area by region to national numbers of convenience stores, the ratio of numbers of residents in security in city area to population, and the ratio of numbers of rural residents in relief to population as outputs. They found that the efficiency of fiscal social security expenditures is affected by the regional economic development. Also, the difference of efficiency between provinces is large.

Chen and Li (2010) enlarged the discussed range about the efficiency of social expenditures, including hygiene, education, and social security through a two-stage DEA-Tobit model. They used panel data of 31 provinces/cities in China from 2000 to 2008 and investigated three separate parts of social expenditures by efficiency scores. The inputs and outputs which this literature used are as follows. Inputs are hygienic expenditures per capita, educational expenditures per capita, and social security expenditures per capita. Outputs are divided into three corresponding parts. The numbers of health care institutions per ten-thousand people, the numbers of beds in health care institutions per ten-thousand people, and the numbers of medical technical personnel per ten-thousand people correspond to hygienic expenditures per capita, the net enrollment ratio of primary schools and the percentage of literate population to total aged 15 and over correspond to educational expenditures per capita, and the coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance, and the coverage rate of urban basic medical care insurance correspond to social security expenditures per capita. They not only measured the direct efficiency of social expenditures by DEA approach but also analyzed the indirect factors of social expenditures' efficiency by Tobit model. They found that there are remarkable

differences of social expenditures' efficiency between eastern, central, and western areas, namely, the inequalities in China are still serious. They also stated that the efficiency of social expenditures is positively relates to the citizens' education level, urbanization, and population, while negatively relates to the government's scale, corruption, income inequality, and GDP per capita.

Xu and Zhao (2010) investigated the efficiency of social security expenditure of 27 provinces/cities in 2008.[14] Inputs are the ratio of educational expenditures to public expenditures, the ratio of medical and health care expenditures to public expenditures, and the ratio of expenditures for social security and employment effort to public expenditures. Outputs are the ratio of numbers of rural basic pension insurance contributors to rural population, the ratio of numbers of basic pension insurance contributors to regional population, the numbers of doctors per ten-thousand people, and the numbers of students per ten-thousand people. Their finding is same as Chen and Li (2010). The efficiency is the obvious differences in areas of similar level of China's social expenditures. Generally speaking, the areas of high efficiency in social security expenditure concentrated in the developed regions.

[14] Tianjin, Hunan, Tibet, and Qinghai are excluded.

Table 2: Literatures About the Determinants of Social Security with the DEA Approach

Author	Sample	Inputs	Outputs
Yan and Hu (2009)	2003-2007 31 provinces in China	1. Pensions for the disabled or for the families of the bereaved and relief funds for social welfare per capita 2. Expenditures on retirees per capita 3. Expenses on subsidies to social security system per capita	1. The coverage rate of urban basic pension insurance 2. The coverage rate of unemployment insurance 3. The coverage rate of urban basic medical care insurance
Wang and Qian (2009)	2006 30 provinces in China	1. The ratio of pensions for the disabled or for the families of the bereaved and relief funds for social welfare to public expenditures 2. The ratio of expenditures on retirees to public expenditures 3. The ratio of expenses on subsidies to social security system to public expenditures 4. The ratio of earning of employed people in social security and social welfare to public expenditures	1. The ratio of numbers of convenience stores in urban area by region to national numbers of convenience stores 2. The ratio of numbers of residents in security in city area to population 3. The ratio of numbers of rural residents in relief to population

Table 2: Literatures About the Determinants of Social Security with the DEA Approach (Continued)

Chen and Li (2010)	2000-2008 31 provinces in China	1. Hygienic expenditures per capita 2. Educational expenditures per capita 3. Social security expenditures per capita	1. The numbers of health care institutions per ten-thousand people, the numbers of beds in health care institutions per ten-thousand people and the numbers of medical technical personnel per ten-thousand people 2. The net enrollment ratio of primary schools and the percentage of literate population to total aged 15 and over 3. The coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance and the coverage rate of urban basic medical care insurance
Xu and Zhao (2010)	2008 27 provinces in China	1. The ratio of educational expenditures to public expenditures 2. The ratio of medical and health care expenditures to public expenditures 3. The ratio of expenditures for social security and employment effort to public expenditures	1. The ratio of numbers of rural basic pension insurance contributors to rural population 2. The ratio of numbers of basic pension insurance contributors to regional population 3. The numbers of doctors per ten-thousand people 4. The numbers of students per ten-thousand people

Source: this table is arranged by the author.
Note: the list of the literatures orders according to the publish year.

CHAPTER 3. FISCAL DECENTRALIZATION AND SOCIAL SECURITY IN CHINA

In this chapter, several reforms of fiscal system between the central and provincial governments are illustrated, especially the TSS implemented after 1994. Then, a measurement of fiscal decentralization is defined and calculated. This study uses this measurement to compress and analyze the degrees of fiscal decentralization in China and lets them be the primary independent variable. In the last section, the statement and some relevant policies of social security are introduced.

3.1 The Process of Fiscal Reform in China

According to fiscal system, this study divided the process of fiscal reform in China into three stages as follows. The first stage is before the 1978 period, the implementation of "conventional fiscal system", which is the revenue remittance and redistributed to provincial governments by the central government. The second stage is during the 1979-1993 period, the implementation of "fiscal contracting systems". The third stage is after the 1994 period, the implementation of "tax sharing system". The following are the details of these reforms by order.

3.1.1 Before the 1978 Period

In the early 1950s, the Soviet model of central planning shaped the relationships between the central and provincial governments in China. The central authority exercised direct administrative control over provincial governments through three central planning mechanisms, which were the physical planning of production, centralized allocation of materials, and budgetary control of revenues and expenditures.[15] Although concentration of power at the central government moved to

[15] According to Feltenstein and Iwata (2005).

decentralization in 1958, recentralization began in the early 1960s. Later a new movement of decentralization started in 1971. However, because of the economic destroy during the Cultural Revolution period, this decentralization reform still failed. As a matter of fact, before 1979, China's budgetary policy essentially consisted in generalized tax collection and profit remittances controlled by the central government and then redistributed as needed to the provincial governments. This fiscal system was so-called the system of "eating from one pot" (chi da guo fan). This system was based on the "conventional fiscal system", which was a central planning system. The main characteristic was that all fiscal policies were based on the national programs. Thus, the intervention of the central government was more serious to provincial governments. This resulted in an equal fiscal capacity among provinces, but provincial governments had no incentives and low efficiency to develop their local economies due to lacking enough fiscal autonomy.

3.1.2 During the 1979-1993 Period

There were three primary reasons that China started to proceed the fiscal reform under market mechanism. First of all, more and more non-national operated enterprises grew up rapidly, such as town and township enterprises, joint enterprises, and private operated enterprises. Also, there were more and more national operated enterprises which undertaken a great loss and resulted in the large national fiscal burden. Second, the economic reform enlarged the powers of provincial governments and made provincial governments submit requests of fiscal decisions. Third, economic benefits affected the decisions of governments and promoted provincial governments to increase fiscal revenues and develop their local economies. Therefore, the fiscal change of centralization into decentralization was urgency.[16]

[16] According to Lin and Liu (2000).

Staring from 1979, China virtually began its fiscal decentralization reform, involving changes concerning how revenue is divided among the central and provincial governments through a major institutional innovation called the "fiscal contracting system (FCS, hereafter)" (cai zheng fen bao zhi), introduced between 1979 and 1993. From then on, the central and provincial governments each began to "eat in separate kitchens" (fen zao chi fan). In 1985, Chinese authority implemented the system of dividing the tax categories, appraising and ratifying the revenues and expenditures, and grading contracts. Furthermore, the FCS gradually formed into six contracting categories by 1988.[17] During the period, the FCS gave the sub-national governments more and more powers to finance their needs, encouraged them to develop a regional economy and collect revenues, and gradually built up their accountability.

However, disadvantages of the FCS were mainly: (1) the fiscal contracting system caused the central revenues regressed,[18] and (2) the different contracting methods were too complicated and unjust, widening the fiscal gap between different provinces.[19]

3.1.3 After the 1994 Period

In 1994, China experienced another fiscal decentralization reform, called the "tax sharing system (TSS, hereafter)" (fen shui zhi). It fundamentally changed the way revenues were shared among the central and provincial governments. The TSS asserted that the income item that was relatively easy to identify belonged to either the

[17] The six categories were as follows: incremental contracting, basic proportional sharing, proportional sharing and incremental sharing, remittance incremental contracting, fixed remittance, and fixed subsidy.

[18] The central government was trapped by the fiscal contracting system, leading to the ratio of central governmental revenues to total revenues continually declining. According to statistics, the percentage of central governmental revenues to total revenues fell from 38.4% in 1985 to 22% in 1992.

[19] The rich provinces with more bargaining power (such as Guangdong) benefited more than others from a favourable contracting system. In addition, under the fiscal contracting system, the central government always fell into an inefficient track bargaining with sub-national governments.

central or provincial governments. In fact, the system of fiscal decentralization was based on the jurisdiction that gave the corresponding government the right to impose tax. The major goal of the TSS implemented in 1994 was to construct a new fiscal system between the central and provincial governments by demarcating the different tax categories. As pointed out by Qiao et al. (2002), the key measures in the TSS included the introduction of a value-added tax (VAT, hereafter) as the major revenue source and the setting up of uniform tax-sharing rates for major taxes, including VAT. The uniform tax-sharing rates replaced the previous fixed-amount remittance scheme adopted in the FCS.

Under this new system, the central and provincial governments each had clearly assigned their "own revenues", and all transfers become more transparent and objective by a rule-based method, rather than a negotiated percentage as before (Wang, 1997). Therefore, each provincial government now had a greater responsibility for its provincial fiscal balance. Also, the tax structure was greatly simplified.[20] In addition, this reform achieved some notable successes: improving the "two ratios", which are the ratio of tax revenues to GDP and the ratio of the central governmental revenues to the total governmental revenues. This result simplified the intergovernmental finance system and tightened fiscal control.[21] Since the TSS replaced the previous six categories taxes of fiscal contracting system, which makes the fiscal system much easier. Meanwhile, the practical measure is that provincial governments must have an adequate level of revenues which are either raised by

[20] The value-added tax replaced the turnover-based product tax, and has been implemented basically at a uniform rate of 17 per cent. The corporate income tax was unified to include all domestic enterprises, and the top rate has been reduced from 55 per cent to 33 per cent. Consumption taxes on tobacco, liquor, and other luxuries were introduced. The previous system of profit and tax contracts, under which SOEs negotiated annual transfers to the government budget, was largely eliminated (Ahmad et al., 2002; Wong 2000).

[21] The establishment of National Tax Services (NTSs) in 1994 and 1995 offered a better control over general tax collection and local tax exemption policies. The interference of local authorities in tax administration and collection of central and shared revenues was substantially restrained.

provincial governments or transferred from the central government and are deducted by payments from province to central. In addition, the details of the TSS policy are illustrated in Table 3.

Table 3: The Contents of China Tax Sharing System Reform in 1994

Process	Contents
Dividing the jurisdictions and expenditures between the central and provincial governments	1. The central government is in charge of national security, diplomacy, the necessary expenses of central organizations' operations and the expenses of adjustments in economic structure, regional development, and macroscopic control. 2. Provincial governments are in charge of the necessary expenses of provincial organizations' operations and the expenses of development in economy and society.
Dividing the revenues between the central and provincial governments	1. All taxes are divided into three kinds of taxes, which are the central tax, the shared tax between the central and provincial governments, and the local tax, respectively. 2. Establishing two kinds of tax institutions which are the central and local tax institutions. The central tax institution levies the central tax and the shared tax between the central and provincial governments. The local tax institution levies the local tax institution.
Establishing the fiscal transferring system between governments	1. The payment, transfer, and subsidy are remained from the previous system. 2. Because of the range and amount expansions of the central fixed fiscal revenue, the central government established the fiscal transferring system from the central government to provincial governments.
Establishing the plan of budgets and the arrangement of funds	1. After the implementation of TSS, the central government and provincial governments plan budgets according to the new tax rates. 2. Let the payments of provincial governments subtract from the transfers of the central government. Assign a rate of arrangement of funds, which is the proportion of the net amount to the expected revenue of the central consumption tax and the value added tax in the current year. According to this rate, the central

Table 3: The Contents of China Tax Sharing System Reform in 1994 (Continued)

	government distributes the central consumption tax and the value added tax to provincial governments.

Source: Cheng (2005).

3.2 The Degree of Fiscal Decentralization

According to the introduction of China's fiscal system in section 3.1, it is found that fiscal decentralization might be an important factor to affect the efficiency of social security, particularly in China, since fiscal resources are the fundaments which the implementations of provincial policy depend on. This study adopts the degree of revenue autonomy to measure the degree of fiscal decentralization based upon the existing literature.[22] Therefore, two variables *FDA* and *FDB* are used to measure the degree of fiscal decentralization and are added into the empirical models to confirm the consistency of empirical results. These two variables are specified as follows.

$$FDA_{i,t} = (RR_{i,t} - SUBMIT_{i,t}) / RE_{i,t} \quad (3.1)$$

$$FDB_{i,t} = (RR_{i,t} - SUBMIT_{i,t}) / (RR_{i,t} - SUBMIT_{i,t} + TRANS_{i,t}) \quad (3.2)$$

In equations (3.1) and (3.2), $FDA_{i,t}$ denotes region *i*'s ratio of retained revenue to total expenditure in period *t*, $FDB_{i,t}$ represents region *i*'s ratio of retained revenue to total revenue in period *t*. In addition, $RR_{i,t}$ represents region *i*'s revenue in period *t*, $SUBMIT_{i,t}$ is the amount region *i* should submit to the central government in period *t*, $RE_{i,t}$ is region *i*'s total expenditure in period *t*, and $TRANS_{i,t}$ is the transfer from the central government to region *i* in period *t*, where *i*=1, 2, . . ., 31; *t*=2000, 2001, . . ., 2008. The higher the value is of *FDA* or *FDB*, the higher the degree would be of fiscal decentralization.

The figures of *FDA* and *FDB* for China's 31 provinces/cities from 2000 to 2008 have been calculated in this study and selected years of *FDA* and *FDB* values for all 31 regions in China are presented in Table 4. In general, the *FDB* values are larger

[22] This study refers the degrees of fiscal decentralization to Zhang and Zou (1998), Ma (2000), and Lin and Liu (2000).

than the *FDA* values. According to Table 4, it is shown that the disparity of fiscal decentralization among regions has been enlarged. The difference between the maximum and minimum value of *FDA* in 2008 is higher than its counterpart in 2000. The former is 73.18%, but the latter is 58.80%. This conclusion is also true while using *FDB* as an indicator for fiscal decentralization. The differences between the maximum and minimum value of *FDB* in 2008 and 2000 are 79.89% and 71.83%, respectively. The differences between the maximum and minimum value of *FDA* and *FDB* increase over time.

Regarding *FDA* in these three years, the top five provinces with higher *FDA* in 2000 were Guangdong, Shandong, Beijing, Fujian, and Zhejiang by order. In 2005, Beijing, Shanghai, Jiangsu, Guangdong, and Shandong were the top five provinces. However, in 2005, two of the top five provinces replaced Fujian and Zhejiang with Shanghai and Jiangsu. In addition, the top five provinces in 2008 were Beijing, Shanghai, Jiangsu, Guangdong, and Zhejiang. In 2008, Zhejiang replaced Shandong as the fifth top province again. The region with the lowest *FDA* was Tibet in these three years. Provinces with lower *FDA* mostly belong to the western area, such as Gansu, Qinghai, and Ningxia. In detail, Chongqing was the fifth bottom province in 2000, but, Guizhou replaced Chongqing as the fifth bottom province in 2008. Chongqing increased its fiscal autonomy with a rapid speed, from 29.36% to 42.56%.

Furthermore, the degrees of revenue autonomy have increased during this period in 14 provinces, but decreased in 17 provinces. The top five provinces with higher increase of *FDA* during this period were Shanghai, Jiangsu, Beijing, Tianjin, and Liaoning, accordingly. However, the bottom five provinces with higher decrease of *FDA* during this period were Sichuan, Hainan, Guangxi, Hubei, and Xinjiang, accordingly.

Using *FDB* as the indicator to represent fiscal decentralization instead, the top five provinces with higher *FDB* in 2000 were Guangdong, Beijing, Fujian, Shandong, and Zhejiang by order. In 2005, Beijing, Shanghai, Guangdong, Zhejiang, and Jiangsu were one of the top five provinces. However, in 2005, two of the top five provinces replaced Fujian and Shandong with Shanghai and Jiangsu. In addition, the top five provinces in 2008 mostly remained the same as in 2005. Noteworthily, Zhejiang and Jiangsu had the same degree of fiscal decentralization, and Tianjin was the first time to be one of the top five provinces. The region with the lowest *FDB* was still Tibet in these three years. Provinces with lower *FDB* mostly belong to the western area, just like the provinces with lower *FDA*.

Furthermore, the degrees of revenue autonomy have increased during this period in 12 provinces, but decreased in 19 provinces. The top five provinces with higher increase of *FDB* during this period were Shanghai, Tianjin, Jiangsu, Zhejiang, and Chongqing accordingly. However, the bottom five provinces with higher decrease of *FDB* during this period were Hainan, Sichuan, Guangxi, Hubei, and Henan, accordingly.

Based upon the above analysis, it is evident that regions with higher degrees of fiscal decentralization are located in the eastern area, while regions in the western area are more likely to have lower degrees of fiscal decentralization.

Table 4: FD-value and Difference among Regions in Selected Year (%)

Regions	FDA			FDB			Difference[1]	
	2000	2005	2008	2000	2005	2008	FDA	FDB
Beijing	56.92 (3)	73.44 (1)	78.36 (1)	72.88 (2)	81.58 (1)	86.33 (1)	★21.44	13.45
Tianjin	40.86	54.78	61.36	55.03	65.17	73.26 (5)	★20.50	★18.23
Hebei	43.71	43.40	43.75	55.01	50.26	49.09	0.04	-5.92
Shanxi	39.10	46.74	46.59	48.12	52.78	54.39	7.49	6.27
Inner Mongolia	31.61	35.12	38.94	36.68	40.06	45.24	7.33	8.56
Liaoning	34.11	41.86	51.94	45.84	53.76	59.80	★17.83	13.96
Jilin	31.64	27.39	31.09	38.57	32.85	35.69	-0.55	-2.88
Heilongjiang	35.90	32.25	31.61	45.05	37.27	36.24	-4.29	-8.81
Shanghai	46.63	68.85 (2)	73.77 (2)	59.90	78.47 (2)	84.14 (2)	★27.14	★24.24
Jiangsu	46.37	60.95 (3)	68.04 (3)	62.47	75.27 (5)	80.11 (4)	★21.68	★17.64
Zhejiang	47.35 (5)	58.93	61.88 (5)	64.51 (5)	76.41 (4)	80.11 (4)	14.53	★15.60
Anhui	40.52	38.60	39.88	50.79	44.44	43.72	-0.64	-7.07
Fujian	54.64 (4)	57.96	58.05	71.00 (3)	69.37	69.08	3.41	-1.92
Jiangxi	34.46	32.99	31.57	48.01	42.74	39.24	-2.89	-8.77
Shandong	57.59 (2)	59.82 (5)	61.20	69.42 (4)	69.08	69.44	3.61	0.02
Henan	42.67	41.61	39.73	52.48	45.89	42.80	-2.94	-9.68
Hubei	40.02	35.78	33.69	49.81	42.42	39.97	-6.33	-9.84
Hunan	38.18	36.72	33.71	45.75	42.73	39.42	-4.47	-6.33
Guangdong	65.48 (1)	60.54 (4)	65.60 (4)	79.22 (1)	78.20 (3)	82.56 (3)	0.12	3.34
Guangxi	43.99	38.49	33.97	53.75	43.70	39.38	-10.02	-14.37
Hainan	44.56	36.54	34.39	57.09	43.64	39.82	-10.17	-17.27
Chongqing	29.36	39.09	42.56	36.67	47.07	51.96	13.19	★15.29
Sichuan	44.67	39.44	31.87	50.02	43.76	34.68	-12.80	-15.34
Guizhou	34.73	32.17	29.40	40.00	35.14	32.29	-5.32	-7.71
Yunnan	38.18	37.26	37.85	42.89	41.11	41.76	-0.34	-1.13
Tibet	6.69	5.19	5.18	7.39	5.80	6.44	-1.50	-0.95
Shaanxi	34.17	34.93	36.20	39.85	41.10	41.74	2.03	1.89
Gansu	28.95	25.62	24.33	32.28	28.29	26.26	-4.62	-6.02
Qinghai	19.80	15.26	15.87	22.60	17.97	18.60	-3.92	-4.00
Ningxia	21.52	21.91	21.47	28.91	27.75	27.98	-0.06	-0.93
Xinjiang	37.93	32.88	31.62	39.27	34.26	34.34	-6.31	-4.93
Average	39.11	40.86	41.79	48.43	48.01	48.58	2.68	0.15
Difference[2]	58.80	68.25	73.18	71.83	75.78	79.89		

Source: Various years of the *China Statistical Yearbook* and the *Finance Yearbook of China*.

Notes: 1. The difference between the value of *FD* in 2008 and 2000 in the same region.

2. The difference between the maximum and minimum value of *FD* in each year.

3. Numbers, shadows, and ★ in parentheses represent rankings, bottom five provinces with lower degrees, and higher decreases of fiscal decentralization and top five provinces with higher increases of fiscal decentralization.

3.3 The Circumstance of Social Security

This section introduces the present circumstance and some relevant policies of social security in China. At the beginning, the social security systems in China just included the assistances of natural calamities and residents' living difficulty in rural areas. These social security systems were mostly temporary and loose measures of assistance. From 21 century, because the reform of economic system turned into market economy precisely and the economic globalization as well as Asian financial turmoil of 1997 affected, they resulted in a lot of economic conflicts and social contradictions in China's urban and rural regions. The problems of unemployment, high inflation, and enlargement of poverty gap promoted and encouraged the larger reform of social security systems during last ten years.

Therefore, in order to examine the implemented policies of social security in provincial governments as the remedial measures, this study would like to investigate the efficiency of social security in China. First of all, the definition of social security in this study includes urban basic pension insurance, unemployment insurance, and urban basic medical care insurance.[23] The following paragraphs are details about these three social security insurances.

Urban basic pension insurance system includes the urban basic pension insurance of employees in enterprises and officials in governments. In 1999, this system completed a reform, which was from the responsibilities of county and city to the responsibilities of province. Later, in 2000, the State Council of China announced a policy about social security system and addressed the primary goal which was establishing the social security system of independence of enterprises, multiple sources in funds, regulations in security system, and socialization in management

[23] The social security systems this study focuses on are for the residents in the urban area. The people in the rural area, especially peasants, have the other system to maintain their lowest living standards.

service. As the development of urban basic pension insurance system, the covered range of this insurance gradually enlarged from the officials in governments to the employees in every kind of enterprises and even the individual workers. Noteworthily, fiscal funds have to pay for the insurance premiums instead of the officials in governments and the standards of pension are related to the wage levels before retirement.

Unemployment insurance system was established in 1999. The State Council of China announced the "Regulations on Unemployment Insurance", which precisely renamed job-waiting insurance as unemployment insurance and enlarged the covered range to all enterprises. This system was designed to possess two functions, which were ensuring lives and promoting employment. The funds of unemployment insurance were raised by employers, employees, and provincial governments. However, the unemployment insurance still has some restrictions on identities. The covered range still only includes staff and workers, not include peasants.

Urban basic medical care insurance system includes the urban basic medical care insurance of employees and residents. In 1998, the State Council of China announced a precise policy, which assured the basic medical care insurance system of combining social overall plans and individual accounts. The insurance premiums were raised by employers, employees, and provincial governments. The system covered all employees in enterprises and officials in governments. Meanwhile, in order to solve the medical care problems of unemployed people, especially children, teenagers, olds, and handicapped people, the State Council of China announced the urban basic medical care insurance system of residents in 2007. There were three primary goals of this system, which were establishing rational mechanism of funds, completed operations of management system and regulations, and mainly overall plans of urban

residents' basic medical care insurance. The concrete measures of fiscal subsidy were decided by the bureau of labor and social security and the bureau of civil administration in fiscal department, and the subsidy funds were covered in fiscal budgets of provincial governments.

In order to implement these social security policies, according to Figure 3, the expenditures for social security and employment effort in China increase over time. It showed that governments paid attention to social security much more than before. Meanwhile, the expenditures for social security and employment effort are the one kind of this study used variables as inputs with DEA approach. However, this study focuses on the efficiency of provincial government's social security, since the incremental expenditures of social security might not improve its efficiency. According to Acemoglu and Verdier (2000), even the best intervention of governments might appear corruption, and this corruption would result in the serious abuse and wrong distribution of social expenditures. Therefore, in order to increase the level of social welfare and improve the living quality of residents cannot simply depend on the incremental expenditures of social security, but the efficiency of social security. In chapter 4 and 5, this study will show the empirical result of the efficiency of provincial government's social security, using the expenditures for social security and employment effort as a factor of DEA approach.

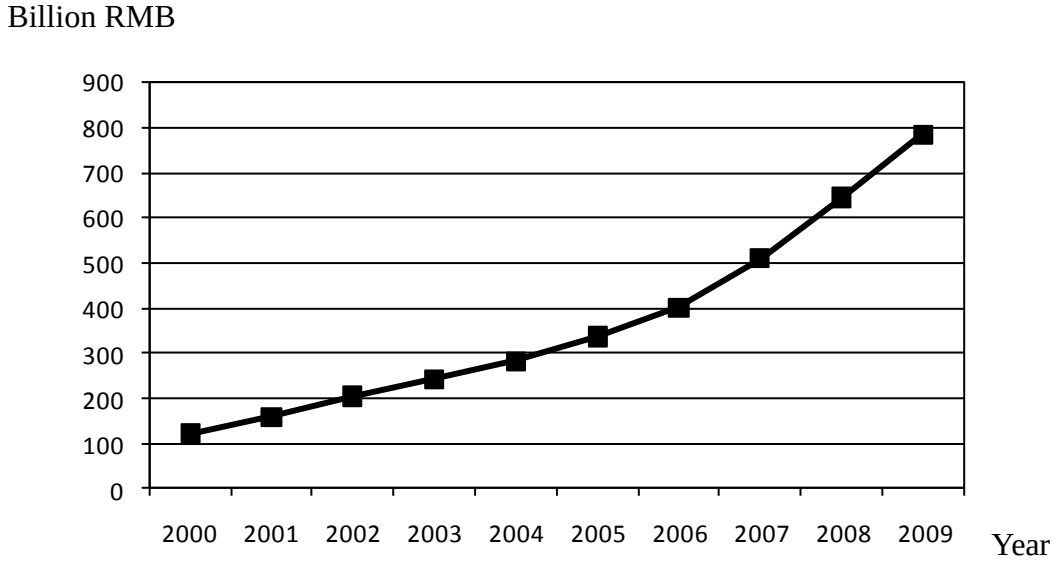

Figure 3: Expenditures for Social Security and Employment Effort in China
Source: Various years of the *China Statistical Yearbook*.

CHAPTER 4. METHODOLOGY AND VARAIBLES

This chapter introduces the methodologies and variables this study uses. This study adopts two methods to estimate and investigate the relationship between the efficiency of social security and fiscal decentralization in China. One is the Data Envelopment Analysis (DEA) approach for measuring the efficiency of social security in China's 31 provinces during 2000 to 2009, and the other one is the econometric method, the Tobit model, for estimating the influence of fiscal decentralization on the efficiency of social security in China during the research period. These two methods are illustrated as follows.

4.1 Data Envelopment Analysis (DEA)

The data envelopment analysis (DEA) approach employs the technique of the envelopment to replace the production function in traditional microeconomics. It is an approach of non parametric mathematical programming technique for estimating efficiency. The DEA approach projects all the inputs and outputs of decision making units (DMU, hereafter) into a space by mathematical programming. Then, the efficiency frontier is reflected by the envelopment, which is based on the maximum outputs or the minimum inputs. The DMU which lies on this efficiency frontier is defined as *efficiency* and represented by a highest efficiency score of one. Conversely, the DMU which does not lie on this frontier is defined as *inefficiency*, and its efficiency score is calculated by its relative distance from this efficiency frontier. Thus, a basic assumption of DEA approach is the concept of "relative efficiency" based on an optimal level of outputs obtained from a given level of inputs, or an optimal level of inputs obtained from a given level of outputs.

This study uses both CCR and BCC models of DEA approaches to estimate the

efficiency of social security of 31 provincial governments in China during 2000 to 2009. The DEA approach was first proposed by Charnes, Cooper, and Rhodes (1978) and developed further by Banker, Charnes, and Cooper (1984). The Charnes, Cooper, and Rhodes (CCR, hereafter) efficiency concept is subject to the strong hypothesis of constant returns to scale (CRS, hereafter). Subsequent researches have considered alternative sets of assumptions, such as Banker, Charnes, and Cooper (BCC, hereafter), who proposed a variable returns to scale model (VRS, hereafter). The BCC model determines the returns to scale (increasing, constant, or decreasing returns to scale) for each of the DMUs.

The biggest advantage of the DEA approach is that it is not necessary to set up functions in advance when processing analyses. It avoids setting problems of models; meanwhile, it could deal with the evaluation of the efficiency based on multiple inputs and multiple outputs. The approach does not have to decide which is relatively important between inputs and outputs. It could also solve the problem about making decision for subjective weights. The details of CCR and BCC models are as follows.

4.1.1 CCR model

Based on the hypothesis of constant returns to scale, the piecewise linear frontiers that are constructed by employing mathematical programming techniques were introduced by Charnes et al. (1978). In CCR model, this study denotes the set of DMUs as J, for each $DMU_j \in J$ (j=1,…,J). This study further defines the following variables in equation (4.1): y_{mj} is the *m*th output of the *j*th DMU, x_{nj} is the *n*th input of the *j*th DMU, u_m is the weight of the *m*th output (m=1,…,M), v_n is the weight of the *n*th input (n=1,…,N), and h_0 is the relative efficiency score of the measured DMU, *k*th. Here, a DMU uses N inputs to produce M outputs, and u_m and v_n are what this model wants to obtain, the weights of outputs and inputs.

$$\max_{u_1,\ldots,u_M;v_1,\ldots,v_N} \quad h_0 = \sum_{m=1}^{M} u_m y_{mk} \Big/ \sum_{n=1}^{N} v_n x_{nk} \tag{4.1}$$

$$s.t. \quad \sum_{m=1}^{M} u_m y_{mj} \Big/ \sum_{n=1}^{N} v_n x_{nj} \le 1 \quad j = 1,2,\ldots,J$$

$$u_1,\ldots u_M; v_1,\ldots,v_N \ge 0$$

4.1.2 BCC model

Banker et al. (1984) extended the assumption of Charnes et al. (1978), which is from a constant returns to scale model to a variable returns to scale model. Because of the existence of variable returns to scale, BCC model add a subjective function $\sum_{n=1}^{N} v_n x_{nj} = 1$ into CCR model.

$$\max_{u_0;u_1,\ldots,u_M;v_1,\ldots,v_N} \quad h_0 = \sum_{m=1}^{M} u_m y_{mk} - u_0 \Big/ \sum_{n=1}^{N} v_n x_{nk} \tag{4.2}$$

$$s.t. \quad \sum_{m=1}^{M} u_m y_{mj} - u_0 \Big/ \sum_{n=1}^{N} v_n x_{nj} \le 1 \quad j = 1,\ldots,J$$

$$u_m, v_n \ge 0, \quad m = 1,\ldots,M, \quad n = 1,\ldots,N$$

In equation (4.2), the sign of u_0 is not limited, but a constant, and this term is equivalent to intercept. It means that the production function does not have to access the origin. That is the difference between BCC model and CCR model.

Figure 3 interprets the concept of DEA approach. Suppose that there are three DMUs: A, B, and C. Under the circumstance of constant returns to scale, the CCR model is adopted to have the CRS efficiency frontier, and it is found that the B DMU lies on this frontier. This implies that the B DMU is the most efficient DMU. Comparing to B, the A and C DMUs are less efficient. Since the C DMU uses more

inputs ($x_B < x_C$), but it obtains less outputs ($y_B > y_C$). As to the definition of efficiency, the C DMU uses x_C to produce y_C, not the most efficient level of y_0 outputs under the CRS assumption. Therefore, y_C/y_0 is represented to measure the relative efficiency of the C DMU.

On the other hand, in the case of variable returns to scale, A and B DMUs both lie on the VRS efficiency frontier, so these two DMUs are defined as efficiency. However, the C DMU is still not efficient, and the relative efficiency can be represented as y_C/y_1. For both models, if this ratio representing the relative efficiency gets closer to one (equaling one at most), it implies that this DMU has a higher efficiency.

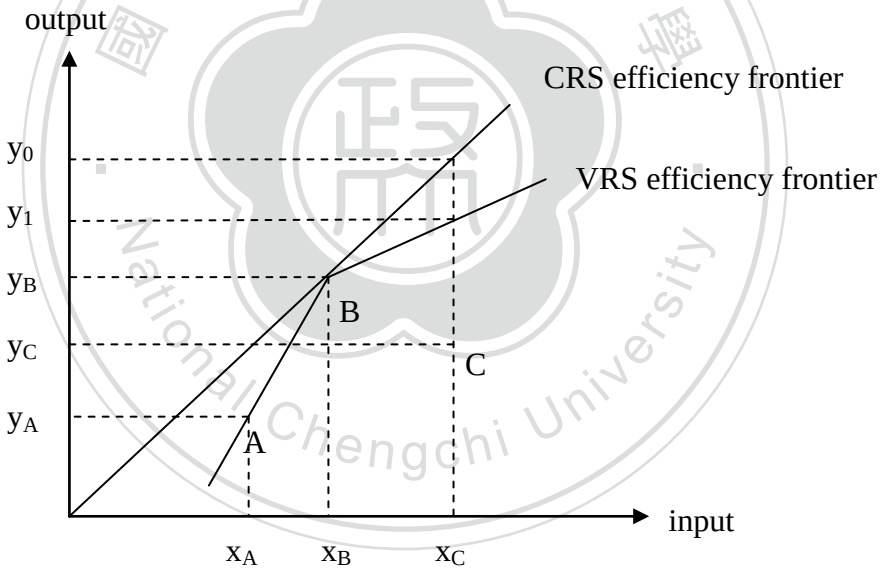

Figure 4: The Relative Efficiency of DMUs with DEA Approach

4.2 Tobit Model

Tobin (1958) constructed the regression model, called the Tobit Model, to estimate parameters by the maximum likelihood method to deal with the problem that the dependent variables cannot be negative in econometric models, that is to say, all negative values will reduce to zero. When the population distribution of dependent variables is a truncated or censored distribution, a limited dependent variables model can be established to solve this problem. In this model, the assumption of the error term follows the normal distribution, but still the estimated coefficients in the regression are not unbiased and inconsistent.

In this study, the efficiency scores of social security in China's 31 provinces are the dependent variables, which are defined as technical efficiency (*TE*), and are continuous and limited to a special range (from zero to one).[24] This limited sample violates the original assumption of linearity, so that the ordinary least squares (OLS) model is not suitable. The empirical results using the Tobit regression model analysis are more efficient and consistent than using the ordinary least squares model. This study establishes a Tobit model as follows.

$$TE_{i,t} = \begin{cases} 0, & TE^*_{i,t} \le 0 \\ TE^*_{i,t}, & 0 < TE^*_{i,t} < 1 \\ 1, & TE^*_{i,t} \ge 1 \end{cases} \tag{4.3}$$

$TE^*_{i,t}$ is called the latent variable. Indeed, the coefficients that this study wants to measure are the effects of independent variable on $TE^*_{i,t}$, not on $TE_{i,t}$. In addition, the efficiency score of social security is denoted as *CRTE* under the assumption of constant returns to scale, and *VRTE* under the assumption of variable returns to scale.

[24] The special range means that the sample of the dependent variables has upper limits, lower limits, or both. Therefore, these data are censored distributed.

4.3 Data and Variables

Panel data analysis is adopted because this study examines the determinants of *TE* distribution across provinces and over time. A major advantage of using the panel data method, as pointed out by Hsiao (1986), is to resolve or reduce the magnitude of a key econometric problem that often arises in empirical studies, namely, the omitted (mis-measured, not observed) variables that are correlated with independent variables. Also, compared with time-series or cross-section data, such data contains more information and observations. Moreover, panel data not only owns dynamic characteristic of time-series data but also expresses different properties that cross-section data has between samples. Due to the larger sample size, the use of panel data can increase the degrees of freedom and make the estimation more accurate.

The panel data are primarily collected from different years of the *China Statistical Yearbook* and the *Finance Yearbook of China* are also used to complement related variables if necessary. However, due to the data limitation,[25] the research period covered by this study is limited to the years from 2000 to 2009. The data set used in this study is a panel data set of China's 31 provinces/cities from 2000 to 2009. The followings are two parts of data, which are DEA variables and Tobit model variables, respectively.

4.3.1 DEA Variables

According to the literatures mentioned in section 2.3, this study adopts two inputs and three outputs to calculate the efficiency scores of social security in China's

[25] Many policies about social security mentioned in section 3.3 have been implemented since 21 century. Therefore, a lot of statistics about social security are available from 2001. It is noteworthy that there is a kind factor of DEA output's variable data in 2001, numbers of people participating in the urban basic medical care insurance programme, is estimated by its proportion in 2002.

31 provinces/cities.[26] Because fiscal expenditures and human resources are mostly common inputs in public sector, this study also uses these two kinds of inputs. The inputs are the proportions of expenditures for social security and employment effort to total public expenditures and the proportions of hygiene, social security, and social welfare employed people to total employed people, all by province. According to the *China Statistical Yearbook*, the expenditures for social security and employment effort refers to the expenses on administration of social security and employment, civil affairs, budgetary subsidy on the social insurance funds, subsidy on National Social Security Fund, retirees of administrative units and institutions, subsidy on enterprise reform, subsidy on employment effort, pension, placement of ex-serviceman, social welfare, the handicapped undertakings, the system of cost of living allowances for urban residents, other urban social relief, rural social relief, living relief of natural disasters, affairs of Red Cross Society, etc. As to the numbers of hygiene, social security, and social welfare employed people represents people aged 16 and over who are engaged in gainful employment of hygiene, social security, and social welfare and can receive remuneration payment or earn business income.

The outputs used in this study are the coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance, and the coverage rate of urban basic medical care insurance.[27] The coverage rate here represents numbers of people participating in the insurance programme divided by the population of aged 15 and over, all by province. According to the *China Statistical Yearbook*, the numbers of people participating in the urban basic pension insurance programme refer to staff, workers, and retirees, who have already had payment records in social security

[26] Because of avoiding the problem of absolute quantity, this study uses the proportion in inputs and outputs as the relative quantity to measure the efficiency of social security.
[27] This study refers these outputs to Yan and Hu (2009) and Chen and Li (2010).

management agencies, including those who have interrupt payment without terminating the insurance programme according to national laws, regulations, and related policies at the end of the reference period. Those who have registered in the programme but with no payment records are not included. The numbers of people participating in the unemployment insurance programme refer to staff and workers in urban enterprises or institutions who have participated in the unemployment insurance programme according to relevant policies and regulations, and other people who have participated according to local government regulations, as at the end of reference period. Finally, the numbers of people participating in the urban basic medical care insurance programme refer to staff, workers, and retirees who attend this programme according to related regulations as at the end of reference period. All descriptive statistics of inputs and outputs are in Table 5.

Table 5: Statistics of Inputs and Outputs (%)

Factors	Maximum	Minimum	Mean	Standard Deviation
Inputs				
The proportions of expenditures for social security and employment effort to total public expenditures	0.260	0.036	0.140	0.047
The proportions of health, social security and social welfare employed people to total employed people	0.072	0.028	0.046	0.008
Outputs				
The coverage rate of urban basic pension insurance	0.562	0.022	0.167	0.102
The coverage rate of unemployment insurance	0.434	0.032	0.113	0.065
The coverage rate of urban basic medical care insurance	0.890	0.009	0.161	0.135

Source: Various years of the *China Statistical Yearbook*.

Before conducting DEA, Lang and Golden (1989) indicated that inputs and outputs have a co-movement relationship, meaning that outputs cannot decrease as inputs increase. Therefore, this study employs a correlation coefficient to ensure the co-movement relationship between inputs and outputs, as shown in Table 6. In Table 6, it is shown that any input factor and any output factor have a non-negative correlation coefficient, and satisfy the assumption of co-movement.

In addition, provincial governments always maximize outputs under a constant budget and inputs. Therefore, this study adopts an input-oriented approach to calculate the efficiency score. Moreover, since two indicators of the efficiency score, *TE*, are adopted in this study, two specifications of the Tobit model will be estimated, one with *CRTE* under the assumption of constant returns to scale as the dependent variable, the other with *VRTE* under the assumption of variable returns to scale.

Table 6: Correlation Coefficient between Input and Output Factors

Input \ Output	The coverage rate of urban basic pension insurance	The coverage rate of unemployment insurance	The coverage rate of urban basic medical care insurance
The proportions of expenditures for social security and employment effort to total public expenditures	0.1644	0.2146	0.1806
The proportions of health, social security and social welfare employed people to total employed people	0.3700	0.5000	0.1833

Source: The empirical data are required by this study.

4.3.2 Tobit Model Variables

As to the independent variables in the Tobit model, according to the literatures, the degree of fiscal decentralization (*FD*), the quadratic term of *FD* (*FDSQ*), gross regional product per capita (*PGRP*), the degree of openness (*OPEN*), the scale of provincial government (*SOG*), and the quadratic term of *SOG* (*SOGSQ*) are thought to be related with the efficiency of social security, which can be represented as the following equation (4.4).

$$TE = f(FD, FDSQ, PGRP, OPEN, SOG, SOGSQ) \tag{4.4}$$

However, different policies and the unbalanced distribution in resource allocation across provinces could cause a disparity of efficiency scores among provinces. If these regional characteristics are ignored, it might lead to a biased estimation result.[28] Thus, the related function can be further extended into the equation (4.5).

$$TE^{*}_{i,t} = \beta_0 + \beta_1 FD_{i,t-1} + \beta_2 FDSQ_{i,t-1} + \beta_3 PGRP_{i,t-1} + \beta_4 OPEN_{i,t-1} + \beta_5 SOG_{i,t-1} + \beta_6 SOGSQ_{i,t-1} + \sum_{k=1}^{3} \gamma_k AREA_{i,k} + \sum_{j=1}^{8} \alpha_j T_j + \varepsilon_{i,t} \tag{4.5}$$

In equation (4.5), *i* represents the i^{th} province/city and *t* means the t^{th} year, where *i*=1, 2, …, 31 and *t*=2001, 2002, …, 2009. $TE^{*}_{i,t}$, as mentioned-above, has two specifications of dependent variables in the Tobit model, which are $CRTE_t$ and $VRTE_t$. Since this study uses *FDA* or *FDB* as the indicator of fiscal decentralization, $FD_{i,t-1}$ could be either $FDA_{i,t-1}$ or $FDB_{i,t-1}$. Therefore, four empirical models are estimated in this study. Owing to the potential differentials among regions, this study adds three area dummy variables to represent the provinces belonging to the eastern, central, and

[28] The regional characteristics also include geographical features and different cultural customs across regions.

northeast areas (*AREA*).[29] Also, eight time dummy variables (T_j) are included in equation (4.5) as independent variables and represent the year of 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and 2009 separately. This study uses T_j to express time dummy variable to investigate whether time affects the determinants of provincial $TE^*_{i,t}$ or not.

Moreover, in order to avoid the problems of causality between dependent and any independent variables or endogeneity between independent variables, all independent variables are lagged by one year except for time dummy variables and area dummy variables.[30] In addition, in order to eliminate any fluctuations in prices, all value variables in this study are adjusted by the CPI deflator with the base year of 2000. Therefore, there are 279 observations (31 provinces, dependent variables from 2001 to 2009 and independent variables from 2000 to 2008) in the empirical models.

The primary independent variable in this study is the degree of fiscal decentralization (*FD*) in each province and is calculated by equations (3.1) and (3.2). There are two specifications of this independent variables in the empirical model, as mentioned in previous paragraph. According to Stigler (1957), Oates (1972), and Oates (1993), fiscal decentralization could improve the resource allocation to achieve an efficient level, so as social security. Since provincial governments are closer to their residents than the central government, and the residents have a right to choose by voting different kinds and quantities of public services. In addition, Martinez-Vazquez

[29] According to China Statistical Bureau, the eastern area includes Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. The central area includes Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan. The northeastern area includes Liaoning, Jilin, and Heilongjiang. The remaining provinces/cities belong to the western area.

[30] It is true that endogeneity might exist in the regression and can be caused by a third factor that potentially affects both dependent and independent variables. This study has considered this issue and tried to deal with this problem by using lagged terms of all independent variables as proxies in the regression model, although doing so can only alleviate this issue to some extent. Thus, the estimation results might be explained as primarily correlation rather than causality, because of the endogeneity issue.

et al. (2005) and Busemeyer (2008) stated that there is a positive relationship between fiscal decentralization and the expenditures of social security. However, Prud'Homme (1994), Prud'Homme (1995), and Bird and Vaillancourt (1998) indicated that decentralization seems likely to result in increased costs, lessened efficiency in service delivery, and probably greater inequity and macroeconomic instability. Based on these thoughts, the influence of fiscal decentralization on the efficiency of social security is still questionable. Besides, this study would like to examine a hypothesis of non-monotonic impact of fiscal decentralization on the efficiency of social security while the expenditures of social security increase. In order to examine whether the non-monotonic relationship exists between fiscal decentralization and the efficiency of social security or not, this study adds the quadratic term of the degree of fiscal decentralization as an independent variable in the Tobit model.[31] The expected influences of *FD* and *FDSQ* are unknown.

Then, gross regional product per capita (*PGRP*) is calculated by gross regional product which is divided by total regional population and is adjusted by the CPI deflator with the base year of 2000. Provinces with higher GRP per capita, implying a higher level of economic development, might have more sufficient materials and a higher quality of human capital than those with lower GRP per capita. Also, residents with higher GRP per capita might well be more conscious and pay more attention to their social security. This might benefit the efficiency of social security. This viewpoint was supported by Afonso and Fernandes (2006). Thus, this study expects there is a positive relationship between the efficiency of social security and *PGRP*.

The degree of openness (*OPEN*) in this study is the percentage of exports value and imports value to gross regional product. The degree of openness in economic

[31] According to Greene (2003).

system has a primary effect on social welfare because the integration of trade and capital market let the domestic economy more easily affected by the economic fluctuation, so as social security. As the degree of openness increases, the wage and employment of workers are under the circumstance of higher risk. Therefore, the policies of incremental expenditures which subsidize the victims in labor market are brought up. Rodrik (1998) adopted the percentage of exports value and imports value to GRP as the degree of openness, just the same with this study. Through the empirical surveys of 68 countries, he pointed out that as the degree of openness increases, the expenditures of social security and welfare also significantly increase. It represents that the expenditures of government play the risk-mitigating role. Korpi and Palme (2003) and Avelino, Brown, and Hunter (2005) also supported this conclusion. However, Rudra and Haggard (2005) indicated that higher degree of openness uncertainly increases the expenditures of social welfare, it depends on whether the national political system is democratic or not. Since the reform of economic system in China turned into market economy precisely, and this study adopts a hypothesis which is the positive relationship between the expenditures of social security and the efficiency of social security. Thus, this study expects a positive coefficient of *OPEN*.

Moreover, the scale of provincial government (*SOG*) here represents the ratio of total public expenditures to gross regional product. The large provincial government might obtain economies of scale, but the large provincial government might increase the costs of supervision. This characteristic of *SOG* is definitely affects the efficiency of social security. According to Gupta and Verhoeven (2001) and Afonso, Schuknecht, and Tanzi (2005), there is a negative relationship between the efficiency of social expenditures and the scale of provincial government. However, Evans et al. (2001)

indicated that there is a positive relationship between them. Therefore, the relationship between the efficiency of social security and the scale of provincial government is noteworthy. Similarly, in order to examine whether the non-monotonic relationship exists between the efficiency of social security and the scale of provincial government or not, this study adds the quadratic term of the scale of provincial government as an independent variable in the Tobit model. According to these literatures, because of the different conclusions, the effects of *SOG* and *SOGSQ* are unknown.

Due to different characteristics among regions, the efficiency of social security in different areas might be different as well. Therefore, three dummy variables, *EAST*, *CENTRAL*, and *NORTHEAST*, are added into the Tobit model to control the regional characteristics, using the western area as a reference group. It is expected that coefficients of *EAST*, *CENTRAL*, and *NORTHEAST* are positive. Since the eastern, central, and northeastern areas obtain knowledge and realization of social security from advanced foreign countries more easily than their counterparts in the western area. Furthermore, the magnitude of the coefficient of *EAST* is expected to be the highest among these three areas.

Finally, this study includes eight time dummy variables in the Tobit model for understanding the change of the efficiency score over time, using year 2009 as a reference group. The definitions, descriptive statistics and expected signs of the variables are listed in Table 7.

Table 7: Variable Descriptions and Statistics in the Tobit Model

Variables	Descriptions	Mean (S.D.)	Maximum (Minimum)	Expected Sign
$CRTE_t$	The efficiency score of social security under the assumption of CRS in year *t*.	0.290 (0.205)	1.000 (0.074)	
$VRTE_t$	The efficiency score of social security under the assumption of VRS in year *t*.	0.693 (0.129)	1.000 (0.483)	
FDA_{t-1}	The ratio of the amount of revenue collected and retained to total expenditures in year *t-1*, all by province. (%)	0.407 (0.153)	0.841 (0.045)	?
FDB_{t-1}	The ratio of the amount of revenue collected and retained to the summation of the amount of revenue collected and retained and the net transfer from the central government in year *t-1*, all by province. (%)	0.472 (0.177)	0.863 (0.051)	?
$FDASQ_{t-1}$	The quadratic term of *FDA* in year *t-1*.	0.189 (0.138)	0.707 (0.002)	?
$FDBSQ_{t-1}$	The quadratic term of *FDB* in year *t-1*.	0.253 (0.178)	0.745 (0.003)	?
$PGRP_{t-1}$	Real GRP per capita in each province in year *t-1*. (RMB, in 2000 price)	13715.314 (10397.476)	63309.450 (2805.257)	+
$OPEN_{t-1}$	The ratio of exports value and imports value to GRP in year *t-1*, all by province. (%)	0.336 (0.409)	1.875 (0.043)	+
SOG_{t-1}	The ratio of total public expenditures to GRP in year *t-1*, all by province. (%)	0.181 (0.123)	0.961 (0.069)	?
$SOGSQ_{t-1}$	The quadratic term of *SOG* in year *t-1*.	0.048 (0.105)	0.924 (0.005)	?
$EAST_t$	=1, if provinces are categorized in the eastern area; =0, otherwise.	0.323 (0.468)	1.000 (0.000)	+
$CENTRAL_t$	=1, if provinces are categorized in the central area; =0, otherwise.	0.194 (0.396)	1.000 (0.000)	+
$NORTHEAST_t$	=1, if provinces are categorized in the northeastern area; =0, otherwise.	0.097 (0.296)	1.000 (0.000)	+
T	=1, if in year 2001; =0, otherwise. Other years are defined by the same token.	0.111 (0.315)	1.000 (0.000)	?
	Observations	279		

Source: Various years of the *China Statistical Yearbook* and the *Finance Yearbook of China*.

CHAPTER 5. EMPIRICAL RESULTS

Before estimating the Tobit model, two efficiency scores of social security in 31 provinces have to be measured by the DEA approach in the first section of this chapter. Using these two efficiency scores as dependent variables, four specifications of the Tobit model are estimated and analyzed in the second section of this section. The last section in this chapter is about the regional-specific and time-specific effects in the Tobit model.

5.1 The Efficiency Score of Social Security

The efficiency scores of *CRTE* and *VRTE* are calculated based upon equations (4.1) and (4.2), respectively. The inputs and outputs which this study uses to illustrate the efficiency of social security are introduced in section 4.3.1. It is worth noting that this study runs the DEA model with all data, which are 279 observations,[32] to represent the characteristics of panel data.[33] The efficiency scores of social security in selected years are presented in Table 8.

Table 8 shows that efficiency scores draw from *CRTE* are quite different from those of *VRTE*. As a whole, the efficiency scores of *VRTE* are higher than those of *CRTE* and more provinces have highest efficiency score, which is one, under the assumption of VRS.[34] The assumption of VRS results in the limitation of non parametric mathematical program much looser, so the efficiency scores under the assumption of VRS are higher than those under the assumption of CRS. In addition,

[32] 279 observations are the data of 31 provinces in nine years.
[33] This study runs the DEA model twice, one is under the assumption of CRS (CCR model), and the other is under the assumption of VRS (BCC model).
[34] In 279 observations, there are 5 data which achieve the highest efficiency score under the assumption of CRS, but there are 10 data which achieve the highest efficiency score under the assumption of VRS.

Table 8: The Efficiency Score of Social Security in Selected Years

Regions	CRTE			VRTE			Difference[1]	
	2001	2005	2009	2001	2005	2009	CRTE	VRTE
Beijing	0.71	0.73	1.00★	0.99	0.95	1.00★	0.29	0.01
Tianjin	0.58	0.57	0.70	0.85	0.80	0.82	0.12	-0.03
Hebei	0.19	0.17	0.23	0.68	0.62	0.61	0.04	-0.07
Shanxi	0.22	0.23	0.36	0.74	0.72	0.72	0.14	-0.02
Inner Mongolia	0.22	0.25	0.38	0.70	0.69	0.64	0.16	-0.06
Liaoning	0.35	0.47	0.48	0.68	0.67	0.64	0.13	-0.04
Jilin	0.22	0.23	0.42	0.61	0.52	0.56	0.21	-0.05
Heilongjiang	0.39	0.42	0.55	0.80	0.80	0.78	0.16	-0.02
Shanghai	1.00★	0.99	1.00★	1.00★	1.00★	1.00★	0.00	0.00
Jiangsu	0.30	0.34	0.74	0.79	0.72	0.82	(2) 0.44	0.03
Zhejiang	0.37	0.48	0.84	0.90	0.92	1.00★	(1) 0.47	(1) 0.10
Anhui	0.15	0.12	0.25	0.64	0.55	0.54	0.10	-0.10
Fujian	0.22	0.28	0.56	0.87	0.90	0.96	(3) 0.34	(2) 0.09
Jiangxi	0.13	0.15	0.33	0.64	0.58	0.59	0.20	-0.06
Shandong	0.20	0.27	0.37	0.73	0.76	0.74	0.18	0.01
Henan	0.17	0.15	0.23	0.64	0.61	0.59	0.06	-0.05
Hubei	0.16	0.22	0.30	0.63	0.56	0.54	0.15	-0.09
Hunan	0.10	0.15	0.27	0.52	0.50	0.52	0.17	0.00
Guangdong	0.32	0.46	0.76	0.77	0.83	0.85	(2) 0.44	(3) 0.07
Guangxi	0.14	0.11	0.22	0.69	0.58	0.51	0.07	-0.18
Hainan	0.23	0.30	0.40	0.72	0.70	0.62	0.18	-0.10
Chongqing	0.16	0.20	0.35	0.65	0.68	0.66	0.20	0.01
Sichuan	0.10	0.15	0.27	0.58	0.56	0.60	0.17	0.02
Guizhou	0.13	0.12	0.22	0.79	0.82	0.66	0.09	-0.13
Yunnan	0.10	0.10	0.21	0.63	0.59	0.59	0.11	-0.03
Tibet	0.11	0.17	0.26	0.88	0.70	0.65	0.14	-0.23
Shaanxi	0.21	0.20	0.26	0.68	0.67	0.58	0.04	-0.11
Gansu	0.18	0.16	0.25	0.75	0.72	0.59	0.08	-0.16
Qinghai	0.14	0.16	0.19	0.52	0.49	0.49	0.05	-0.03
Ningxia	0.17	0.24	0.43	0.69	0.71	0.67	0.26	-0.02
Xinjiang	0.23	0.28	0.42	0.64	0.64	0.63	0.19	-0.01
Average	0.25	0.29	0.43	0.72	0.70	0.68	0.17	-0.04
Eastern[2]	0.41	0.46	0.66	0.83	0.82	0.84	0.25	0.01
Central[2]	0.16	0.17	0.29	0.63	0.59	0.58	0.14	-0.05
Northeastern[2]	0.32	0.37	0.48	0.70	0.66	0.66	0.16	-0.04
Western[2]	0.16	0.18	0.29	0.68	0.65	0.61	0.13	-0.08

Source: Various years of the *China Statistical Yearbook*.

Note: 1. The difference between the scores of efficiency in 2009 and 2001 in the same region.

2. The regions are similarly categorized by the area dummy variables.

3. Numbers, ★, and shadows in parentheses represent rankings of top three provinces with larger increase, the highest efficiency scores, and the lowest efficiency scores and bottom three provinces with larger decrease.

the average scores of *CRTE* show an upward trend over time, but the average scores of *VRTE* show a downward trend over time. Meanwhile, the increasing magnitude of *CRTE* is larger than *VRTE*.

Under the assumption of CRS, there is one province with *CRTE*=1 in 2001, which is Shanghai, implying the highest efficiency score. However, the numbers of province with the highest efficiency score increase to two in 2009, which are Beijing and Shanghai. However, the provinces with the lowest efficiency score, which is 0.1, are Hunan, Sichuan, and Yunnan in 2001. In 2009, Qinghai has the lowest efficiency score, which is 0.19. During the research period, every province has improved their efficiency of social security. The top three provinces with larger increase of *CRTE* are Zhejiang, Jiangsu, Guangdong, which have the same scores, and Fujian, accordingly. These provinces all gather in the eastern area.

With regard to *VRTE*, more provinces have the highest efficiency scores under the assumption of VRS than under the assumption of CRS. Shanghai is the only one province with the highest efficiency score in 2001, but in 2009, there are three provinces with the highest efficiency score, which are Beijing, Shanghai, and Zhejiang. However, the provinces with the lowest efficiency score, which is 0.52, are Hunan and Qinghai in 2001. In 2009, Qinghai still has the lowest efficiency score, which is 0.49. In addition, during 2001 to 2009, only ten provinces have increased or retained their efficiency scores. The top three provinces with larger increase of *VRTE* are Zhejiang, Fujian, and Guangdong, accordingly. These provinces also gather in the eastern area. Conversely, the bottom three provinces with larger decrease of *VRTE* are Tibet, Guangxi, and Gansu, by order. These provinces all gather in the western area.

Moreover, according to Table 8, the provinces in all areas have improved their efficiency of social security under the assumption of CRS, that is to say, *CRTE*. It is

worth noting that the largest increase of *CRTE* appears in the eastern area, which is 0.25. The provinces that are in the eastern area have improved their efficiency of social security obviously under the assumption of CRS. However, this phenomenon shows completely converse under the assumption of VRS. Only the provinces in the eastern area have improved their efficiency of social security under the assumption of VRS. The remaining provinces in those three areas have suffered the decrease of efficiency. The western area has the largest decrease of *VRTE*, which is 0.08. This conclusion shows that there is still a serious regional inequality in China. The higher efficiency scores always appear in the eastern area, no matter under the assumption which CRS or VRS, but the lower efficiency scores gather in the both central and western areas, no matter under the assumption which CRS or VRS.

Due to the different scenarios observed based on *CRTE* and *VRTE*, this study estimates two specifications of the Tobit model. One uses *CRTE* and the other one uses *VRTE* as dependent variables, for confirming the robustness of findings regarding the influence of fiscal decentralization on the efficiency of social security in China.

5.2 Determinants of the Efficiency of Social Security

As mentioned above, the primary purpose of this study is to examine the influence of fiscal decentralization on the efficiency of social security in China. Using 31 provincial-level panel data in China during 2000 to 2009, the DEA approach to obtain the efficiency scores as dependent variables and the econometric technique, Tobit model, the estimated results of equation (4.5) are presented in Table 9. There are four specifications of the empirical model used in this study. Based on the different definitions of dependent variables and primary independent variables, model 1 uses the efficiency score under the assumption of CRS as the dependent variable and the degree of fiscal decentralization calculated by equation (3.1) as the primary independent variable. Model 2 uses the efficiency score under the assumption of VRS as the dependent variable and the degree of fiscal decentralization calculated by equation (3.1) as the primary independent variable. Model 3 uses the efficiency score under the assumption of CRS as the dependent variable and the degree of fiscal decentralization calculated by equation (3.2) as the primary independent variable. Finally, model 4 uses the efficiency score under the assumption of VRS as the dependent variable and the degree of fiscal decentralization calculated by equation (3.2) as the primary independent variable.

From Table 9, it is obvious that the primary factor, the degree of fiscal decentralization, which affects the efficiency of social security in China are the same results in all models. This finding suggests that the conclusions made in this study are very robust, no matter which technical efficiency indicators and fiscal decentralization indicators are adopted as dependent variables and independent variables. It is found that the degrees of fiscal decentralization have a significantly positive influence on the efficiency of social security in China at 1% significance level for all specifications of

the empirical model. It means that as the degree of fiscal decentralization increases, provincial governments would improve their efficiency of social security because provincial governments possess more information about preferences of residents and costs of providing public goods, such as social security. Therefore, while provincial governments have more resources to use, representing the higher degree of fiscal decentralization, they can improve their efficiency of social security. However, the coefficients of *FDSQ* are significantly negative in three models, except the insignificant coefficient in model 4. Although the coefficient of *FDSQ* is insignificant

Table 9: Empirical Results of the Tobit Model

Variables	Model 1: $CRTE_t$ with FDA_{t-1}		Model 2: $VRTE_t$ with FDA_{t-1}	
	Coefficient	p-value	Coefficient	p-value
CONSTANT	-4.464×10^{-1} ***	0.000	4.031×10^{-2}	0.624
FDA_{t-1}	1.077 ***	0.000	1.045 ***	0.000
$FDASQ_{t-1}$	-1.085 ***	0.000	-5.995×10^{-1} **	0.010
$PGRP_{t-1}$	1.790×10^{-5} ***	0.000	5.220×10^{-6} ***	0.000
$OPEN_{t-1}$	6.602×10^{-2} ***	0.001	-1.168×10^{-2}	0.586
SOG_{t-1}	1.307 ***	0.000	1.140 ***	0.000
$SOGSQ_{t-1}$	-1.027 ***	0.000	-6.467×10^{-1} ***	0.000
Observations	279		279	
Log likelihood	338.739		308.383	

Variables	Model 3: $CRTE_t$ with FDB_{t-1}		Model 4: $VRTE_t$ with FDB_{t-1}	
	Coefficient	p-value	Coefficient	p-value
CONSTANT	-4.691×10^{-1} ***	0.000	4.803×10^{-2}	0.587
FDB_{t-1}	1.030 ***	0.000	8.266×10^{-1} ***	0.001
$FDBSQ_{t-1}$	-8.619×10^{-1} ***	0.000	-2.825×10^{-1}	0.197
$PGRP_{t-1}$	1.684×10^{-5} ***	0.000	4.579×10^{-6} ***	0.000
$OPEN_{t-1}$	7.084×10^{-2} ***	0.001	-2.960×10^{-2}	0.182
SOG_{t-1}	1.373 ***	0.000	1.224 ***	0.000
$SOGSQ_{t-1}$	-1.055 ***	0.000	-7.443×10^{-1} ***	0.000
Observations	279		279	
Log likelihood	336.294		312.102	

Source: The empirical data are required by this study.

Notes: 1. Asterisks indicate variables whose coefficients are significant at the 10% (*), 5% (**), and 1% (***) levels.

in model 4, there are still three significant results respectively at 1% significance level in model 1 and model 3 and 5% significance level in model 2 supporting this conclusion. This finding implies there is a non-monotonic relationship between fiscal decentralization and the efficiency of social security. That is to say, the influence of fiscal decentralization on the efficiency of social security is not always positive and it may be negative at some degree of fiscal decentralization. Their distributed relationship may be kinked curve. This finding can explain why the relationship between fiscal decentralization and the efficiency of provincial government's social security is controversial in some previous studies.

In addition to the degree of fiscal decentralization, other factors also play important roles in the efficiency of social security in China during 2000 to 2009. It is found that there is a positive relationship at 1% significance level between the efficiency of social security and the gross regional product. This finding is consistent with previous expectations and is very robust in all specifications of empirical model. This result implies that provincial residents with higher GRP per capita would be more conscious and pay more attention to their social security, and this benefits the efficiency of social security.

As to the degree of openness, there is an interesting result showed in Table 9. Under the assumption of CRS, the coefficients of *OPEN* are significantly positive at 1% significance level, no matter which indicator of fiscal decentralization is chosen. It is consistent with previous expectations. The reason is that as the degree of openness increases, the wage and employment of workers are under the circumstance of higher risk. Provincial governments should bring up policies of incremental expenditures and improve the efficiency of social security to subsidize the victims in labor market. However, under the assumption of VRS, there are insignificant impacts of the degree

of openness, no matter which indicator of fiscal decentralization is chosen.

Finally, the relationship between the efficiency of social security and the scale of provincial government is significantly positive at 1% significance level in all specifications of empirical model. This result shows that larger provincial governments in China obtain economies of scale at the social security respect. Similarly, the coefficients of *SOGSQ* are significantly negative at 1% significance level in all specifications of empirical model. Therefore, there is also a non-monotonic relationship between the efficiency of social security and the scale of provincial government. In other words, the influence of *SOG* may transfer from positive to negative at some level. This finding can also explain why the relationship between the scale of provincial government and the efficiency of provincial government's social security is controversial in some previous studies.

5.3 The Regional-Specific and Time-Specific Effects

After the estimation with the Tobit model, the regional-specific and time-specific effects are obtained. The regional-specific and time-specific effects which estimate the unbalanced distribution in resource allocation across provinces and different policies over time are also important factors to observe the efficiency of social security in China.

In order to investigate the differences among different regions, this study adds three area dummy variables into the Tobit model of four specifications. Table 10 shows the regional-specific effects of every area. Keeping the other variables constant, the regional-specific effect refers to the efficiency of social security in four areas of China. Also, there is a robust and consistent conclusion. Comparing to the western area, no matter which indicators of fiscal decentralization adopted, all the three areas have significantly positive impacts on the efficiency of social security at 1% significance level in model 1 and similar circumstance also exists in model 3 except that the coefficient of *CENTRAL* is significantly positive at 5% significance level.

Table 10: The Regional-Specific Effect

Regions	$EAST_t$		$CENTRAL_t$		$NORTHEAST_t$	
Model 1: $CRTE_t$ with FDA_{t-1}	5.790×10^{-2} (0.002)	***	3.781×10^{-2} (0.008)	***	1.141×10^{-1} (0.000)	***
Model 2: $VRTE_t$ with FDA_{t-1}	7.817×10^{-2} (0.000)	***	-1.685×10^{-2} (0.273)		3.799×10^{-2} (0.044)	**
Model 3: $CRTE_t$ with FDB_{t-1}	5.645×10^{-2} (0.004)	***	3.370×10^{-2} (0.018)	**	1.137×10^{-1} (0.000)	***
Model 4: $VRTE_t$ with FDB_{t-1}	6.097×10^{-2} (0.003)	***	-2.401×10^{-2} (0.111)		3.119×10^{-2} (0.087)	*

Source: The empirical data are required by this study.

Notes: 1. Asterisks indicate variables whose coefficients are significant at the 10% (*), 5% (**), and 1% (***) levels.

2. The numbers in the parentheses are p-value.

It means that under the assumption of CRS, these three areas have the characteristics of higher efficiency of social security than the western area due to their own developments. However, under the assumption of VRS, no matter which indicators of fiscal decentralization adopted, the impacts of provinces in the central area are not significant. Still, comparing to the western area, provinces in the eastern area and northeastern area are significantly positive at 1%, 5%, and 10% significance level, respectively.

With respect to time dummy variables, there is also a robust phenomenon like the regional-specific effect showed in Table 11. Keeping the other variables constant, the time-specific effects indicate the efficiency of social security in every year. The effect represents the characteristics belonging to each year. Comparing to 2009, no matter which indicators of fiscal decentralization adopted, 2001, 2002, and 2004 have significantly positive impacts under the assumption of CRS. 2007 and 2008 have significantly negative impacts on the efficiency of social security at 1% significance level. On the other hand, under the assumption of VRS, no matter which indicators of fiscal decentralization adopted, the time-specific effects from 2001 to 2006 are significantly positive at 1% significance level and the trend is decreasing. The lowest significant impact appears in 2007 at 10% significance level and is still positive. In general, the efficiency of social security decreases over time in all specifications of empirical model. This probably results from the global financial crisis in 2008 and 2009.

Table 11: The Time-Specific Effect

Time	Model 1: $CRTE_t$ with FDA_{t-1}		Model 2: $VRTE_t$ with FDA_{t-1}		Model 3: $CRTE_t$ with FDB_{t-1}		Model 4: $VRTE_t$ with FDB_{t-1}	
2001	1.012×10^{-1}	***	1.631×10^{-1}	***	8.751×10^{-2}	***	1.448×10^{-1}	***
	(0.000)		(0.000)		(0.000)		(0.000)	
2002	5.058×10^{-2}	**	1.126×10^{-1}	***	3.830×10^{-2}	*	9.846×10^{-2}	***
	(0.013)		(0.000)		(0.058)		(0.000)	
2003	2.901×10^{-2}		1.152×10^{-1}	***	1.642×10^{-2}		1.038×10^{-1}	***
	(0.144)		(0.000)		(0.404)		(0.000)	
2004	4.476×10^{-2}	**	1.017×10^{-1}	***	3.543×10^{-2}	*	9.646×10^{-2}	***
	(0.022)		(0.000)		(0.069)		(0.000)	
2005	2.449×10^{-2}		9.444×10^{-2}	***	1.938×10^{-2}		9.682×10^{-2}	***
	(0.205)		(0.000)		(0.317)		(0.000)	
2006	-1.377×10^{-2}		6.702×10^{-2}	***	-1.840×10^{-2}		6.311×10^{-2}	***
	(0.458)		(0.001)		(0.323)		(0.002)	
2007	-5.168×10^{-2}	***	3.669×10^{-2}	*	-5.499×10^{-2}	***	3.650×10^{-2}	*
	(0.004)		(0.062)		(0.003)		(0.058)	
2008	-7.598×10^{-2}	***	-2.338×10^{-2}		-8.067×10^{-2}	***	9.233×10^{-3}	
	(0.000)		(0.257)		(0.000)		(0.627)	

Source: The empirical data are required by this study.

Notes: 1. Asterisks indicate variables whose coefficients are significant at the 10% (*), 5% (**), and 1% (***) levels.

2. The numbers in the parentheses are p-value.

CHAPTER 6. CONCLUDING REMARKS AND POLICY IMPLICATIONS

6.1 Concluding Remarks

The purpose of this study is to investigate the influence of fiscal decentralization on the efficiency of social security in China since the realization of social security was promoted and some relevant policies were implemented in 21 century. This study uses China's provincial-level data of 31 regions from 2000 to 2009 and the DEA approach to measure the efficiency scores of provincial government's social security in China as the dependent variables, and then establishes four specifications of the Tobit model to illustrate the relationship more comprehensively between fiscal decentralization and the efficiency of provincial government's social security in China.

First of all, this study uses two inputs and three outputs to calculate the efficiency scores. The inputs are the proportions of expenditures for social security and employment effort to total public expenditures and the proportions of hygiene, social security, and social welfare employed people to total employed people, and the outputs the coverage rate of urban basic pension insurance, the coverage rate of unemployment insurance, and the coverage rate of urban basic medical care insurance. Second, as a provincial government has a higher degree of fiscal decentralization, which means that the provincial government has higher revenue autonomy. Whether this circumstance can improve the efficiency of provincial government's social security in China or not is interesting. Thus, this study investigates the primary factor, the degree of fiscal decentralization, in the Tobit model. Moreover, in order to examine whether the non-monotonic relationship exists between fiscal decentralization and the efficiency of social security or not, this study adopts the

quadratic term of the degree of fiscal decentralization as a factor. Finally, other factors which probably affect the efficiency of provincial government's social security in China are added into this model, such as gross regional product per capita, the degree of openness, the scale of provincial government, and the quadratic term of the scale of provincial government.

The primary finding of this study is that fiscal decentralization has a positively non-monotonic influence on the efficiency of social security. This means it contributes positively to the efficiency of provincial government's social security, but this positive influence does not always exist. Their distributed relationship may be kinked curve. This finding can explain why the relationship between fiscal decentralization and the efficiency of provincial government's social security is controversial in some previous studies.

Other factors such as gross regional product per capita, the degree of openness, the scale of provincial government, the quadratic term of the former, area dummy variables, and time dummy variables are all important to the efficiency of provincial government's social security. In general, *PGRP*, *OPEN*, and *SOG* have positive impacts on the efficiency of provincial government's social security. In addition, *SOG* also has a non-monotonic relationship with the efficiency of social security, just like fiscal decentralization. Meanwhile, provinces in the eastern and northeastern areas have relatively high efficiency of social security than their counterparts in the western area. Moreover, in general, the efficiency of social security decreases over time. These mentioned-above conclusions are quite robust and reliable, no matter which efficiency score indicators and the indicators of fiscal decentralization are used as the dependent variable and the primary independent variable.

6.2 Policy Implications

While China has achieved remarkable economic growth over the past 30 years, the economic disparity among provinces has become a serious problem in China. As indicated by Huang, Kuo, and Kao (2003), the level of inequality in China's regional economies clearly exhibited a slight upward trend after 1991. What worse is this economic disparity results in a lot of social problems, such as social welfare, social security, the quality of living, hygiene, health, and poverty. In order to examine how big this difference of social problem is, this study investigates the efficiency of provincial government's social security and its affected factors.

In this study, it is suggested that fiscal decentralization could improve the efficiency of provincial government's social security. If the central government in China would like to mitigate this social security gap among provinces, it could release its fiscal power to those provinces with lower efficiency score. With larger revenue autonomy as administrative resource, provincial governments can draw up and implement policies about social security more flexible and easier. Hence, this study suggests that with a view of eliminating the unequal social development among provinces, the central government in China could release the power of fiscal decentralization in some provinces with lower efficiency to improve their implementation about social security. However, it should be aware of the degree of fiscal decentralization which is too high to improve the efficiency of social security.

The provinces with higher efficiency score of social security can help the residents to have better living qualities. Taiwanese businessmen in China should also pay attention to those social policies to take care of their employees and adopt the recommendations of this study as references for future operations and investments.

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