Chapter 1
Grassroots Community Construction, Comparative Study on Chinese and Japanese Communities, and Qinghe Experiment

Qiang LI

Professor of School of Social Sciences, Tsinghua University, Beijing, China.

Abstract

Through exchange and cooperation with Professor Hiroshige Tanaka from Chuo University, Tokyo, Japan, the research group of Tsinghua University, China, which is under my leadership, provided four papers focusing on the research of grassroots community construction. Here I'd like to mention three points: the importance of study on grassroots community construction, the great significance of comparative study on Chinese and Japanese communities, and the Qinghe Experiment conducted by Tsinghua University.

I. Why do we study the grassroots community construction?

For a long time, empirical sociological studies in China have mostly taken place at the community level where their variables were relatively easy to manipulate. A community is a territorial community where the people live. We can also say that a community is exactly a small society. It is both a primary-level unit of Chinese administrative system in the urban-rural society, and a common space where residents live their daily life. It assumes such basic functions as developing identity, expressing interests, offering services and enabling management. Community studies have always been the foundation of sociology. For 38 years since China's reform and opening up, radical changes have taken place in the social structure, community structure, composition of residents, grassroots communities, and grassroots organizations. Sociologists can only have a profound understanding of the tremendous changes in China's society and communities through specific community studies.

After the reform and opening up, China shifted its highly centralized planned economic system to market economic system, with the function and position of unit system increasingly weakened. The housing system reform in the late 1990s has made the communities of commercial residential buildings developed by real estate businesses become a mainstream model for new-type urban communities in China. To some extent, the commercialization of housing has also changed the governance model of Chinese urban communities. The "unit people" have gradually turned into "community people". After the reform of state-owned system, the former unit courtyards declined. The housing, old people supporting, healthcare and other systems and mechanisms have all

changed, bringing many new problems and new challenges.

In terms of the spatial form, urban and rural grassroots communities in 30 years before the reform and opening up existed roughly in three major types: *Hutong* (alleyways), courtyards, and villages; since the reform and opening up, the *Hutong* areas have experienced urbanized reconstruction and renovation, while the reform of public housing system led to the disintegration of some unit courtyards, and the rural areas went through the process of rapid urbanization. China's communities saw diversified spatial forms of communities, including communities of commercial residential buildings, unit courtyards, older residential communities, communities of buildings for back-moving residents, urban villages, and pure rural communities.

Since the reform and opening up, significant changes have taken place in the governance system of grassroots communities in China. The community management system has also seen diversified models from the "monopoly" by the country or a unit to the market-oriented operation, with a wide range of management forms including continued "unit system", community residents' committees, service by a property management company + self-management of owners in communities of commercial residential buildings, and coexistence of villagers' committees + residents' committees in non-agricultural areas.

In China, urban residents' committees are known as the uppermost grassroots organizations in urban communities of China. The work of grassroots communities has an increasingly important position and role in the social governance of cities. At present, the grassroots social governance system and capacity are under unprecedented pressures: the social changes are so rapid that the governmental management system cannot adapt to the great changes in grassroots communities; communities are weak in self-organization, and community residents are less integrated; the market power of communities is developed insufficiently, with strained relationship among the property management company, residents and residents' committees; there are many difficulties for the migrant workers in cities to become citizens; the highly centralization of population has caused huge risks, and the like.

The innovation of community governance in China is an exploration and experiment at the level of grassroots communities conducted in the context of China's reform and opening up, on the basis of grassroots self-governance and democratic participation, by means of governmental governance and collaboration of various social organizations, with the aim to promote stabilization of order, facilitate provision of public services and products. Such experiment will be further discussed in Part III of this paper, "Qinghe Experiment". The core of China's social governance transformation is how to understand the relationship between the government and other authorities and

the public, and to re-clarify their respective tasks and responsibilities. Namely, how a mutually adaptive relation is formed between the State and the society and market is exactly a core issue for the building of modern governance structure in different countries[1]. Therefore, the study on governance of grassroots communities is of great significance in China's social transformation.

II. Great Significance of Comparative Study on Chinese and Japanese Communities

Our cooperation with Professor Hiroshige Tanaka from Chuo University Tokyo, Japan was largely about a China-Japan comparative study. Japan completed its urbanization and industrialization in the 1970s. China started the process of urbanization later than Japan, so there are many things to learn from Japan's development experience. The comparative study on Chinese and Japanese communities is of great significance.

With industrialization as its national strategy after the World War II, Japan began to carry out effective industrial planning and layout. High-end manufacturing and export-driving became an important engine for the rapid development of Japan. The rapid industrialization brought highly agglomerated population, industries and cities for Japan. Based on the development strategy of intensive land, Japan worked out the development planning of Japanese Metropolitan Areas. Driven quickly by industrialization, three metropolitan areas, i.e. Tokyo, Osaka and Nagoya Metropolitan Areas came into being. The highly centralized urbanization has driven the high-speed development of urbanization in Japan. To intensify the driving and radiation effect of metropolises, flyover-crossing traffic has been another important guarantee for the development of urbanization in Japan. Convenient traffic has given rise to a great number of functional satellite cities surrounding metropolises, which have played an important role in relieving various pressures in metropolises.

In the process of industrialization and urbanization in Japan, market has been an important force driving the urbanization. But the government's guidance and measures of rule by law are also essential. The government plays its role appropriately, providing important decision-making basis for the sound development of urbanization. Through scientific planning and effective guidance, the market mechanism plays its basic role in allocating resources in the process of urbanization, effectively avoiding such prominent problems as subjective bias resulted from human factors, destructive enthusiasm of administrative wills, and disorderly growth with loose rein.

---

1) Elaine Kamarch: Experience and Lessons from Reform of Governments in Different Countries over the Past 2 Decades, *Comparative Economic & Social Systems*, 2005 No.6.

Facing the problems resulted from urbanization and industrialization, Japan finds that it may be impossible to ensure the achievement of economic and social development goals exclusively through the play of roles of market and government. It needs the interaction of stakeholders including the government, enterprises and residents, requiring a set of economic and social operation mechanisms established through social innovation, in order to achieve coordinated supply and demands. The supply of public products from the government shall meet local demands and be really implemented, and the residents' demands should be expressed effectively. Therefore, as demanders, the residents shall participate in and assess the process of supply of public products and service by the government, and make their due contribution to social innovation. The "Chuo University Tokyo・Hachioji City Model" is exactly a government-residents interaction system designed to encourage social innovation.

The study of this research group also involves the comparison of two megacities in East Asia: Tokyo and Beijing. These two cities have more things in common, both being the political, economic and cultural center of their own country, both with highly agglomerated population, both being a society with mega-population. The highly dense living of mega-population will bring huge risks and challenges for the cities and communities. According to British sociologist A. Giddens, living in a highly modern world is living in a world of opportunities and risks. The modern society is a society with high risks. Due to the high density of population, some local or sudden events in mega-cities may possibly result in great social disasters. Previously we had social risk investigations in several mega-cities in East Asia including Beijing and Tokyo. Papers provided this time also show similar comparative studies.

III. Qinghe Experiment

The 1.3-billion-plus population in mainland China is doing an urbanization experiment which is the largest in the history of human, and China's reform and opening up is so far the largest modern experiment across the world. The study on governance of grassroots communities in China needs to detect and solve social problems in communities of certain size, and find out ways for the urbanization and modernization of a society with huge size and high density of population. Just in such a context, the research group led by me started the experiment of Qinghe grassroots community.

Qinghe Sub-district is located in the northeast part of Haidian District, Beijing, China, with a total area of 9.37 km^2, and total population of about 180,000, including more than 80,000 local residents and more than 90,000 non-local ones. Now Qinghe consists of 28 community residents' committees. There

are extremely complicated types of community here, including both high-end and top-grade science parks, high- and middle-grade commercial housing communities, and declined unit courtyards, and lagging urban villages, and non-local population centers with bad conditions. The population composition is also extremely complicated here. There are both high-income entrepreneurs, high-tech talents, white-collars, and old residents moving from old districts, traditional laid-off workers, low-income migrant workers, and even farmers with original household registration. Qinghe area is an epitome of drastic changes in Chinese society over the past 38 years of reform and opening up. All problems in China's reform and social change can be tracked in Qinghe area.

From Qinghe Experiment we see that, in terms of the power of the government, market and society, society is still the weakest now. The prominent problems include insufficient development of society, and insufficient participation of community residents. China is a government-dominated society. Certainly, a strong government power is good for overall regulating and control, but will restrain the vitality of society. Before the reform and opening up, China's problem in mechanism and system was the serious absence of market. Therefore there was the severe insufficiency of economic supply. After the reform and opening up, the market-oriented economy system was established stepwise. In Qinghe area, this is reflected by land marketization and introduction of real estate mechanism, which has indeed greatly stimulated the real estate economy, and significantly increased the economic aggregate, but caused a lot of problems of unbalanced development. We think that, the market development is as important as the social development. Moreover, without the social development, the real development of market will be impossible. This is also one of the greatest problems in China's reform and development. Now China's market has made great development. But the social development is seriously lagging behind. Therefore, we need to reform the systems and mechanisms that constrain the social vitality and social development, and provide more people with the opportunity to take initiative in social governance. These are our theoretical frameworks for initiating the Qinghe Experiment.

Chapter **2**

Innovation of Green Technology, Redistribution of Global Investment Funds and Emission Trading in the Paris Agreement Scheme of Climate Change[1]

Hiroshige TANAKA

Professor of Faculty of Economics, Chuo University, Tokyo, Japan.

Abstract

The climate change is well known as global public goods. Provision of global public goods is likely to convey market and government failures in the global community. The global community should prevent these failures from transforming into complicated issues. In the Paris Agreement adopted in COP 21, 2015 each member country should announce voluntarily the target to reduce the emission of the greenhouse gases.

We construct the integrated scheme for the global climate change issues. In the firm structure of agreement each participant of this scheme should owe the obligation to be attained. Markets of emission trading could be designed to be an effective option for the purposes and should be improved in the practical experiences positively. Many governments have promoted policies to innovate environmental technology for another purpose of generating energy efficiently. By developing the integrated theoretical model of global community, we can expect to manage the efficiently constructed mechanism with the green innovation and the scheme of emission trading market. In this paper, we make a method to investigate the social impact of emission trading market on the global community. The impact analysis will enforce the driving power to guide the global community into the effective mechanism to reduce greenhouse gases.

Key words: the Paris Agreement, market of emission trading, innovation of environmental technology, redistribution of funds for investment, global community.

1. Introduction

In the globally accepted view, the programs to decrease greenhouse gases in the Kyoto Scheme should be reconstructed in the second commitment period, 2013-2020. It is expected that the series of conventions such as the Paris

---

1) This paper is produced in English to develop Tanaka (2013) written in Japanese.

Agreement in COP 21 could establish the appropriate mechanism after 2020 to mitigate climate change problems. Regarding the main discussing point in this research papers, the problems of the climate change do not only need to improve solubility of imperative problems in the global community beyond the framework of states, but also require the local community to solve the inherent issues. The climate change problems involve many local issues. The local community is obliged to confront with the inherent regional issues but should not dedicate only to the own region. Even if a single local community came to the dead lock, the global community could reach to find out clues to the problems with a cooperation of members. The increasing social needs in the local communities have appeared globally as the common phenomena. The social needs that could not be satisfied in the local community flow out into the issues of the global community. Consequently, the global community becomes to face the increasing social needs. Some local issues could be improved by the efficient support of the global community. The global community usually seems to be an imaginary and abstract subject, but should be organized according to various social needs. The global community sometimes might appear to be only responsible entity for global issues. But it has not obtained the same controlling functions as the state and could be authorized in a limited range of enforcements of regulation. The social and economic system of the global community is managed by the competitive and cooperative mechanism that is dominated by voluntary methods.

The global community provides public goods voluntary. The voluntary provision of global public goods that depends on the international agreement is influenced by the interests of many players participating the negotiation. The interests depend deeply on the estimated values of the future environments. The various participants and the uncertain estimation on the future might make the prospect of the goal out of the negotiation unclear. To show the way out from the present confusion, we should make clear the interrelation among innovation of environmental technology, the fund raising system for the investment and voluntary contribution for climate change issues. The funds raising scheme turns the innovation into real investment for the green economy.

Tanaka (2016) argues that the market and government failures might cause bottleneck in the global public goods and that the dead weight loss in the global market should be shared by the all members of the community. Tanaka (2016) suggests the appropriate and diverse rate of burden for each country according to concern with the bottleneck.

Although the distribution of the contributions to reduce the greenhouse gases is decided principally by political arrangements, actually the voluntary

approach is expected to support a large part of contributions in the framework of the Paris Agreement. The voluntary approach is managed and operated by private economy and residents. The voluntary approach is controlled not only by costs and benefits based on the market mechanism but also social impacts on the global and local communities.

The environmental economics provides the theoretical foundations that the emission trading could activate efficient market mechanism and achieve the targeted reduction of the target effectively. We argue in this paper that the emission trading among local communities or states could propel voluntary contributions to reduce greenhouse gases in social and economic activities effectively. In particular, the markets of emission trading make effects on the inter states redistribution of funds for green investments. The transfer of fund could promote innovation for the environmental technology in the global community.

By the theoretical framework with market of emission trading, we could analyze the climate change issues such as the scheme of voluntary contribution, the innovation for the environmental technology, the transfer of the funds for green economy and the social cost sharing for climate change in a single integrated theoretical model.

It is assumed in this paper that one country announces publicly the own target to reduce the gases but might not owe the obligation to achieve it. Whether obligations are defined or not, the governments must pursue the feasible program to reduce the gases in the future. The market solution is constructed to correct the welfare loss in the demand and control. If the system of the market supports to achieve the target to reduce the gases effectively, each government might make a more positive decision to reduce the gases.

If many governments share an optimistic view to achieve the targets, the international negotiation for reducing the gases could make a great progress cooperatively. Unfortunately, some great disasters caused by the climate change might suffer people diversely in many regions. If the critical expectation prevails, the effective program to prevent crisis should be argued seriously on the negotiation processes. As a result, a positive agreement will be likely to be available with the intensive discussion.

Recently, coping with the economic development in the global scale, many countries intend to acquire a low price and a large amount of energy sustainably. Many governments promote policies to innovate environmental technology generating energy efficiently. The social impact of emission trading could evaluate the main obstacles to lead us to the profitable agreement for the inhabitants in the future generations on the earth. The participants in the

market would trade voluntarily the emission permits by their own expectations. The uncertainties caused by innovations in environmental technology and developments of economies have a possibility to influence the target aimed to be achieved[2] and the scheme itself. Tanaka (1998) analyzed the efficient scheme of emission trading by using the cost benefit approach presented by Yohe (1998). Tanaka and Hasegawa (2003) developed the analysis in the uncertain situation by using a sensitive analysis of the cost benefits. As a method of social impact approaches[3] on emission trading prevails the significant meaning of the Paris Agreement, this paper makes clear the prospects of the scheme to be performed globally. Tanaka (2008) argues that the properties of intensities of energy and carbon should become effective signal toward the low carbon community.

This paper is constructed as follows. In the section 2, a two countries model is formulated to analyze the negotiation to reduce the gases in the frame work of the Kyoto Mechanism. The model of the two countries expresses the following assumptions. The country one obtains the responsibility to reduce the gases. The country 2 dose not owe the obligation of reduction at the present but is possible to accept the obligation by the result of international negotiation to reduce the emission of the gases. This model has the implication that the social impact of the market scheme induced by the cap to reduce the gases depend on the improvement of the technology and the scale of caps. The section 3 discusses the main points in the Scheme of the Paris Agreement. In particular, if the countries which owed obligation to reduce the gases are allocated the suitable amount of emission permits, we could construct a management rule of the emission trading market under the uncertainty regarding the progress of the environmental technology.

We summarize the 7 main results in this paper as following. 1. The improvement of technology decreasing emission of greenhouse gases in the country 1 increases the surplus of emission trading for the country 1 but declines the surplus in the country 2 from emission trading. 2. On the contrary, the improvement of technology decreasing greenhouse gases in the country 2 enhances the surplus of emission trading in both countries. 3. In the case that the requirement for the county 1 to reduce emission of the gases is greater to some extent than the one for the country 2, the enlargement of the regulation cap for the county 1 increases the surplus of the both countries from using the emission trading. The increase in the regulation cap for the country 2

---

2) Ellerman et al (2007) and Burney (2010) survey theoretically the some related problems with emission trading.

3) Epstein and Yuthas (2014) discuss the implication and the management of social impacts.

decreases the surplus of the country 1 to use the emission trading. To initiate the emission regulation for the county 2 implies that the relative obligation of the country 1 is lowering and that the country 1 could attain the reduction target with the lesser emission permits. 4. When the regulation for the country 1 enlarges, the country 2 becomes more sensitive to join the market of the emission trading. To enforce the regulation for the county 2 shrinks the surplus on the own country market.

We consider the case that a large scale of uncertainty prevails in the following cases 5–7. 5. The country 1 can obtain net benefit from the market of emission trading. 6. If the regulation cap for the country 2 increases in comparing with the counterpart of the country 1, the country 2 is possibly to receive a negative benefit from the market of emission trading. 7. If the requirement of regulation for the country 1 is stated in the large enough level, both countries can obtain a positive expected benefit from the market of emission trading. Although the uncertainty regarding the agreement from the negotiation does not disappear, the market of emission trading could pave the way toward the agreement with the obligation to be achieved.

2. Two Countries Model Analysis in the Framework of Kyoto Protocol
2–1. A Model Analysis on the International Negotiation on the Climate Change
In the framework of Paris Agreement for the climate change, some counties declare the targets to reduce the greenhouse gases. Others do not have targets nor obligations for reducing gases but should declare the efforts to contribute for the climate change problems. Some countries might not ratify the agreement officially and remain as outside member of the agreement. Although some types of approach to decrease greenhouse gases are available, we must construct a comprehensive management system to mitigate problems of the climate change.

In this paper we provide the theoretical foundation to reform international framework to reduce the emission of the gases. To simplify the analysis, we make clear the assumptions about the model as follows. The countries in the world are classified into two types. The country 1 obtains the obligation to reduce the gases according to the publicly announced target. The country 2 is not required to take any obligation to reduce the gases in the frame work of the agreement[4].

In the first, in this model analysis the country 1 is assumed to be required to reduce the greenhouse gases by e but the country 2 is supposed to owe no

---

4)   Many arguments focus on the Post Kyoto framework. For example, Aldy and Stavins (2007) survey the main subjects on this topic comprehensively.
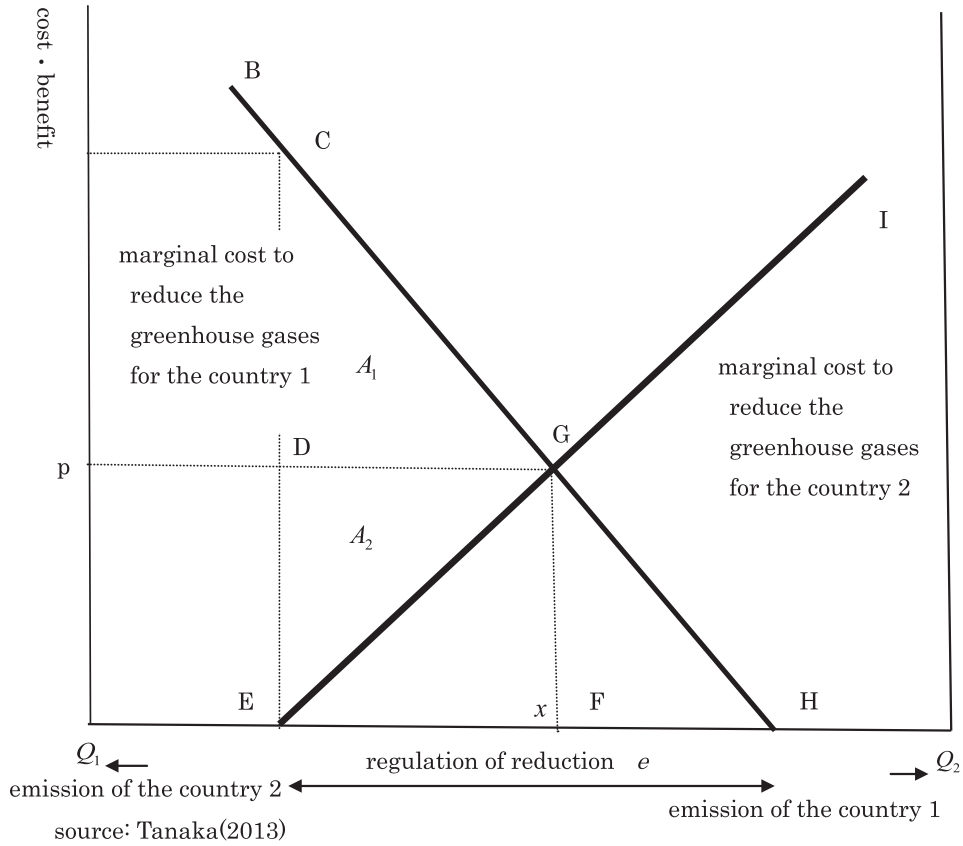
Figure 1. The country 1 is required to reduce the greenhouse gases unilaterally.

regulation for emitting the green gases. In the Paris Agreement the country 1 could decide e voluntary, but neighboring countries evaluate the value of e critically. The variable e is assumed to be exogenous in this model. This paper investigates the mechanism that both country 1 and 2 reduce the emission of the gases cooperatively. We present a popular approach of the cost benefit analysis by Figure1. Figure 1 is depicted as follows. The emission of the gases is measured along the horizontal axis. When the country 1 moves to the right, the country emits more the gases. On the contrary, reducing the emission of the gases moves the country 1 to the leftward. The reducing the emission of the gases in the country 2 is expressed by the movement from the left to the right. The benefits and the costs to increase or to decrease emission of the greenhouse gases are indicated along the vertical axis. The largest possible emission amount for the country 1 is expressed by the length of Q_1H. As the country 1 increases the reduction of the gases, the efforts to reduce the gases

are represented by traveling to the left on the marginal cost curve BH. The curve EI shows the marginal reducing cost of the country 2. The movement from the start point E to the right shows the increasing marginal cost of reduction. The curves HB and EI are increasing marginal costs and have slopes $-b_1$ and b_2 to indicate the efficiency of decrement of the gases for the both countries.

It is supposed that the country 1 accepts the e units of reduction of emission. The market of emission trading lowers the burden on the country 1 from the area of the triangle CEH, to achieve the target without the market, into the summation of the area of the triangle GFH and the area of rectangular DEFG that expresses the cost of purchasing the emission permits in the market. The net payoff of the country 2 from the market is the area of the triangle DEG by deducting the cost to reduce the emission in the country 2 from revenue of selling the permits.

Without the market the country 1 must pay the cost to be equal to the area of the triangle CEH. But the country 2 must finance the fund of the area of triangle EFG to initiate the project to reduce the gases. If the country 2 fails to finance the cost of the reduction, the country could not join the framework of the Paris Agreement. The joint reduction of the gases by the both countries should be founded by the mechanism of sharing reduction costs. Some options of sharing the cost are available for the both countries. The country 1 could offer the country 2 the actual cost of reduction shown by the area of triangle EFG and the surplus A_2. But the required reduction cost for the country 2 is indicated by the area of triangle EFG. The process of the negotiation in the Paris Agreement should focus on the incidence of the surplus A_2. In particular, the financial support of the country 1 for the country 2 is expected to be effective to reduce the greenhouse gases globally. But the negotiations in the global community could not prospect the optimal results. As many complicated factors may influence the results, we should analyze the process of negotiation more closely.

The establishment of the market of emission trading organized by many members of the Paris Agreement is supposed to lead the negotiation to the suitable aim. Actually, the market cannot work completely, the allocation of the surpluses is determined not by the theoretical reasoning but by the negotiation powers of the both countries. But the theoretical analysis indicates that regulation regarding emission of the gases and improvement of the technology to reduce the climate change state the feature of the market. The alterations of the above factors make influence on the negotiation structure of member countries and might move into another trading solution by facilitating the cooperative managements system for the problems of the climate change.

The equilibrium of the emission trading market equalizes the marginal costs to reduce emission of the gases for the two countries and is represented by the point G. The price and the quantity in the market equilibrium are presented by p and x. The country 1 gains the surplus A_1 from the market of emission trading to be equal to the area of the triangle CDG. The surplus of the country 2 from emission trading is denoted by A_2 and expressed by the area of the triangle DEG precisely. The equilibrating condition of marginal costs for the both counties is expressed by the equality,

$$b_2 x = b_1 (e - x).$$

Transforming the above equality, the market quantity and the market price are stated by

$$x = \frac{b_1 e}{b_1 + b_2}, \tag{1}$$

$$p = \frac{b_1 b_2 e}{b_1 + b_2}. \tag{2}$$

The progress in the technology to reduce emission of the greenhouse gases is supposed to bring a new effect on the decrement of the marginal cost in the Figure 1. The effect implies to lower the coefficients b_1 and b_2. By differentiating (2) with b_1 and b_2, we make assure the signs obtained in (3) and (4).

$$\frac{\partial p}{\partial b_1} = \frac{e b_2^2}{(b_1 + b_2)^2} > 0. \tag{3}$$

$$\frac{\partial p}{\partial b_2} = \frac{e b_1^2}{(b_1 + b_2)^2} > 0. \tag{4}$$

The expressions of (3) and (4) imply that the progress of the technology to reduce emission of the greenhouse gases in the both countries lowers the market prices. Similarly, the differentiation with e expresses,

$$\frac{\partial p}{\partial e} = \frac{b_1 b_2}{b_1 + b_2} > 0. \tag{5}$$

The above expression (5) describes that the enforcement of regulation to reduce the emission of the gases raises the market price of emission trading. We could make certain the positive correlation between the price and the regulation cap in the market of emission trading by the mathematical formula. The market price evaluates to reduce the emission of the gases. The expression (5) implies that the enforcement of regulation enhances the caution for the problems of the climate change. The expressions (3) and (4) mean that revolution of

the technology regarding emission of the gases mitigates the critical situation of the climate change. The finance to improve the technology is the issue to be argued in the following section.

2-2. Social Welfare Analysis and the Market of Emission Trading

The motivations for the participants to use the market are influenced by their surpluses of the emission trading. The larger the surplus becomes, the more profit the two countries could obtain. The surplus could be funded on the technological revolution to reduce the emission of the gases. The investment financed by the surplus is expected to become the main contributing factor to the problems of climate change. This section makes sure the mechanism by the market to increase the investment for the problems of the climate change. The surplus is a significant index for the two countries to gain their own merits in the market of emission trading. We could evaluate the surpluses of the two countries by the areas of the triangles as the following expressions (6), (7) and (8).

$$A_1 = \frac{e^2 b_1^3}{2 (b_1 + b_2)^2} \cdot \qquad (6)$$

$$A_2 = \frac{e^2 b_1^2 b_2}{2 (b_1 + b_2)^2} \cdot \qquad (7)$$

$$A_1 + A_2 = \frac{b_1^2 e^2}{2 (b_1 + b_2)} \cdot \qquad (8)$$

The regulation cap e on the emission of the greenhouse gases has been discussed in one of the significant subjects on the conventions of the climate change. The innovation in the environmental technology might offer the newly available choices for the agreement. The suitably composed combination between the innovation of environmental technology and the emission trading is expected to be an effective harness to make the negotiation of the climate change forward.

This section makes confirm the above reasoning in the theoretical framework. The innovation of environmental technology is brought by fiery competitions in various fields. If the competition promotes the efficient reduction of the greenhouse gases, the agreements in the multinational negotiation of the climate change are influenced by the results of the competition among many technologies. The globally spreading emission trading seems to be connected with the innovations deeply. Tanaka (2012) proposes the effective policy index to support the reduction of the greenhouse gases by

using competitive market mechanism. To analyze the relation between the innovation and the activation of the emission trading, the surpluses of each countries A_1 and A_2 are differentiated by b_1 and b_2 indicating efficiencies to reduce the emission.[5] Since the country 1 is expected to be obliged to contribute greater reduction in the emission of the gases than the country 2, the former is assumed to employ a higher efficient technology of cost than the latter. This relation is assumed to be expressed by the inequality, $b_1 < b_2$.

$$\frac{\partial A_1}{\partial b_1} = \frac{e^2 b_1^3 (b_1 - 3b_2)}{2 (b_1 + b_2)^3} < 0. \tag{9}$$

$$\frac{\partial A_1}{\partial b_2} = \frac{e^2 b_1^3}{(b_1 + b_2)^3} < 0. \tag{10}$$

$$\frac{\partial A_2}{\partial b_1} = \frac{e^2 b_1 b_2^2}{(b_1 + b_2)^3} > 0. \tag{11}$$

$$\frac{\partial A_2}{\partial b_2} = \frac{e\ b_1 (b_1 - b_2)}{2 (b_1 + b_2)^3} < 0. \tag{12}$$

The above inequalities imply that the revolution of environmental technology in one country influences differently on the surpluses of the two countries. The negative sign in (9) and (10) implies that the revolutions of environmental technology in the both countries increase the surpluses of the country 1. The market change to decrease b_1 shifts the equilibrium point G in the Figure 1. The leftward rotation of the curve BH around the point B moves the market price lower greatly but declines the quantity slightly. Lowing b_2 rotates the curve EI rightward around the point E. The changes increase A_1. The expression (9) means downing price and decreasing quantity. The expression (10) states that the price decreases and the quantity enhances in the market change. In particular, the improvement of technology in the country 2 raises the surplus A_1. The investment to induce the innovation on the emission of the green house gases in the country 2 could be supported by the technologies and funds of country 2 and the emission trading market could facilitate investment from the country 1. By using the emission trading the country 1 is encouraged to invest the revolutions of environmental technology in the both countries. The positive and the negative signs in (11) and (12) mean that the surplus of the country 2 is decreased by the revolution of technology in the country 1 but

---

5) Tanaka (2010a), (2010b) argue the theoretical approach on the problems of the climate change and revolution of environmental technology.

increased by the achievement of revolution in the country 2. The surplus of the country 2 is decreased by the investment on the technology in the country 1 but is raised by the innovation in the country 2. The investment on the country 2 increases the relative advantage of the country 2 in the emission trading market but the investment on the country 1 declines the advantage. In the situation that the investment on the country 1 executes fine achievements on the target of reducing the emission of the gases, the country 2 declines the profit or the incentive to enter the emission trading market. The development of the emission trading market requires sufficient investment to reduce emission of the green house gases in the initiation.

The country 1 that owes the obligation to reduce the gases endeavors positively the technology revolution with the support of the emission permit market in the both countries. The transaction in the globally organized emission permit market involves the transfer of the funds from the country 1 to the country 2. The country 2 without obligation to reduce emission of the gases could not obtain a positive benefit by investment on the country 1. The country 2 needs more funds from the global community according to the Paris Agreement.

In this paper the coefficients b_1 and b_2 express the cost to reduce one unit of the greenhouse gases. Kolstad[6] argues the effectiveness of intensity analysis such as energy intensity and carbon intensity in the dynamical and uncertain process. We make clear that the fund for investment could be financed in the emission trading could be under the value of the surplus exhibited by the coefficients b_1, b_2 and e. Consequently, this paper suggests the effective policies that could remove the obstacles on the appropriate cooperation on the international conventions of climate change in a large part.

3. Structural Analysis on the Paris Agreement Scheme
3-1. Regulation of Reduction on the Country 2
In 2008, G8 at Toyako Summit declared the official target to reduce emission of the greenhouse gases 50% by 2050. To achieve the medium or the long term target, the international conventions will confirm the structure of the Paris Agreement Scheme.

In the process of the agreement the discussion focuses on the regulation of emission for the countries that have not obtained obligation of reducing the gases. Although the agreement cannot establish the regulation officially, the methods of the market should contain the contract with the credit. The expectation on the revolution of environmental technology might also have the

---

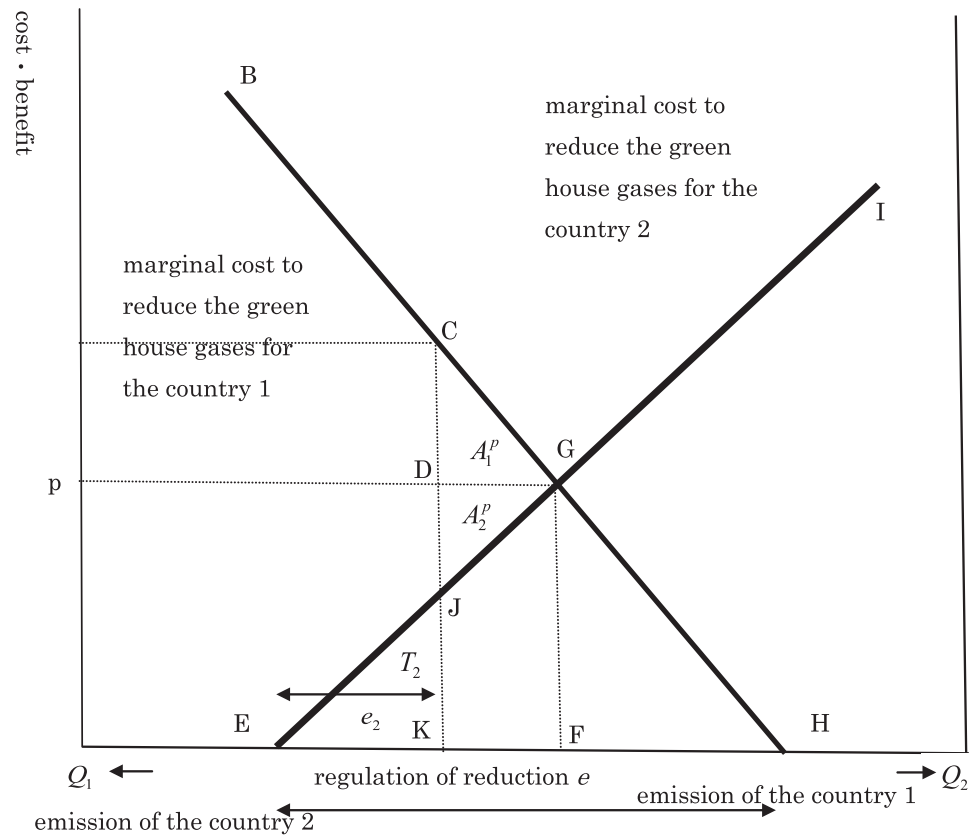6)   Refer the chapter 7 of Hansjürgens (2005).

Figure 2. The additional regulation for the country 2.

influence on the process to achieve the agreement. This section discusses the additional regulation e_2 for the country 2 and the uncertainty about the revolution of the environmental technology.

We replace Figure 1 by Figure 2 to consider the structure of the Paris Agreement Scheme suitably. To improve the effect to reduce emission of the greenhouse gases globally we should facilitate the regulation. It is assumed that the regulated amount is less than the transaction quantity ($e_2 < x$). The country 2 must pay the cost to reduce the emission expressed by the area of the triangle JEK (T_2). The surplus of the country 1 and country 2 are A_1^p indicated by the area of the triangle CDG and A_2^p (the area of the triangle DJG). The surpluses obtained by the both countries are equal to the expressions (13), (15) by calculating the net benefit from the emission trading.

$$A_1^p = \frac{b_1}{2} \left\{ \frac{eb_1 - e_2 (b_1 + b_2)}{b_1 + b_2} \right\}^2. \qquad (13)$$

$$A_2^p = \frac{b_2}{2} \left\{ \frac{eb_1 - e_2 (b_1 + b_2)}{b_1 + b_2} \right\}^2. \qquad (14)$$

$$A_2^p - T_2 = b_1 b_2 e \frac{b_1 e - 2 (b_1 + b_2) e_2}{2 (b_1 + b_2)^2}. \qquad (15)$$

In the next, we investigate the effects that regulations e and e_2 affect the surpluses of the both countries. If the condition $eb_1 > e_2 (b_1 + b_2)$ is satisfied, the different signs of surplus on the country 1 are assured by noticing (16) and (17).

$$\frac{\partial A_1^p}{\partial e} = \frac{b_1^2 \{eb_1 - e_2 (b_1 + b_2)\}}{(b_1 + b_2)^2} > 0. \qquad (16)$$

$$\frac{\partial A_1^p}{\partial e_2} = \frac{b_1 \{eb_1 - e_2 (b_1 + b_2)\}}{(b_1 + b_2)} < 0. \qquad (17)$$

It is supposed that the regulation for the country 1 is more strict for the country 2. As the regulation e is raised, the surplus obtained by the country 1 from the market of emission permit increases. The higher regulation the country 2 confronts, the lower the surplus of the county 1 from the emission trading becomes. In this case the motivation for the country 1 to use the market of the emission permit is supposed to decline. The contribution by the country 1 to reduce the emission is shared by the country 2. The country 1 could raise more fund to invest on the reduction of the gases by the enhancing regulation of own country, but the increasing regulation of the country 2 lowers the investment in the country 1. The various regulations of emission permit promote the dispersion of investment on reducing emission between the both countries.

The relation between the surplus of the country 2 from the emission trading and the regulations for the both countries are stated the signs of the expressions (18) and (19). If the inequality

$$e > \frac{(b_1 + b_2) e_2}{b_1}$$

is supposed to be satisfied, we obtain the expressions (18) and (19).

$$\frac{\partial (A_2^p - T_2)}{\partial e} = b_1 b_2 \frac{b_1 e - (b_1 + b_2) e_2}{(b_1 + b_2)^2} > 0. \quad (18)$$

$$\frac{\partial\,(A_2^{\,p} - T_2)}{\partial e_2} = -\frac{b_1 b_2 e}{b_1 + b_2} < 0. \tag{19}$$

The above inequalities state that the uprising total regulation increases the motivation for the country 2 to participate the emission trading and that the increased regulation on the country 2 curtails the motivation of this country. The enforcement of regulation that a large number of countries to reduce emission of green house gases compensates the emission trading.

3-2.   Progress of Technologies and Regulation on the Emission

Principally, the emission market is based on the voluntary participation of each country. The surplus analysis makes clear the motivation of each country to participate the emission trading and sources of investments. The surplus depends on the progress determined by the improvement of environmental technologies and the regulations on the emission. However, the progress is supported by successful achievements in many fields of technology and demands a large amount of funds. The investment on the revolution of technology requires a large scale of funds but could not necessarily lead to the success for the business. The innovation of technology could not be achieved without the severe competitions.

The uncertainty on the revolution of environmental technology appears a dark shadow in front of the international negotiation of the climate change. The traditional approach for the uncertainty supposes the set of the more and the less successful contingents of technology evolution for the both counties $(b_1^1,\ b_2^1)$ and $(b_1^0,\ b_2^0)$. The probabilities to occur the two events are denoted by π and $1-\pi$. Mathematically, the following inequalities are supposed,

$b_1^1 < b_2^1,\ b_1^0 < b_2^0,\ b_1^1 < b_1^0,\ b_2^1 < b_2^0.$

The expected net benefits for both countries from the emission market E $(A_1^{\,p})$ and $E\,(A_2^{\,p} - T)$ are stated by the expressions (20) and (21).

$$E\,(A_1^{\,p}) = \frac{1}{2}\left\{\pi b_1^1\left(\frac{b_1^1}{b_1^1 + b_2^1}\,e - e_2\right)^2 + (1-\pi)\,b_1^0\left(\frac{b_1^0}{b_1^0 + b_2^0}\,e - e_2\right)^2\right\}. \tag{20}$$

$$E\,(A_2^{\,p} - T) =$$
$$\frac{1}{2}\left\{\frac{\pi b_1^1 b_2^1 e}{b_1^1 + b_2^1}\left(\frac{b_1^1}{b_1^1 + b_2^1}\,e - 2e_2\right) + (1-\pi)\,\frac{b_1^0 b_2^0 e}{b_1^0 + b_2^0}\left(\frac{b_1^0}{b_1^0 + b_2^0}\,e - 2e_2\right)\right\}. \tag{21}$$

Since the sign of (20) is non negative, the country 1 could gain the expected net benefit from the market of emission permit under uncertainty. However, the incentive for the country 1 to use the scheme of the markets depends on the

values, $\dfrac{e_2}{e}$, $\dfrac{b_1^1}{b_1^1 + b_2^1}$, $\dfrac{b_1^0}{b_1^0 + b_2^0}$, πb_1^1, $(1-\pi)b_1^0$. By reminding that the expression (20) is transformed to

$$E(A_1^p) = \frac{e^2}{2}\left\{\pi b_1^1\left(\frac{b_1^1}{b_1^1 + b_2^1} - \frac{e_2}{e}\right)^2 + (1-\pi)b_1^0\left(\frac{b_1^0}{b_1^0 + b_2^0} - \frac{e_2}{e}\right)^2\right\}. \tag{22}$$

In the right hand of (22), the first term implies that enhancing the target to reduce the emission in the global community makes the market trading in the country 1 more profitable. The innovation of green technology could not perform the excellent achievement, at least one of b_1^1, b_1^0 is kept in high level. Suppose that the regulation of the country 2, e_2 is kept in approximately zero and that $b_1^1\left(\dfrac{b_1^1}{b_1^1 + b_2^1} - \dfrac{e_2}{e}\right)^2$ or $b_1^0\left(\dfrac{b_1^0}{b_1^0 + b_2^0} - \dfrac{e_2}{e}\right)^2$ remains in significant values. In the situation, the expected net benefit of the market trading involves investment to decrease emission of the gases.

To the contrary, the previous values on $b_1^1\left(\dfrac{b_1^1}{b_1^1 + b_2^1} - \dfrac{e_2}{e}\right)^2$ and $b_1^0\left(\dfrac{b_1^0}{b_1^0 + b_2^0} - \dfrac{e_2}{e}\right)^2$ approximate to zero, the expected value is too small to prompt any investment. That is the market is effective in the limited range.

It is supposed that the regulation for the country 2 e_2 enlarges. When the condition

$$2\frac{e_2}{e} \geq \max\left\{\frac{b_1^1}{b_1^1 + b_2^1}, \frac{b_1^0}{b_1^0 + b_2^0}\right\}$$

is satisfied, the expected net benefit expressed by (21) is more likely to be negative. It implies the following case. As the regulation for the country 2 increases beyond the extent, this country would change the position from the supplier to the demander in the emission market. Around the turning point the country 2 loses motivation to utilize the market of emission. After the stage the country 2 has the same incentive as the country 1. The country 2 is the subject of analysis by using not (21) but (20). Since (20) and (21) are the quadratic forms mathematically, the values are positive for the sufficiently large e. In the range of values, the both countries evaluate the positive net benefit of the emission market. After the regulations for the two counties reach a sufficiently large range appropriately, the emission market plays the effective method for solving the problems of the climate change.

The governmental supports could make a significant effect on the evolution of technology. Although the market policies of the government skew the efficient allocation of the market mechanism and deteriorate the budget deficit, the positive policies to support environmental innovation seek for raising the

probability π to achieve the progress in the environmental revolution. The effective polices to promote environmental innovation are stated by (20). Reminding that the first term in (20) is the product of πb_1^1 and $\dfrac{eb_1^1}{(b_1^1 + b_2^1)^2} - e_2$, the uprising probability supported by the government keeps πb_1^1 in a high value and increases $\dfrac{eb_1^1}{(b_1^1 + b_2^1)^2} - e_2$ by lowering $(b_1^1 + b_2^1)^2$. In this circumstance, the demand of the country 1 to use the emission market is increasing[7]. The expression (20) explains that the prospect of the agreement of the climate change depends on the many complicated factors but that the governmental positive policies for revolution of environmental technologies and regulations for emission of gases are deeply concerned with the growth of the emission market[8].The theoretical consideration in this paper could evaluate the following scenario steadily.

If the country 2 has an effective achievement on decrease of the gases in prospect of the progress of environmental technologies, this country could facilitate the emission market profitably in the view of cost benefit analysis.[9]

In the preceding discussion, the emission trading market could be evaluated to be effective method to reduce the green house gases. We should notice the three significant implications as the performances of the emission trading market. In the first, the serious intension to mitigate the climate change problems could be shared in the global community. In the second, the governmental policies to promote the technological innovation of the green economy could improve the significant effects with the support of the emission trading markets. The synergy between governmental innovation on the green economy and the emission trading market could make effects in a middle term. In the third, when the evolution in the green technology is dominated in the uncertain situation, the emission trading market will be possible to promote investment on green economy by the enhancing regulation on the emission of the gases.

4. Concluding Remarks

To mitigate the problems of the climate change the effective reduction of the greenhouse gases is the critical factor for the global community. The

---

7)   If the values of (20) and (21) remain a sufficiently large, the country would accept the regulation with the net benefit.
8)   The social innovation strategy for the low carbon society are argued by many authors such as Tanaka (2012) and Robert (2013).
9)   Tanaka・Hasegawa (2003), pp.85.

globalizing economies contribute to spread the sources of the emission of greenhouse gases in a large area. The enlargement of the market economies causes the market failure in the global community pervasively. The coping with this type of market failure has been appeared as the chronic problem and could be classified as the governmental failure in the global community. The enlargement of the economies raises the importance to use the market policies in the international coordination of resources and environmental problems. The market policies are composed by two types of approaches. One type attempts to regulate economic activities to be harmonized with global community. Another type is willing to enlarge the role of market to achieve environmental and social problems by the incentive mechanism of economy. For example, the FIT is widely recognized as the innovative scheme to prevail the renewable energy. Although the many market policies are designed increasingly to promote innovative and environmental technologies, actually a large amount of governmental polies may induce the miss allocation of resources. The emission trading is expected to play the significant role of solving government failures. In particular, the emission trading is the indispensable method to manage the reduction of the green gases globally.

　We must promote the revolution of environmental technology and the reform of the social structure to reduce the emission of greenhouse gases effectively. The two incentive mechanisms of the market and the voluntary contribution in the community must work together in the same direction to achieve the target with the least social cost. In this paper we recognize that the development of the social system could be brought not only by the market mechanism but also by the collaborating restructure in the social system. In the mechanism to reduce rising emission of green house gases, emission trading is likely to be accepted as the market solution. The theoretical approach in this paper makes certain that the incentive mechanism of the market could improve the social and environmental problems efficiently but should be supported by estimating social net benefit of global community.

References

Aldy,J.E. and R.N.Stavins(2007), *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World*, Cambridge, Cambridge University Press.

Burney,N,E.(ed.)(2010), *Carbon Tax and Cap-and-Trade Tools: Market-based Approaches for Controlling Greenhouse Gases*, New York, Nova Science Publishers Inc.

Ellerman,A.D., K.B.Bucher, and C.Carrraro(eds.)(2007), *Allocation in the European Emissions Trading Scheme*, Cambridge, Cambridge University Press.

Epstein,M.J.and K.Yuthas(2014), *Measuring and Improving Social Impacts: A Guidw for Nonprofits, Companies, and Impact Investors*, Sheffield UK,Greenleaf Publishing.

Hansjürgens, B.(ed.)(2005), *Emission Trading for Climate Policy: US and European*

perspectives, Cambridge, Cambridge University Press.

Roberts,T.P.Upham,S.Mander,C.McLachlan,P.Boucher,C.Gough and D.A.Ghanem, (eds.)(2013), *Low-Carbon Energy Controversies*, New York, Routledge.

Tanaka,H.(2008), "Two Intensities Analysis of London Accord," *Discussion Paper No 103 in Chuo University, Research Institute of Economics*, pp.1–9.

http://www2.tamacc.chuo-u.ac.jp/keizaiken/discussno103.pdf (2016.3.10)

London Accord website introduces this essay as an important contribution.

http://www.longfinance.net/programmes/london-accord/la-reports/la-citations.html (2016.3.31)

Tanaka,H.(2012), "Global Public Supports for Innovation in Environmental Technology," *London Accord*, pp.1–12. http://www.longfinance.net/images/reports/pdf/tanaka_innovation_2010.pdf(2016.2.10)

Tanaka,H.(2016), "The Finance System as Global Public Goods and the Regeneration of Global Communities," *London Accord*, pp.1–12. http://www.longfinance.net/programmes/london-accord/la-reports.html?view=report&id=533 (2016.2.10)

Yohe,G.W.(1998), "First Principle and the Economic Comparison of Regulatory Alternatives in Global Change", in Toth,(ed.) *Cost–Benefit Analysis of Climate Change:* The Broader Perspective, Basel, Birkhäuser Verleg, pp.17–28.

Papers Written in Japanese:

Tanaka,H.(1998), "Green Developing Mechanism and Market of Emission Permits." *International Public Economy Studies*, Vol.8, pp.14–21.

Tanaka,H. and T.Hasegawa(2003), "The Solution for the Global Warming Considering Uncertainty," Tanaka,H.(ed.) (2003), *Cost Benefit Analysis*, Chuo University Press, pp.63–87.

Tanaka,H.(2010a), "Climate Change and Revolution of Environmental Technologies," *Global Environmental Policy in Japan*, Vol.13, pp.1–14.

Tanaka,H.(2010b), *Problems of Climate Change and Strategies on Environmental Technology*, Chuo University Education GP.

http://www2.chuo-u.ac.jp/econ/gp/img/publish/2009bookletindex.pdf (2014.3.13)

Tanaka,H.(2013), Emission Trading in the Post Kyoto Scheme, *Keizairomsan; Chuo University*, Vol.54, pp.31–41.

Chapter 3
Public Goods and Political Trust in the East Asian Mega-Cities: An Empirical Study on Beijing, Seoul and Tokyo

Tianren GE [*] and Tianguang MENG
School of Public Management, Tsinghua University, Beijing, China

Abstract

As the foundation of government legitimacy and policy effectiveness, political trust mediates the relationship between the government and society and plays an important role in urban governance. Based on survey data from the three most influential cities in the East Asian region, namely Beijing, Seoul and Tokyo, the paper examines how the provision of public goods affects political trust. We make a distinction between infrastructural goods and social justice goods and find out that (1) public goods provision has a significant effect on political trust; (2) as compared to infrastructural goods, social justice goods plays a more significant role in contributing to political trust. This suggests that government should provide more social justice goods for enhancing political trust in these mega-cities.
Key Words: East Asia, Mega-City, Public Goods, Political Trust.

Introduction

Many researchers are concerned with the issue of governance of mega-cities which play fundamental functions in the global economic network. The global cities have been the "commanding heights" in the global economy (Sassen, 2001). The entrepreneurial government has to provide much better public goods to compete with the others in the global economic change (Harvey, 1989). However, global economic changes also bring about political and social challenges to these mega-cities. Increasing social inequality resulting from the global economy gives rise to a higher level of distrust towards the municipal governments (Sassen, 2011).

Under these circumstances, Beijing, Seoul and Tokyo governments have taken a series of initiatives to manage the economic competition, social risks and political challenges. The governments increased infrastructural investments in order to promote the economic growth, and initiated distribution or redistribution policies to lower social inequality. The governments provide not

[*] Email：getr2013@sina.cn
Cell: +86-188-1158-3985

only transportation, environment, food safety, and public security, but also employment, education, health care and pension service. In this paper, we ask the following questions. First, what are the influences of the public goods on the political trust of the citizens in these cities in general? Second, would different types of public goods have different effects on the political trust?

This paper examines the theories on political trust and conduct an empirical analysis on three East Asian cities including Beijing, Seoul, and Tokyo. The concept of political trust, as the foundation of governmental legitimacy and effectiveness of policy, provides us with an effective analytic tool for understanding the relationship between the people and government. This research does not only test the applicability of the rational choice model to explain the political trust in the East Asian area, but also has practical implications for the policy options for the governance of East Asian mega-cities. Moreover, we make a distinction between *the infrastructural goods* and *social justice goods* to explore the varying effects of different types of public goods. To make our findings more robust, we add the analysis of *satisfaction of government* as a complementary test. The previous research has found that political trust is closely related with *satisfaction of government* (Levi and Braithwaite, 1998). Based on the analysis, this article tries to offer some policy suggestions on the governance of these mega-cities.

Literature Review and Hypotheses

The empirical tradition of political trust can be traced back to Almond's study political culture (Almond and Verba, 1963). While some scholars believe that political trust comes from the general trust of human beings (Lane, 1959) or from social trust (Putnam, 1995), others argue that political trust arises from the political sphere and has its own properties; is the support to politicians, political organs, or political institutions (Easton, 1995). In the Chinese context, political trust is a belief on the positive consequences of the whole or partial political institutions (Shi, 2001). It is very important for us to explore the influential factors of political trust from both theoretical and practical perspectives.

So far, there are four approaches, namely the structural, cultural, rational and institutional, in examining political trust as a dependent variable. The structural approach owes its origin largely to Putnam's social capital theory and treats social capital as an exogenous factor to the political system to explain political trust (Putnam, 1993, 2000). Some other scholars are concerned with other structural factors including gender, age, education, income, and so on (Catterberg &Alejandro, 2006). Researchers have found that political trust was closely related to one's life circle or the period effects of political socialization.

Some research found education as the most influential factor that shapes the political trust of the youths based on a comparative study of the twenty-nine countries (Torney-Purta et al., 2004).

The cultural approach takes political culture as the primary explanatory factor. This theory argues that the political trust is depended more on the political culture or tradition. In the East Asian area, China, Korea or Japan share the common strong tradition of nationalism and the higher level of political trust on the state in a varying level. Chen found that the Chinese held a high level of emotional support but a low level of instrumental support for the Chinese government (Chen, 1997). And Ma shows that authoritarian values can be mainly accounted for political trust in the East Asian area (Ma, 2007). In post-socialist countries, researchers found out that the socialism heritages, ideologies or values, played a very fundamental role in shaping people's political trust (Valentina & Eszter, 2010).

The institutional approach, in contrast, highlights the role of institution in the formation of political trust. Some scholars argue that democracy is more conducive to political trust (Levi, 1998), but some others argue that democracy is not so close with the political trust, they argue that the corruption of government in the process of democratization results in a breakdown of the foundation of political trust, and the rising economic inequality in the process of market transition lowers the level of political trust (Uslaner, 2002). Thus, they argue that democracy is not much relevant to the political trust. According to a recent research on six Asian countries, it is the institutional factors such as the political and economic performances of governments, not post-material culture, traditional values, authoritarian values, that have exerted more influences on political trusts (Wong et al., 2009).

Although the approaches above have accounted for political trust in varying degrees, the rational model, which focuses on the critical impacts of the performances of government, has been accepted by more researchers. The rational model, according to Levi (1998), examines "rational and strategic individuals who make choices within constraints to obtain their desired ends, whose decisions rest on their assessment of the probable action." Under this approach, one rational person would regard a government's performance, expense, and efficiency as important (Nye, 1997). If a government has an excellent performance, it will be trusted by the citizens (Uslaner, 2002; Citrin, 1974). Research has shown both the objective performances of government and the subjective perceptions of public goods have positive effects on political trust (Citrin, 1974; Hetherington, 1998; Mishler and Rose, 2001). The Rational Choice model, highlighting the economic rationality more than the other approaches, provides us with an analytical tool for studying political trust in the East Asian

mega-cities.

However, the crucial problem comes to be whether the performance of government can be applied in the cross-national studies. Levi (1998) argues that democracy is the critical institutional variable, which has an important effect on the formation of political trust or even political legitimacy. Nonetheless, this point of view reveals that democracy is in fact the hidden assumption of the rational choice model in the comparative studies. But frankly speaking, the theory of the performance of government has own its applicability in different political systems and can be used even in the non-democratic countries. For instance, Miller and Rose (2001) showed that the government performance accounted effectively for the political trust in the East European transitional countries. Hu (2011) shows that the performance of government affects significantly the people's political trust in Urban China. Gao & Zhai (2013) point out that the satisfaction of government, especially about the Food Safety, Disaster Relief and Justice System, also has significant influences on the Political Trust. The same situation is also applied to the Taiwan (Shi, 2001), and Hong Kong (Wong et al., 2009). The performances of government have significant effects on the political trust of the East Asian countries including Japan, China, and Korea(Wong et al., 2009). Although these countries have very different systems, they share the common authoritarian values and have experienced rapid economic growth (Kim and Voorhees, 2011). However, we still do not know how the different aspects of the governmental performances or different kinds of public goods affect the political trust.

This paper focuses on the influential factors of political trust of Beijing, Japan and Korea, and how different types of public goods affect the political trust in these areas. The public goods, provided by the government, not only reflects the level of the performance of government, but also has exerted quite influences on the political trust (Meng & Yang, 2012). As we observed, the city government provides two main types of public goods to deal with the urban problems or issues, that is, the infrastructural goods and the social justice goods, between which we are attempt to make a distinction in this paper. The former are the economic goods to deal with population growth, environmental pollution, traffic congestion, energy consumption, and food safety; the latter are the social oriented goods such as race, citizenship, income inequality, social welfare and so on. Based on the rational model, the provision of these two types of public goods are both very influential in the formation of the political trust. Some scholars argue that economic performance is the most influential factor for the improvement of political trust (Citrin, 1974), but the others argue social justice goods could be more significant accounts (Mason & Kluegel, 2000). For instance, in Britain, not only economic performance but also social justice

and civil welfare are the critical factor (Stoneman, 2008). In China, economic performance has lost its influences on political trust, but social justice goods has more influences in terms of reducing unemployment, narrowing the gap between the rich and the poor, increasing the expenditures of social welfare per capita (Meng & Yang, 2012). Furthermore, performance of government includes not only economic performances but also the improvement of social justices for the government. In a recent research on the East European transitional countries, the government enhanced the political trust of the people through the lustration law by the means of dismissal, exposure and confession (Choi and David, 2012). Thus, based on the literature, this paper attempts to test whether the provision of social justice goods contribute to increase the political trust in the East Asian Mega-Cities.

In short, it is proven by many researches that either the government performance or the cognition to the performance plays an increasing and positive role in the shaping of Political Trust. Nevertheless, is it applied in the East Asian urban region? According to the theoretical review, we try to use a comprehensive model to make an analysis on the public goods and the political trust by controlling the factors including the individual characteristics, institutional preferences, political values and other intervening variables in the measurements and modeling processes.

Reviewing the literature, this paper assumes that *the public goods should have a significant impact on the political trust of the people in the East Asian mega-cities such as Beijing, Seoul and Tokyo* (**Hypothesis 1**).

On the basis of the rational model and recent literatures, this paper makes the second assumption that *the social just goods would have much more impacts than the infrastructural goods* (**Hypothesis 2**).

Data, Variables and Models
Data
The data is from *the 2012 Survey of Urban Management and Civil Consciousness in Beijing, Seoul and Tokyo*, which is directed cooperatively by the Department of Sociology in Tsinghua University, the Institute of Seoul, and the Nomura Research Institute of Japan. This survey, which accessed to a total of 1609 persons from the three cities above, was implemented in a period ranging from July to August at 2012 in Beijing, Seoul and Tokyo with PPS and Personnel Interview Methods. The valid data in the sampling population are: 560 in Beijing, accounts for 34.8% of the total; 512 in Seoul accounts for 31.8%; and 537 in Tokyo, accounts for 33.4% (Table 1).

Variable Measurements
Dependent Variable
Our model seeks to measure degrees of political trust effectively by two variables *political trust and satisfaction of the government* in varied levels. We measure the dependent variable through interviewing the people with the questions: "*very trust, basic trust, not very trust and distrust.*" On the one hand, we transform the ordinal variables into binary variables which are either trusts or distrusts. On the other hand, we measure the comprehensive satisfaction of the government in various levels of the government ranging from the Central government, municipal government (provincial government), district government, and town or sub-district government (the grassroots level). Several illustrations are presented here that we use the mean value of government satisfaction in four levels to denote the total government satisfaction, considering the Cronbach's Alpha of the above four questions is 0.8677.

Independent Variable
Obviously, it is an inevitable choice for any municipal government to provide the public goods to the citizens. It is also the most important responsibility for the government to supply the sufficient public goods with higher quality for the purpose of the habitability or internationalization. In view of diversity of public goods, this article divides public goods into two categories including infrastructural goods and social justice goods. We make an emphasis that we use the degrees of subjective perception of public goods to reflect the objective degrees of provision of public goods.

To the specific, the performance of government in providing the infrastructural goods is measured with the negative value assignment method by the mean value of government satisfactions on the subjects such as road construction and maintenance, city transportation, sewerage system, garbage disposal, green area, water supply, gas supply, electric power supply, lighting system, city sanitation, air quality, food safety, public security and central heating supply.[1] Meanwhile, we calculate the mean value using the negative assignments method to comprehensively denote the satisfactions on the social justice goods, with their evaluations of which consists of income, career opportunity, higher education opportunity, hiring and promotion of public servants, public medical service, popularization of the compulsory education, legal enforcement, capital and local development, urban and rural development,

---

1)　The Cronbach's Alpha of the satisfaction on urban infrastructural goods is 0.9092, so we can sum all them as one variable.

social welfare, tax policy, gender equality and disadvantaged groups policy.[2] Table 2 shows the descriptive statistics of the main independent variables.[3]

Controlling Variables

The controlling variables involve demographic variables such as age, gender, education and political value. According to current theories, political value accounts largely for the political trust (Shi, 2001). It is well concerned that either the post-materialism or the authoritarian value plays an important role in shaping the political trust in the East Asian Countries (Ma, 2007). It is political value that shapes our foundation in understanding the people's political attitudes and behaviors. This paper measures the political value in Beijing, Seoul and Tokyo through a series of questions in the survey including "whether you respect the customs and authorities or not", "Is individual or state in responsible for everyone's life?", "Self-interest or State interest that matters?" and "to narrow the gap between the rich and the poor through gradual reform or all-round reform?". We find by factorial analysis that these four questions have measured two latent variables: the citizens' preferences of the government intervention and respects for authority or collectivity.

Research Models

This paper focuses on the effectiveness and responsiveness of the government action in the urban governance through a survey in the three East Asian Cities. We could enhance the applicability of this research and deepen the diverse understandings of the relationship between public goods and political trust through an empirical analysis of the great cities. In the consideration of the binary feature of political trust involves the citizens' trusts or distrusts, we employ the Binary Regression Model, which are applicable to that the dependent variables are nominal variables, to analyze the political trust variable. This Model is used to estimate probability of behaviors (the occurrence is 1, the nonoccurrence is 0) affected by the independent variables[4].

We firstly transformed the binary nominal variables and then make a linear regression on the converted variables. It is worthy to note that we need to convert the regression coefficient to the odds by using their natural logarithm, because the regression coefficient in the logistic model is in fact the logic converted value. Thus, our analysis of the regression results is based on the

---

2) The Cronbach's Alpha of the satisfaction on urban social justice goods is 0.8809, so we can sum all them as one variable.
3) See the table 2 for the descriptive statistics of dependent variables.
4) Yu Xie, *Regression Analysis*, Beijing: Social Sciences Academic Press, 2010:330

Chapter 3 Public Goods and Political Trust in the East Asian Mega-Cities: An Empirical Study on Beijing, Seoul and Tokyo

32

explanation of the odds in next parts. In this paper, we measured the satisfaction of government which is as the supplementary variables to denote the political trust. Because the type of variables of government satisfaction is the continuous variables, we make an analysis of the relationship between the independent variables and dependent variables through the general linear regression model. In order to make a comparison on the degree of influences which various independent variables make on the dependent variables, we give the standardized regression coefficients of all the independent variables in this paper. The statistical analysis in this paper can infer the overall samplings according to using the weighing results of sampling in the three cities.

Research Findings
Perception of Public Goods and Political Trust

Firstly, we use the binary logistic regression model to analyze the relationship between the public goods and the political trust in these Mega-Cities. After controlling the independent variables such as female, age, education, government intervention preference, authoritarian/collective value, we find out that the odds of the infrastructural goods: 2.649 in Beijing, 1.489 in Seoul, 1.706 in Tokyo, and 1.864 in total; the odds of the social just goods: 6.198 in Beijing, 4.712 in Seoul, 3.931 in Tokyo, 4.990 in total. Comparing with Tokyo, the odds of social just goods is 14.919 in Beijing, and 3.911 in Seoul (Table 3). We could make conclusions that the public goods have influenced the political trust very significantly, and the social justice goods in total have impacts on the political trust more significantly than the infrastructural goods in total. It shows that either the infrastructural goods or social justice goods has the highest odds in Beijing.

Complementary Test: Perception of Public Goods and Satisfaction of Government

Secondly, we used the general linear regression model to analyze the relationship between the perception of public goods and satisfaction of the government. Similarly, after controlling the independent variables such as female, age, education, the governmental intervention preference, authoritarian/ collective value, we find out that the standardized coefficients of the infrastructural goods are 0.357 in Beijing, 0.385 in Seoul, 0.183 in Tokyo, 0.350 in total; the standardized coefficients of the social justice goods are 0.336 in Beijing, 0.203 in Seoul, 0.432 in Tokyo, 0.318 in total. (Table 4)

It shows that the perception of public goods have a significant impact on the satisfaction of the government as well. To be specific, on the one hand, the infrastructural goods have the largest effects on Seoul, and then in turn are

Beijing and Tokyo. The satisfaction of infrastructural goods increases in 1 SRC, the level of political trust increases in 0.350 SRC. However, it is noted that the infrastructural goods have the lowest effects on the political trust in the Tokyo. On the other hand, the social justice goods have the most impacts on the satisfaction of the government in Tokyo, and then in turn are Beijing, Seoul. The perception of infrastructural goods increases in 1 SRC, the level of political trust increases in 0.318 SRC. (Table 4)

To be specific, we find out that the infrastructural goods have a series of impacts on the political trust in Beijing, then in turn is Tokyo, Seoul. The perception of infrastructural goods increases in 1 degree, the level of political trust increases in 0.623 times (Table 3). The social justice goods have the most significant effects on the political trust in Beijing, and then in turn is Seoul, Tokyo (Table 3). The perception of social justice goods increases in 1 degree, the level of political trust increases in 1.608 times, which is far higher than the effects of the infrastructural goods (0.623). (Table3) In short, the assumptions have been proved that both two types of public goods have impacts on the political trust significantly, and the social just goods exert more effects on the political trust than the infrastructural goods. (Table 3)

Based on the results of hypothesis testing, the data supports the hypothesis 1: it turns out that the public goods have a significant effect on not only the political trust but also the satisfaction of government. Hypothesis 2 was also supported by the data: the political trust has been affected by social justice goods more than the infrastructural goods in every single city, and the complementary test has not rejected the model.

Conclusion

This paper attempts to make an analysis of the influences which the public goods exert on the political trust in the globalizing cities incorporate Beijing, Seoul and Tokyo, through an empirical research by analyzing the data from *the survey of the Urban Management and Civil Consciousness in Beijing, Seoul and Tokyo at 2012.*

This paper makes a distinction between the infrastructural goods and social justice goods. According to our results, we find out eventually that the public goods affect the political trust significantly in these East Asian mega-cities. On the one hand, the infrastructural goods provided by the government could be able to enhance the political trust significantly in Beijing, Seoul and Tokyo. On the other hand, the social justice goods have more influences than the infrastructural goods. It means that the citizens in all these cities are more inclined to the demands of the social justice goods, although they shared the common authoritarian values under the varying political institutions. Although

in the background of globalization, which brings the larger political challenges to the big cities in the East Asia, the city governments could also be able to response to the political appeals by the improvement of governmental performances in providing better public goods. Our research has proved the assumptions in this paper that the performance of city government has a significant effect on the political trust of these three cities and it can improve the level of the citizens' political trust effectively, especially we should know about provision of the social justice goods can give rise to higher level of trust than the economic infrastructural goods.

However, because of the length of this paper and the complexity of the research variables, this paper has not given a further analysis of the mechanisms of differentiation in either the political trust or the satisfaction of government among these cities. Meanwhile, we also have not given a more elaborate analysis of the institutional factors and the cultural factors which are very important in shaping the political trust of the people. Nevertheless, these research flaws are not enough to change our final analysis conclusions.

From the perspective of the urban policies, the globalization is a double-edged sword for the great cities. It is inevitable for the government to take a risk with the rising social inequality and more political appeals & conflicts in the process of becoming a global city and competing to command the heights of the global economy. Just for the citizens in the East Asian megacities, we find out that the infrastructural goods could not meet the public demands, while the provision of social just goods could be more effective to enhance the political trusts. For the construction of the world city, a great and ambitious plan in the future, the Beijing municipal government needs to consider more about the redistribution policies to provide better efficient social justice goods and make initiatives to respond to the appeals of the people in the decision making for the prospective public policies.

Appendixes

Table 1: Sampling Distribution in Beijing, Seoul and Tokyo

	Frequency	Percentage(%)
Beijing	560	34.8
Seoul	512	31.8
Tokyo	537	33.4
Total	1609	100

Table 2: Descriptive Statistics of Main Variables

Variables	Beijing		Seoul		Tokyo	
	AVG	STDEV	AVG	STDEV	AVG	STDEV
Age	39.02	13.94	43.17	13.93	39.32	14.53
Female	0.48	0.50	0.51	0.50	0.49	0.50
Education	4.77	1.43	5.42	1.02	5.30	0.95
Political Trust	0.68	0.47	0.30	0.46	0.22	0.41
Government Satisfaction	3.64	0.98	3.11	0.69	3.61	0.59
Perception of Infrastructural goods	3.44	0.74	3.18	0.59	3.98	0.65
Perception of Social Justice Goods	2.40	0.54	2.21	0.44	2.50	0.46
Government Intervention Preference	0.17	1.16	-0.08	1.05	-0.11	0.71
Authoritarian/Collective Value	0.29	1.22	-0.01	0.88	-0.29	0.73
n	560		512		537	

Table 3: Public Goods and Political Trust in the Global Cities

Independent Variables	Beijing		Seoul		Tokyo		In total	
	Coef.	Odds	Coef.	Odds	Coef.	Odds	Coef.	Odds
Female	0.488+	1.629	-0.656**	0.519	-0.247	0.781	-0.161	0.851
Age	0.024*	1.024	0.005	1.005	-0.006	0.994	0.004	1.004
Education	-0.065	0.937	-0.145	0.865	0.224	1.251	-0.051	0.950
Perception of Infrastructural goods	0.974***	2.649	0.398+	1.489	0.534*	1.706	0.623***	1.864
Perception of Social Justice Goods	1.824***	6.198	1.550***	4.712	1.369***	3.931	1.608***	4.990
Government Intervention Preference	0.088	1.092	-0.337**	0.714	0.168	1.183	-0.063	0.939
Authoritarian/Collective Value	0.232*	1.261	0.372**	1.450	0.251	1.286	0.303***	1.354
Compared to Tokyo:								
Beijing							2.703***	14.919
Seoul							1.364***	3.911
Constant Term	7.349***	1555.025	5.256***	191.718	2.390*	10.915	4.018***	55.571
n	542		512		447		1501	
Pseudo R2	0.2946		0.1592		0.1146		0.2604	
Log likelihood	-246.32		-262.55		-211.44		-743.88	

Notes: *** means 0.001 significant levels, ** means 0.01 significant levels, * means 0.05 significant levels, + means 0.1 significant levels

Table 4 : Public Goods and Government Satisfaction in the Globalizing Cities

Independent variable	Beijing		Seoul		Tokyo		The three cities in Total	
	Coef.	SRC	Coef.	SRC	Coef.	SRC	Coef.	SRC
Female	0.182*	0.092	0.038	0.028	0.086	0.068	0.122**	0.073
Age	-0.003	-0.042	0.002	0.032	0.008**	0.213	0.002	0.029
Education	-0.038	-0.054	-0.007	-0.010	0.003	0.004	-0.026	-0.038
Perception of Infrastructural goods	0.459***	0.357	0.451***	0.385	0.171**	0.183	0.385***	0.350
Perception of Social Justice goods	0.616***	0.336	0.317***	0.203	0.561***	0.432	0.525***	0.318
Government Intervention Preference	-0.008	-0.009	-0.014	-0.022	0.048	0.054	0.003	0.004
Authoritarian/Collective Value	0.071*	0.088	0.029	0.037	0.146***	0.168	0.082***	0.100
Compare to Tokyo								
Beijing							0.202***	0.116
Seoul							-0.098+	-0.056
Constant Term	-0.595*		0.791**		0.953**		0.232	
n	537		512		447		1473	
R2	0.4552		0.2825		0.4104		0.4369	
F	47.31***		27.38***		22.54***		101.51***	

Notes: *** means 0.001 significant levels, ** means 0.01 significant levels, * means 0.05 significant levels, + means 0.1 significant levels

References

Almond, G.A. and Verba S., *The Civic Culture: Political Attitudes and Democracy in Five Nations*, Princeton, NJ: Princeton University Press, 1963.

Braithwaite, Valarie and Margaret Levi, *Trust and Governance*, Russell Sage Foundation, 1998.

Chen Jie et., 1997, "The Level and Sources of Popular Support for China's Current Political Regime", *Communist and Post-Communist Societies* 30, No.1.pp.45-64.

Choi, Susanne Y.P. and Roman David, "Lustration Systems and Trust: Evidence from Survey Experiments in the Czech Republic, Hungary, and Poland", *American Journal of Sociology*, Vol. 117, No.4 (January 2012), pp 1172-1201.

Citrin, J. and Muste, C. , *Trust in Government, Measures of Political Attitudes*, Ed. Robinson, J.P., Shaver, P. R., &Wringsman, L.S., San Diego, London, Boston, New York, Sydney, Tokyo, Toronto: Academic Press. 1999: 465-532.

Citrin, J., "Comment: The Political Relevance of Trust in Government". *American Political Science Review* 68, 1974, pp.973-988.

Catterberg, Gabriela & Moreno, Alejandro, "The Individual Bases of Political Trust: Trends in New and Established Democracies". In *the International Journal of Public Opinion Research*, 2006: 18 (1).

Easton, D., *A Systems Analysis of Political Life*, New York: John Wiley and Sons, 1965.

Gao, Xuege and Zhai Xuewei, "A Comparative Study on Trust in Government Between Urban and Rural Residents" *Sociological Studies*, March, 2013, Vol.28.

Harvey, D., "From Managerialism to Entrepreneurialism: The Transformation in Urban Governance in Late Capitalism", *Geografiska Annaler. Series B, Human Geography*, Vol. 71,No.1, *the Roots of Geographical Change: 1973 to the Present 1989*, pp. 3-17.

Hetherington, M.J., "The Political Relevance of Political Trust", *American Political Science Review*, 1998, 92 (4) :791-808.

Hu Rong, Hu Kong and Wen Yingying, "Social Capital, Government Performance and Urban Residents' Trust in Government", *Sociological Studies*, No.1, 2011, pp.96.

Kim Myunghee and Mychal Voorhees, "Government Effectiveness and Institutional Trust in Japan, South Korea, and China", *Asian Politics & Policy*, Volume 3, Number 3, pp. 413-432.

Lane, R E., *Political Life*, New York: Free Press, 1959.

Lewis-Beck, Michael S. &Wenfang Tang and & Nicholas Martini, "A Chinese Popularity Function: Sources of Government Support", *Political Research Quarterly*, SAGE, April 30, 2013.

Levi, Margaret, 1998, "A State of Trust", In *Trust and Governance*, (eds.), by V. Braithwaite Levi. New York：Russell Sage Foundation.

Newton, K. and Pippa Norris, "Confidence in Public Institutions: Faith, Culture, or Performance? " In Susan, J. Rharr and Robert, D. Putnam, *Disaffected Democracies*, Princeton, NJ: Princeton University Press, 1997, pp.52.

Newton, K., 2001, "Trust, Social Capital, Civil Society and Democracy", *International Political Science Review*, Vol.22, No.2, PP201-214.

Nye, Joseph S. 1997, "Introduction: The Decline of Confidence In Government." In Joseph S. Nye, Jr., Phillip D. Zelikow & David C. King (eds.), *Why People Don't Trust Government?* Cambridge, MA: Harvard University Press.

Ma, Deyong, "The Political Trust and Its Origins: A Comparative Study on the 8 Countries

or Areas in Asia", *Comparative Economic & Social Systems*, 2007(5).

Mason, David S. and James R Kluegel, "Introduction: Public Opinion and Political Change in the Post-communist States." In David Mason et al eds. *Marketing Democracy: Changing Opinion about Inequality and Politics in the East Central Europe*. Lanham, Boulder, New York, Oxford: Rowman and Littlefield Publishers, 2008.

Meng Tianguang and Yang Ming, "Governance Performance and Political Trust in Transitional China: From 'Economic Growth Legitimacy' to 'Public Goods Legitimacy'", *Comparative Economic and Social Systems*, No.4, 2012.

Miller, A. and O. Listhaug., "Political Performance and Institutional Trust", In *Critical Citizens*, edited by Pippa Norris, 204-216, UK: Oxford University Press, 1999.

Mishler, W. and Rose, R., "What are the origins of Political Trust? Testing Institutional and Cultural Theories in Post-communist Societies." *Comparative Political Studies*, Beverly Hills: Feb 2001. Vol. 34, Iss.1, PP30-62.

Putnam, Robert. D., Robert Leonardi and RaffaellaNanetti, *Making Democracy Work: Civic Traditions in Modern Italy*, Princeton University Press, 1993; *Bowling Alone: The Collapse and Revival of American Community*, New York: Simon and Schuster, 2000.

Saskia Sassen, *The Global City: New York, London and Tokyo*, Shanghai: Shanghai Social Sciences and Academic Press, 2001:14.

Shi, T.J., "Cultural Values and Political Trust: A Comparison of the People's Republic of China and Taiwan." *Comparative Politics* 33, 2001.

Stoneman, Paul, *This Thing Called Trust: Civic Society in Britain*, Palgrave Macmillan, 2008 E.M. Uslaner, *The Moral Foundations of Trust*, UK: Cambridge University Press, 2002.

Torney-Purt, Judith, "Adolescents' Political Socialization in Changing Contexts: An International Study in the Spirit of Nevitt Sanford", *Political Psychology*, Vol. 25, No.3, Special Issue (Part Two): Prospect Theory (Jun., 2004), pp. 465-478.

Uslaner, E.M., 2002, *The Moral Foundation of Trust*, New York : Cambridge University Press.

Valentina Dimitrova-Grajzl, Eszter Simon, "Political Trust and Historical Legacy: The Effect of Varieties of Socialism." In *East European Politics & Societies*, 2010: 22(1).

Xie, Yu, *Regression Analysis*, Beijing: Social Sciences Academic Press,　2010:330.

Wang, Zhengxu, "Before the Emergence of Critical Citizens: Economic Development and Political Trust in China." *International Review of Sociology*, 2005.

Wong, Timothy Ka-Ying, Hsin-Huang Michael Hsiao & Po-San Wan, "Comparing Political Trust in Hong Kong and Taiwan: Levels, Determinants, and Implications." *Japanese Journal of Political Science* 10, 2009.

Chapter 4
Evaluation and Influential Factor of Regional Total Factor Energy Efficiency in China

Jing HAN

School of Economics and Resouece Management, Beijing Normal University, China.

Qingxin LAN

Institute of International Economy, University of International Business and Economics, China.

Abstract

There are big gaps in total factor energy efficiency among all regions of China, high in the east to low in the west. The difference between the eastern part and the mid-western part is expanding, while the difference between the middle and western region decreases. In terms of different regions, the total factor energy efficiency in the eastern district greatly diverges, and it continues to shrink in the mid-western part. Technical level, openness and industrialization level of the region play a positive effect on improving the total factor energy efficiency, while the regional ownership structure negatively influences the development of the total factor energy efficiency.

Key Words: the total factor energy efficiency (TFEE), DEA model, evaluation, influential factors.

Ⅰ. Introduction

Energy, an important resource, is vital for the modern economic growth, and plays a dominant role in driving economic development. Since China adopted the reform and opening-up policy, energy has been the important and "dynamic support" for the sustainable and rapid development of China's economy. However, along the economic growth, the stress of energy's extensive consumption to economic development and environmental protection is weighing more and more heavily. And energy efficiency needs to be increased urgently. Thus, it is of great significance to achieve the objective of energy saving and emission reduction by analyzing the energy efficiency in China and the influential factors.

DEA method was widely applied to measure and compare the efficiency of various energy sectors, especially electricity and coal industries, in foreign research (Azadehetal., 2007；Mukherjee, 2008). Hu and Wang (2006) made pioneering contribution to the energy efficiency of China energy sectors.

Hu and Wang adopted the constant returns to scale (CRS) model based on DEA, estimating the potential energy inputs of every province from 1995 to 2002, and defining the total factor energy efficiency as the ratio of the potential energy inputs to the real energy inputs. Thus, it founds that the energy efficiency was highest in the east and lowest in the middle. Wei Chu and Shen Manhong (2007), referring to the method of Hu and Wang (2006), indicated that the evolution of China's energy efficiency tended to be the inverted U-shape. And the energy efficiency decreased by regions from the north-east old industrial bases to the east to the middle to the west. Shi Fu and Shen Kunrong (2008) enforced the knowledge stock under the production function as input index, attributing the super efficiency DEA method to estimate the total factor energy efficiency among provinces. Shi Dan et al. (2008) set up an analyzing frame of the regional difference of energy efficiency based on the stochastic frontier production function, and calculated the effect of the energy efficiency factors on regional industries of China from 1980 to 2005. The above methods mainly based on the linear programming technique to determine the optimal DMUs. Though it systematically estimated and compared the energy efficiency of all DMUs, there was still room for the improving the energy efficiency evaluation and the influential factors. The paper will adopt the CRS based on super-efficiency DEA model to estimate the energy efficiency of different regions in China from 2000 to 2007, apply the Malmquist index to dynamically evaluate the total factor energy efficiency, and use Tobit method to empirical test on the factors affecting the regional energy efficiency.

Ⅱ. Measure of the total factor energy efficiency
1. Research methods
DEA was initially advanced by Charnes, Cooper and Rhodes (1978), named CCR model. It was a nonparametric frontier established by the linear programming method, which was used to estimate the relative efficiency of Decision Making Unit (DMU for short) with multi-inputs and outputs.

CCR model based on DEA divided the DUM into two groups: the effective and the non-effective. As for several effective DUMs, it was hard to make a further evaluation and comparison of the DUMs. To remedy the defect, Andersen and Petersen (1993) established the super-efficiency DEA model, which could compare the efficiency of the relatively effective DUMs. The basic thinking was to evaluate some DUM, and excluded it from the DUM set. It would be reflected in the model to form the following linear programming model:

$$\min \theta_c^{crs-super}$$

$$\text{s.t.} \sum_{\substack{j=1 \\ j \neq k}}^{n} x_j \lambda_j \leq \theta_c^{crs-super} x_k$$

$$\sum_{\substack{j=1 \\ j \neq k}}^{n} y_j \lambda_j \leq y_k$$

$$\lambda_j \geq 0, j=1, 2, 3 \cdots n$$

$\theta_c^{crs-super}$ means the efficiency of DMU$_c$.. Based on the input-oriented super-efficiency DEA model, the paper estimated the total factor energy efficiency of China's 30 provinces, autonomous regions and municipalities from 2000 to 2007.

2. Data extraction

30 provinces, autonomous regions and municipalities of China excluding Tibet ARE chosen as the research project. And the research period is from 2003 to 2010. GDP is regarded as the output variable of the model, and the input variables contain capital, labor and energy. The production function can be represented by:

$Y=f(C, L, E)$ (1)

Capital (C): selecting the investment in fixed assets. To ensure the consistency of input-output variables, the author adopts GDP deflator to converse capital stock into the data based on 2000.

Unit: million yuan.

Labor (L): selecting the employees in the end of year, instead of effective labor time of the total employed people due to lack of statistical data related to the average working hours.

Unit: 10 thousand persons

Energy (E): energy input is represented by the annual energy consumption of all provinces, calculated by adding the consumption of the main consumable energies, including coal, oil, natural gas, hyper-power in the unified units, since the kinds of energy consumption are different in China.

GDP (Y): the output variable is expressed by the real GDP at the constant prices of 2000. The source data originate from China Statistical Yearbook.

Unit: million yuan.

Adopting the input-oriented CRS super-efficiency DEA model, the table 1 reveals the measurement results of the total factor energy efficiency of China evaluated by software EMS-130.

3. Evaluation Results

Nationally, the regional total factor energy efficiency fluctuates significantly. The average energy usage was the highest in 2000, about 0.79, and has been decreased year after year. It reached a low point in 2006, about 0.63. The mean value of China's total factor energy efficiency was 0.684 from 2000 to 2011. There was still a great improvement for energy efficiency of China. As for the provinces and cities, the average values of total factor energy efficiency of Shanghai and Guangdong were over 0.9, and have been increasing from 2003 to 2010, which exceeded 1 in 2010. At present, the total energy efficiency of Shanghai and Guangzhou still dominate in China, since they are the undisputed leaders in institutional innovation of China, with strong capacity to learn foreign advanced operation and management philosophy and experience. It also indicates that both places are setting the pace in energy utilization technology. Besides Shanghai, technological efficiency of Tianjin, Beijing, Fujian and Jiangsu is high as well. Along the east coast, they are advanced in technology with abundant human capital and perfect institutional environment, and which make it better to realize the innovation in operation and management model and the optimized allocation of resources during the economic development and foreign exchange. Moreover, Heilongjiang is outstanding in central China, edged itself in technological efficiency of China. But we should affirm that the total factor energy efficiency of Heilongjiang has been decreasing in recent years.

Comparing the total factor energy efficiency in the eastern, the central and the western areas of China, it is quite distinct from each other. The energy efficiency of the central China reached the highest in 2000, but then it has been trending down. The western area lagged behind the other parts in energy efficiency since 2000, and which increased in 2010 as other provinces and cities. More efforts needed to save energy and reduce pollutants in central and western areas. The efficiency value of the eastern part peaked in 2002, about 0.82, then begun to peak off in 2003, raised again in 2007, and reached 0.82 in 2011. That it was the first to enter the post industrialization age may have contributed. Simon Smith Kuznets insisted that the amount of industry energy may be considered negligible in the low level economic development. Thus, the industry energy consumption intensity was approaching zero, while it shall be increased noticeably in the peak hours for industrial production. As for the post industrialization age, it might begin to slide along with the economic structure transferring from industry-oriented to service-oriented. The eastern areas, including Beijing and Shanghai, are entering the post industrialization stage. Figure 1 reveals that the gap on the total factor energy efficiency between the central and the western was about to start shrinking recently, while it enlarged between the eastern parts and the central and western parts.
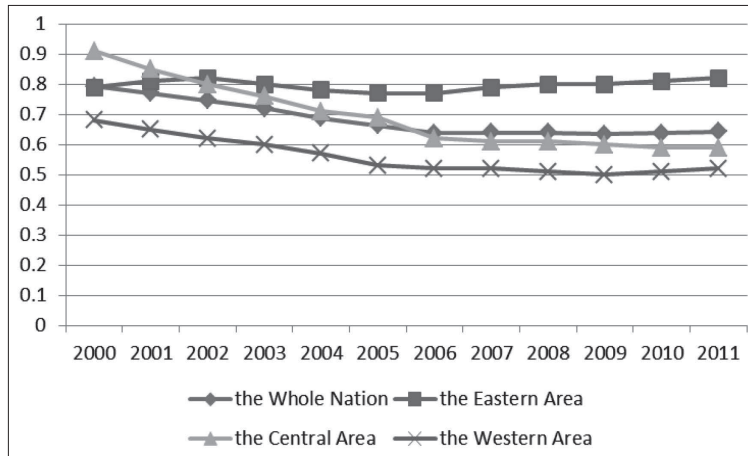
Figure 1 Energy Efficiency Comparison of China 2000-2011
(Source: Han Jing, Lan Qingxin)

Ⅲ. Dynamic Changes of the Total Factor Energy Efficiency in China

To further analyze the dynamic changes of the total factor energy efficiency in China the paper calculated the Malmquist index and the decomposition from 2003 to 2010 according to the statistical data of China's 30 provinces, autonomous regions and municipalities. The results were shown as followed in table 1.

Table 1 indicates the changes of the total factor energy efficiency and the decomposition of China's 30 provinces, autonomous regions and municipalities from 2000 to 2011. The total factor energy efficiency looks gloomy in China from time series. Except 2010-2011, Malmquist index of the total factor energy efficiency was below 1, which showed a downtrend curve in most time within 2003-2010. Next, we shall analyze the reason leading to the reduction of Malmquist index by decomposing it into two parts-comprehensive technical efficiency changes and technical changes. Table 1 reveals technical level in energy utilization of China was increasing slowly from 2003 to 2005, but slipped back from 2005 to 2007. Thus, the government put forward to make great efforts in developing circular economy at the Central Economic Work Conference in 2004, which means lightening the pressure on the total resources of China is urgently needed. Hereafter, all areas in China extensively pursued energy saving and pollutants reduction technologies. And the energy technological level was rising at a rapid speed every year. Comparing to the rising technological level, the comprehensive technical efficiency changes were barely satisfactory. And it was descending all the time expect it was higher than 1 during 2005-2006. Obviously, energy management regulation and

Table 1 Changes and Decomposition of the Annual Malquist Index 2003-2010
(Source: Han Jing, Lan Qingxin)

Efficiency Evaluation Period	Comprehensive Technical Efficiency Changes	Technical Changes	Pure Technical Efficiency Changes	Scale Efficiency Changes	Malmquist Productivity Index
2000-2001	0.965	0.918	0.937	0.980	0.886
2001-2002	0.983	0.953	0.962	0.991	0.937
2002-2003	0.970	0.968	0.974	0.994	0.939
2003-2004	0.978	1.001	0.995	0.982	0.979
2004-2005	0.938	1.029	0.947	0.991	0.965
2005-2006	1.018	0.957	0.998	1.020	0.975
2006-2007	0.989	0.989	0.974	1.015	0.978
2007-2008	0.959	1.000	0.965	0.993	0.959
2008-2009	0.942	1.038	0.953	0.988	0.978
2009-2010	0.964	0.964	0.967	0.997	0.929
2010-2011	0.991	1.018	0.997	1.021	1.009
Average Value	0.972	0.985	0.970	0.997	0.958

decision of China have yet to be improved. At present, there were multi-divisions to decentralize the energy administration. The management duties of non-renewable energy, such as coal, electricity, and oil, are distributed among dozens of divisions, with no centralized energy management department. It is incompatible with the requirements of energy supply, storage and safety. In fact, multifarious administrations which make the operation cost high is the main reason leading to the lower energy efficiency. And the backward of the comprehensive technical efficiency drags the Malmquist productivity index.

Convergence analysis of the total factor energy efficiency of China is stated as follows. Figure 2 shows the standard deviation of the total factor energy efficiency from the whole nation and areas. Nationally, the total factor energy efficiency σ of China is in the tendency of rising except a sharp decline in 2006 and a small drop in 2007. It is divergent in China's energy efficiency. In terms of different regions, the tendency of the total factor energy efficiency σ in east coast is similar to the nation. It reveals to be divergent except the convergent
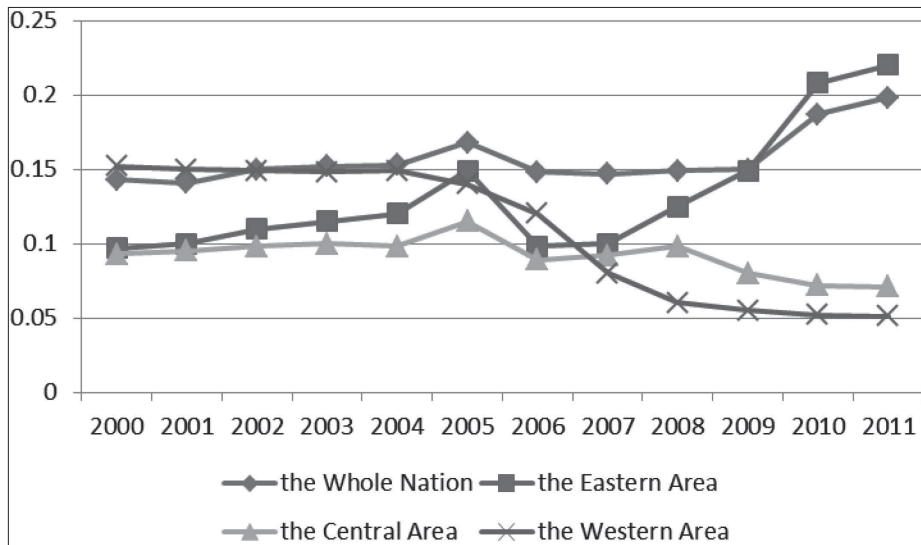
Figure 2 Energy Efficiency Standard Deviation of the Whole Nation
and Different Areas (Source: Han Jing, Lan Qingxin)

situation in 2006-2007, and which indicated the large gap on energy efficiency among the different areas in the east. Recently, the industrialization in Liaoning and Hebei is obviously different from the eastern area. Liaoning is one of the old industrial bases with great gaps in internal economies, and some parts have less awareness on energy efficiency. Most part in Hebei is in the central rather than the east, along with lower technical level and poor fluidity in resources. Thus, it cannot adjust the input scale of capital and labor timely, resulting in the lower pace to the perfect efficiency. In addition, the total factor energy efficiency σ in central fluctuates dramatically with the distinct tendency of declining. That means the gap among the central is getting smaller. The total factor energy efficiency σ is decreasing unilaterally with strong convergence. The reason of efficiency convergence in the central and the west is due to imitate the great organization form and management style to improve the efficiency. Provinces and cities in the poor development are stronger in the post-advantages and faster in surpassing others. Therefore, the difference among the provinces and cities becomes smaller.

IV. Empirical Analysis

The paper analyzes the degree of three variables, including the actual utilized foreign capitals, amount of the technical market and the importation of foreign technologies on the explained variables based on the annual data from 2000 to 2011. It adopts the panel-data analysis method of software Eviews, and which

is concretely studied by establishing the panel-regression model.

1. Analyzing the national data

The paper is to model and analyze based on the whole nation data. The results are listed below:

Table 2 Regression Analysis of the Technical Efficiency and the Explaining Variables
(Source: Han Jing, Lan Qingxin)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.018324	0.074805	16.874950	0
LNFDI	**0.023014**	0.009766	-2.984642	0.0049
LNJSSC	**0.007938**	0.008649	1.7183944	0.0932
LNGWJS	**0.014279**	0.006953	-2.7462942	0.0091
R-squared	0.761973			
S.E. of regression	0.023187			
F-statistic	14.78974			
Durbin-Watson stat	0.867394			
Prob(F-statistic)	0			

It reveals that though coefficients are low in significance, the model guasi-degree is relatively high. The model is validated on the 10% level.

Table 3 The Regression Coefficients of Explaining Variables on Technical Efficiency
Values 2000-2011 (Source: Han Jing, Lan Qingxin)

Explaining Variable	Coefficient
Foreign Capitals Actually Utilized	**0.023014**
The Amount of the National Technical Market	**0.007938**
The Amount of the Foreign Technical Market	**0.014279**

The coefficients reveal the degree of explaining variables on the technical efficiency values. The larger the coefficient is, the greater contribution it makes on the variables be explained. In terms of the whole nation, the degree of the foreign capitals actually utilized and the amount of the national technical market on the technical efficiency changes reaches the highest. It indicates the technical efficiency is greatly improved by FDI, which is closely related to the technical spillover and institutional innovation. Comparing the national technical transfer and the direct importation of foreign technologies, we find that the former makes more contribution to the technical efficiency than the latter. The

joint innovation has played a role in the technical cooperation among the national enterprises. The desired effect of importing directly from the foreign countries has not been produced since it totally differs from the national situation. We should pay more attention on FDI and technical spillover to further improve the technical transfer efficiency and perfect the national technical market. The absorption problem after directly importing the foreign technologies should be first taken into consideration.

2. Analyzing the Provincial Data

Next, the paper studies the relation between the technical efficiency of the eastern and the central areas and the explaining variables. The results are listed below:

Table 4 The Regression Coefficients of Explaining Variables of the East, the Central and the West on Technical Efficiency Values 2000-2011 (Source: Han Jing, Lan Qingxin)

	The East			The Central			The West		
Variable	Coeffici ent	T-statist ic	P	Coefficie nt	T-statist ic	P	Coeffici ent	T-statist ic	P
C	1.0387	26.142	0	1.12647	9.3439	0	1.00925	0.1192	0
LNFDI	**0.0471**	-4.395	0.0001	**0.03769**	-2.3442	0.023	**0.03612**	-1.6946	0.0968
LNJSSC	**0.062**	1.6942	0.0588	**0.00465**	-1.1616	0.087	**0.01804**	1.7298	0.0651
LNGWJS	**0.0187**	1.9875	0.0564	**0.002515**	-1.2152	0.084	**0.02624**	-3.0106	0.0041
R-squared	0.7205			R-squared	0.643		R-squared	0.7766	
Akaike info criterion	-9.896			Akaike info criterion	-6.682		Akaike info criterion	-4.1712	
Schwarz criterion	-5.003			Schwarz criterion	-3.416		Schwarz criterion	-3.515	
Log likelihood	183.97			Log likelihood	117.39		Log likelihood	157.32	
F-statistic	6.8611			F-statistic	0.6294		F-statistic	9.0811	
Prob(F-statistic)	0			Prob(F-statistic)	0.00057		Prob(F-statistic)	0	

It shows that the model guasi-degree is relatively high, and passes the test. Overall, there are totally different in the regression coefficients affecting the technical efficiency of the eastern, central and western areas in China. However, it is basically consistent to the results from the above spatial data analysis. Namely, the actual utilized foreign capital is an important factor to technical efficiency changes.

As shown Table 5, in terms of different areas, the amount of the national technical market has a great influence on the technical efficiency in the eastern area, since it might have good foundation in technical innovation. As for the central and west, the actual utilized foreign capital is still the major reason for technical changes.

Table 5 The Regression Coefficients of Technical Efficiency Values in the East, the Central and the West 2000-2011 (Source: Han Jing, Lan Qingxin)

Explaining Variables	Coefficient in the East	Coefficient in the Central	Coefficient in the West
Actual Utilized Foreign Capitals	0.0471	0.03769	0.03612
Amount of the National Technical Market	0.062	0.00465	0.01804
Amount of the Foreign Technical Import	0.0187	0.002515	0.02624

Ⅴ. Conclusion

The paper estimates the total factor energy efficiency of China's 30 provinces, autonomous regions and municipalities from 2000 to 2011, by adopting the DEA super-efficiency method, and studies the factors affecting the regional energy efficiency of China by the means of Tobit. It notices that, first the total factor energy efficiency of China was decreasing, since there were obvious defects in China's energy management methods and management system. Meanwhile, the technical level in energy utilization was improving year after year; second, there were greatly different in the total factor energy efficiency in China. It was the highest in the east, intermediate in the central, while the west was the-lowest. The gaps of the total factor energy efficiency between the eastern area and the central and western areas were larger, while it become smaller between the central and the west; third, the convergence analysis of the total factor energy efficiency indicates that it became more different in the intro-eastern region, while constantly reduced in the intro-central and western regions; four, TOBIT reveals that the regional technical level, regional openness and industrialization has a significant positive influence on the regional total factor energy efficiency. That is to mean, it needs to improve the technological level of China by further upgrading regional total factor energy efficiency. And it shall be more open with no threaten on regional industry safety. Meanwhile, the resources of industries should be integrated, producing the scale economy effect; five, regional ownership structure has played a significantly negative

role in improving the total factor energy efficiency. It reveals that all areas should deepen the ownership reform and make constant innovation.

Acknowledgement

References

Wei Chu, Shen Manhong. Energy Efficiency and the Influencing Factors: an Empirical Analysis Based on DEA [J], *Management World*, 2007 (8): 39-49.

Shi Fu, Shen Kunrong, China's Total Factor Energy Efficiency under Market Segmentation [J], *World Economy*, 2008 (2):35-43.

Shi Dan et al. Study on Regional Difference of China's Energy Efficiency and the Factors [J], *Management World*, 2008 (2): 35-43.

Charnes, A. Cooper, W.W, and Rhodes, E. Measuring the Efficiency of Decision Making Units [J]. *European Journal of Operational Research*, 1978, 2：pp. 429-444.

Andersen, Per. and Petersen, N. C. A Procedure for Ranking Efficient Units in Data Envelopment Analysis [J]. *Management Science*, 1993,9, pp. 1261-1264.

Kuznets, Simon. Economic Growth and Income Inequality [J].*American Economic Review*, 1955, 45 (1) (March), 1-28.

Hu, Jin-Li and Shih-Chuan Wang, 2006, Total Factor Energy Efficiency of Regions in China [J], *Energy Policy*, Vol 34 (17),3206-3217.

Mukherjee, K., 2008, Energy Use Efficiency in US Manufacturing: A Non-parametric Analysis [J], *Energy Economics* 30, 76-96.