

2016 Doctor's Thesis

The Legal Issues of Carbon Trading Market

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Abstract

Global climate change is one of the most significant challenges facing humanity, and dangers the ecological security of Earth and human survival and development. The international community has launched the process of combined efforts in addressing climate change, and agreed with the purpose of controlling global average surface temperature increasing within 2 degrees Celsius above the preindustrial level. The core measure is to control and reduce greenhouse gas emissions.

Carbon trading market is considered a useful means to reach dual goals of carbon emission reduction and economic development cost-effectively, providing long-acting incentive and competitive mechanism to the market participants. The essence of market behaviour is the circulation of rights, the premise of which is the clear definition of rights, and the latter depends on the analysis of its legal basis and institutional objects.

In carbon trading market, the clear definition of rights involves a series of problems. First is the legal attribute of subject matter, carbon dioxide. This problem concerns the regulatory instruments that may be adopted by government on the subject matter and its relevant rights. Second is the ownership of carbon emission rights. As the core problem of initial delimitation of the rights, the ownership of carbon emission rights influences transaction costs and efficiency of circulation directly. Last is the verification system of the rights and emission amount. Since carbon emission rights are not formed naturally but given by government through administrative behaviours, the verification is a necessary procedure for initial delimitation of carbon emission rights, as well as guarantee to ensure the rights be accepted by the market. The main carbon trading markets, like that in the EU and China, still

have significant deficiencies in the relevant legal institutions, so do other countries that took on emission reduction targets. The dissertation studies the series of problems mentioned above one by one, from Chapter III to Chapter V.

The dissertation's analytical perspective focuses on the change of transaction cost which is influenced by the institutions on carbon emission rights' circulation. The relevant institutions of carbon emission rights' circulation not only have to integrate with current legal system, but also accord with the characteristics of carbon emission rights.

The methodology adopted by the dissertation is a combination of administrative law, civil law and new institutional economics. The theoretical innovation includes the introduction of one pair of concepts, the institutional transaction costs and the contractual transaction costs, and a new model of the relationship among these kinds of transaction costs, legal institutions, institutional scale, asset specificity and fundamental human rights. The practical innovation includes the series of findings and solutions on the initial delimitation of carbon emission rights.

Chapter I 'Introduction' introduces the background, the basic constitution of relevant legal institutions in China, the characteristics of carbon emission reduction which make it different but combinative with traditional environmental problems in legal institutions, and the controversy on comparison of between carbon tax and carbon trading market.

Chapter II 'Theory and Methodology' describes and discusses the theories and methodologies in the dissertation. It includes two main sections: legal theories and new institutional economics. The first section is an overview of the legal theories employed to solve some current legal issues of carbon trading markets, including administrative law and

civil law theories. The second section is an overview and development of part of new institutional economics to analysis the further legal deficiency in the construction of broader carbon trading markets, especially in the establishment of China's national carbon trading scheme. The theoretical discovery includes: 1) the comparison of institutional transaction costs and contractual transaction costs is the endogenous factor of institutional scale; 2) the asset specificity, the key factor which influences the institutional transaction costs and contractual transaction costs, could be adjusted by legal institutions; 3) the lower the asset specificity is, the more advantage the internal organisation enjoys, and the institutions will be more integrated into components; and 4) subject to the bounded rationality and opportunism of human behaviour, some rights which are called fundamental human rights must be protected by legal institutions.

Chapter III 'Legal Attribute of Carbon Dioxide' studies the subject matters of carbon trading. The chapter demonstrates the feasibility and necessity of carbon dioxide as a statutory air pollutant from two perspectives of positive analysis and normative analysis. The first section makes positive analysis based on representative relevant laws of various countries, from the definition of pollutants in the context of environmental science, economics and jurisprudence. The second section focuses on the problem whether carbon dioxide should be considered as a statutory air pollutant, and makes normative analysis of various essential administrative behaviours and their legal basis in the means of carbon dioxide emission reduction to demonstrate the necessity to include carbon dioxide in *Air Pollution Prevention and Control Law*. The third section is the comments on the objections. The finding is, for pollutants discharge standards, CDM projects, compulsory carbon trading market and

voluntary carbon trading, the legal basis for their relevant administrative behaviours are not clear or completely missing. One of the solutions is to make special legislation for them. Since special legislation causes heavy work and uncertain time, the dissertation suggests to combine it with the emendation of *Air Pollution Prevent and Control Law* to incorporate carbon dioxide into air pollutants.

Chapter IV 'Ownership of Carbon Emission Rights' studies the relevant rights of the subject matters in carbon trading market. The first section provides a theoretical analysis of environmental law and international law, discusses the fragmentation and integration of the right to development and the right to use environmental capacity and concludes that carbon emission rights should be divided into two parts: the right to development owned by natural persons and the right to use environmental capacity owned by countries. The carbon emission rights owned by natural persons shall not be transferred in the market, as a kind of fundamental human rights; and the carbon emission rights owned by countries may enter the market through administrative behaviours like free allocation, or through civil contracts like auction. The second section discusses the role of rights distribution in economising transaction costs through a case analysis of Japan's air pollution tort lawsuits. The result is, in the field of air pollution, simply using of the rights allocation theory in civil law is not enough to promote but may even hinder the rights circulation. So the construction of legal institutions on emission rights should adopts the rights allocation theory in new institutional economics, in order to economise transaction costs and facilitate rights circulation. Concretely speaking, the legal institutions should endow rights to parties with more members, looser organisation and less information. Whether legal persons should receive rights depends on their industry

and organisational characteristics but not emission amounts.

Chapter V ‘Verification of Carbon Emission Rights’ focuses on the verification of carbon emissions rights. The chapter analyses the relevant legal institutions from the perspective of transaction costs economising, especially the effects of relevant asset specificity. The result shows that the carbon trading markets of the EU and China adopt different strategy on transaction costs economising, and both have own advantages and disadvantages. In the verification system of the EU, the counterparty of verifiers is enterprises within the market, which means the legal institution leans towards free market and devote itself to economise the contractual transaction costs directly. But it is faced with evident fraud risks. In the verification system of China, the counterparty of verifiers is government, which means the legal institution leans towards government regulation and devote itself to economise the contractual transaction costs more, with expenditure of higher institutional transaction costs. It may work in pilot carbon trading markets limited in size, but may have several inevitable problems in the future when China’s nation-wide carbon trading market is established, like monopoly, excessive fiscal expenditure and rent-seeking, etc.. The chapter suggests that China shall enlarge the human asset specificity of verifiers by legal institution and change the counterparty of verifiers from government to enterprises. The Chinese Institute of Certified Public Accountants (CICPA) may be suitable for the comprehensive arrangement of the verification process.

Chapter VI ‘Conclusion and Outlook’ concludes the theoretical and practical findings and policy suggestions of the dissertation. It also points out that many follow-up legal issues haven’t be well-studied. Further studies are required on the legal institutions of the trading

agreements and the contract disputes among carbon trading market.

Chapter I. Introduction

1. Background

China has become the second-largest economy in the world since 2010, and it is the biggest exporter all over the world, with the fastest speed in industrialization and urbanization. And, not least, China is the biggest country in terms of carbon emission.

The average concentration of carbon dioxide in global atmosphere was only 280ppm before the industrial revolution. However, fossil energy, such as coal and petroleum, has been widely and largely used since industrial revolution. As a result, the concentration soared to 391ppm by 2011. A large number of data demonstrate that global warming has become an undisputed reality. And this reality means a severe challenge to China whose natural environment is very fragile, for both its eastern coastal area with a resident population of 800 million and its northwestern area where people's life highly depends on snowmelt of Himalayas and Mount Tianshan suffer tremendous loss because of frequent occurrence of extreme climate events.

The carbon trading market is considered an effective means to address global warming issues. The theoretical bases include the approach of regulating negative externality products by market with the case of pollution that was proposed by Coase after analysing the delimitation of property rights and transaction cost as well as 'emission trading' directly raised by Dales. The three main areas in China's carbon trading are Clean Development Mechanism (CDM), compulsory carbon market and voluntary carbon market.

Clean Development Mechanism in Kyoto Protocol is the first one that China adopted. The carrier of carbon emission rights in the mechanism is Certified Emission Reductions (CERs). Besides, it can be supplied on the carbon trading market in developed nations. The legal basis is the *Approach of Management of Clean Development Mechanism* issued by National Development and Reform Commission, Ministry of Technology, Ministry of Foreign Affairs and Ministry of Finance in 2005.

From June 2013 to July 2014, seven provinces successively opened up compulsory carbon trading pilot markets, including Shenzhen, Shanghai, Beijing, Guangzhou, Tianjin, Hubei and Chongqing. The legal basis is the *Temporary Approach of Management of Carbon Emission Trading* issued by National Development and Reform Commission in 2014. The type of greenhouse gas, industrial scope and national quota allocation plan on the compulsory market are all in the temporary approach and confirmed by National Development and Reform Commission. Local development and reform commission decides the scope of included enterprises and allocation plan on the basis.

After the pilot markets launched in the seven provinces and cities, National Development and Reform Commission carried out exploration into voluntary carbon trading. The reduction of carbon amount that was kept in files was called Chinese Certified Emission Reductions (CCERs). In addition, it can be traded on the compulsory carbon trading market. The legal basis is the *Temporary Approach of Management of Voluntary Reduction Trading of Greenhouse Gas* issued by National Development and Reform Commission in 2012.

On September 25th, 2015, ‘*U.S.-China Joint Presidential Statement on Climate Change*’ mentioned that China planned to launch national carbon emission trading system in 2017.

The current legal institutions of China’s carbon trading market is still significantly inadequate. The legal level is mostly departmental regulation but not law. Most practices of the pilot trading markets are just non-copyable tries without legal guidance or protection. The connection of CDM, compulsory reduction markets and voluntary reduction markets demands the improvement of legal institutions urgently, so do the establishment of national trading markets.

2. Characteristics of Carbon Emission Reduction

2.1. Distinction from Traditional Environmental Problems

It is easy to understand the literal meaning of low carbon. Because of this, low carbon is often confounded with traditional environmental problem. System response to carbon

emission problem shall be established based on mastering of features of carbon emission problem, and then twice as much can be accomplished with half the effort.

Carbon emission problem is born out of and different from traditional environmental problem. Comparatively speaking, carbon emission problem has the following four features.

2.1.1. Controversy and Prevention First

Carbon emission reduction is only a method aiming to prevent climate system from dangerous man-made interference, make ecological system naturally fit with climate change, protect food production against threats and guarantee sustainable economic development. However, since IPCC issued the first report, dissenting voices can be heard without end. Scientists with dissenting opinions set up one tit-for-tat organisation in 1993 and officially called it Nongovernmental International Panel on Climate Change (NIPCC) in 1997. NIPCC issued *Climate Change Reconsidered* in 2009 and criticized assessment reports made by IPCC item by item.

It can be said that disputes about carbon emission problem run through the whole logical process. Whether the global climate is warming? Whether global warming is caused by greenhouse gases produced in human activities? What kind of consequence will human face if the climate is warming? So far, there is no final conclusion for these disputes. Moreover, in the foreseeable future, the conclusion cannot be made successfully.

However, these disputes shall be considered by meteorologists and statisticians. As to Chinese researchers on law, their research basis shall be *Convention* approved by the Standing Committee of the National People's Congress in 1992. In the chapter 'Risk Prevention and Minimum Cost Rules' of *Convention*, it is clearly provided that 'The implementation of preventive measures shall not be delayed with the excuse of having no complete certainty scientifically'.

Compared to certainty and governance-first feature of traditional environmental problem, unique characteristic of carbon emission problem is fully revealed in *Convention*. Although carbon emission problem is full of controversy, legal research shall be based on its feature of

‘prevention first’.

2.1.2. Long Feedback Process

If the whole global ecological environment is considered as one system, influence of behavioural results caused by human activities on human activities can be treated as feedback towards the system. The author uses ‘feedback process’ to mean time factor of this environmental feedback and ‘feedback scope’ to mean space factor.

Let’s study famous environmental pollution events which happened around the world in the last century. Take London Smog Incident which happened in 1952 as an example. In winter, most people in London use coal heating. On December 5th of 1952, emission of pollutants caused by coal burning shrouded London due to thermal inversion, leading to a tragedy. Take ‘Minamata Disease’ incidents happened in Japan as another example. Japan Nitrogenous Fertilizer Company located near Minamata Bay has ceaselessly discharge mercury-contained waste water into the bay since 1925. And residents living around the bay drank and utilise the water in the bay for a long time. As a result, ‘Minamata Disease’ incidents happened in 1956, shocking the whole world. From these examples, we can find that: in terms of traditional environmental problem, the time of feedback process from starting of relevant human acts to influence caused by the act is relatively short. In general, the time is only several days or several months, never exceeding one generation.

The feedback process of carbon emission problem is different from that of traditional environmental problem, and it needs a long period. Nobody will suffer disease or even die directly because of carbon emission. Global warming can only be caused by large accumulation of carbon emission starting from the period of industrial revolution. After the phenomenon of global warning happens, the effect of carbon emission is finally reflected on human body through influencing glacier, snow melting, water resource distribution, sea level rise and other changes of natural environment. In addition, efforts made by human beings on carbon emission reduction, including establishment of legal system, can also obtain effect only after a long period of feedback process.

2.1.3. Wide Feedback Scope

In terms of space factor, feedback scope of carbon emission problem is far wider than that of traditional environmental problem. Let's make a study based on the above traditional environmental pollution events. Influence of London's coal burning pollution was basically within the City of London, and the Minamata Disease happened within the peripheral area of Minamata Bay into which mercury-contained waste water was discharged. The range of influence of acid rain which is generally considered as international or regional event is limited. In 2010, five cities of Guangdong Province were listed as 'area with heavy acid rain' by the provincial environmental protection bureau; the report issued by Tibetan Environmental Protection Bureau showed that no acid rain happened in Tibet in 2010, even in the provincial capital of Lhasa.

Consequence of climate change arising from carbon emission is really global. The glacier of uninhabited Qinghai-Tibet Plateau shrinks to some extent because of global warming, and abnormal melting of the glacier cause different patterns of disastrous consequence to the people whose survival greatly depends on Yangtze River, Ganges River and Indus River.

2.1.4. Global Responsibility and International Cooperation

In the chapter 'Common but Different Obligation Principle' of *Convention*, it is indicated that: addressing climate change is the common obligation of the universe and each country shall bear the responsibility for addressing the climate change. Since economic activities of human beings are the most fundamental source of carbon emission, carbon emission problem has become a real global problem with the globalization of economic activity. We must understand that: achievement on the carbon emission problem cannot be accomplished without international coordinated action, close cooperation and joint efforts; if China fails to effectively and timely transform itself towards low-carbon society, the international pressure it faces will cause adverse effect on its political and economic activities, such as 'carbon

tariff' which is hanging in China's international trade and may come true at some time.

2.1.5. Lack of Social Identity

Traditional environmental pollution has features of certain reasons and results, short feedback process and narrow feedback scope. Therefore, it becomes a commonly disgusted action in the human society and is greatly blame-worthy in the society. As a result, environment protection has universal value. However, carbon emission problem cannot be commonly acknowledged by the society due to its several features discussed before.

From research on emission source, according to general cognition of people, the majority of traditional environmental pollutants are produced by enterprises and plants. In common people's opinions, their contribution to environmental protection is limited on recycling waste batteries, reducing utilisation of plastics and other actions. Although in fact, various consumptions of common people influences the generation of pollution generation upstream industries, the generation has no direct relation with them. Therefore, they can blame the environmental pollution unscrupulously. However, carbon emission problem is closely related to life style of each person. When common people hear about the phrase of 'low-carbon society', they may immediately envision a society full of strained and embarrassed life style, which does not fully symbolize groundless worry. If economic development and public opinion basis are neglected, and low-carbon policies are implemented in an imposed way, the society may end with strained and embarrassed life style.

From research on feedback results, traditional environmental pollution will bring obvious and negative influence to people living in areas surrounding the pollution; however, consequences of heavy carbon emission will not be experienced directly. We can imagine that if one chemical plant is established near one community with its dark smoke covering all the sky and waste water polluting the water and vanishing fish and shrimp in the water, residents in the community will be certain to rally together and protest against the plant so as to maintain their benefit. However, if the plant only discharges a large number of carbon dioxide,

the residents will have no discomfort feeling¹⁾ but will be very happy after they find that their production of crops increases year by year²⁾.

Solving carbon emission problem is a long way to go, and the problem cannot be solved in one day. Moreover, compared to traditional environmental problem, carbon emission problem cannot be solved at a fast speed and with obvious achievements. Therefore, the author holds that the system for low-carbon economy cannot be established without support and efforts from each individual in the society, i.e. 'social identity' must be obtained. The main methods to cultivate 'social identity' is combining incentive mechanism into administrative laws and regulations concerning low-carbon economy, eliminating previous administrative-power-centered thought, emphasizing cultivation of subjective willing of administrative counterpart and influencing his action. The method is essentially different from that for traditional environmental problem, and it determines that law researchers must have new thoughts in system construction for low-carbon economy.

2.2. Coincidence with Traditional Environmental Problem in Legal Institutions

As the economy started to make growth at fast speed after the industrial revolution, all kinds of problems caused by environmental pollution gradually emerged; non-renewable property of traditional energy, such as coal and petroleum, were gradually attached importance to by people; the natural ecology was damaged by human economic activities and needed be restored urgently. In the face of environmental problems comprehensively consisting of environmental pollution, energy crisis and ecological protection and other issues, the implementation of special system becomes inevitable; most countries adopt legislation-led regulation on environmental problems. On the one hand, the legislation authority is required to formulate special laws and regulation to control the environmental problem; on the other

hand, exclusive administration authority in charge of environmental protection is set and granted with control power over the problem.

At that moment, the influence of carbon emission on global climate change was not obvious, and the relation between carbon emission and global climate change was not acknowledged by each country. Therefore, although carbon emission problem gradually emerged, it still hid back the traditional environmental problem, and control legislation of each country did not include special response to carbon emission problem.

However, the author still calls the period of carbon emission problem ‘control legislation-led period’. The reason is that in terms of part of institutional response to traditional environmental problem, because of all kinds of features of carbon source, the period accords with carbon emission reduction we discuss nowadays. Practically speaking, carbon emission is reduced in this period. Understanding and research on this period can provide data and reference for present reduction of carbon emission. This section studies China’s legal institutions response to the traditional environmental problem, classifies part of it which coincides with carbon emission problem into the following categories, and explains briefly its institutional selection.

2.2.1. Prevention of Atmospheric Pollution

Carbon dioxide has not been included into ‘atmospheric pollutants’ in most countries yet, but it discharges mainly in the form of gas, and thus reduction of carbon emission is inseparable from prevention of atmospheric pollution in traditional environmental problem.

Law on Prevention of Air Pollution of the People's Republic of China issued in 2000 is formulated to prevent generation of acid rain and emission of sulfur dioxide. Relevant regulations specified in the chapter three ‘Prevention and Control of Atmospheric Pollution by the Burning of Coal’ and the chapter four ‘Prevention and Control of Pollutants Discharge by Motor-driven Vehicles and Vessels’ of the law also make a contribution to carbon emission reduction. In addition, Article 25 of the law concerns about improvement on urban energy structure and production and utilisation of clear energy; Article 28 of the law concerns about

prohibiting building heating boiler based on burning of coal in centralized heating area; Article 34 of the law concerns about encouragement on producing, consuming and utilising motor vehicles and ships driven by clear energy. From the chapter six ‘Legal Responsibility’ of the law, it can be seen that administrative penalties are conducted on institutions or individuals who violate the law, and the penalties include fine, confiscating illegal gains, revoking license and ordering suspension of production and business. Moreover, the law includes regulations on continuous utilisation of civil law and criminal law, and they are opposite to contents of control, i.e. both civil damages and criminal penalties are connected with items of control.

Except the above regulations and laws, there are many other department rules and local laws and regulations which are similar to each other.

2.2.2. Response to Energy Crisis

Energy crisis and carbon emission problem can be treated as both sides of one coin. The large utilisation of traditional fossil energy, such as coal and petroleum, is the major cause of carbon emission; similarly, carbon emission can be caused by thermal power generation which is the core source of electricity. Therefore, when the human society does not understand carbon emission problem, system response to energy crisis can be considered as appropriate for the problem.

Achievements made by Chinese government on legal construction for energy crisis are mainly reflected in *Energy Conservation Law of the People’s Republic of China* which was revised in 2007 and *Renewable Energy Law of the People’s Republic of China* which was revised and implemented in 2009 and 2006 respectively.

Energy Conservation Law of the People’s Republic of China was formulated to motivate the whole society to save energy, improve energy efficiency, protect and improve the environment, and to develop the economy and society in a comprehensive, coordinated and sustainable way³). In the chapter three ‘Rational utilisation and Conservation of Energy’, the classification of major energy conservation goals is basically identical with China’s present

key target industries of carbon emission reduction, i.e. ‘Industrial Energy Conservation’, ‘Building Energy Conservation’ and ‘Transportation Energy Conservation’ from section two to section four. In the chapter six ‘Legal Responsibility’, administrative punishment measures, such as fine, ordering suspension of production and business, are mainly described.

Renewable Energy Law of the People’s Republic of China was formulated to promote the development and utilisation of renewable energy, increase energy supply, improve energy structure, guarantee energy safety, protect the environment, and to realise economically and socially sustainable development⁴). This law is closely related to power sector, in which it is regulated that the construction of grid-connected power generation project by renewable energy shall obtain administrative licensing or be submitted for the record⁵), and that administrative punishment shall be conducted to relevant enterprises violating this law.

It is greatly worthwhile to note that in the two laws, there are regulations about a series of incentive measures which are mainly reflected in the chapter five ‘Incentive Measures’ of the former and the chapter five ‘Price Control and Cost Apportionment’ and the chapter Six ‘Economic Incentives and Supervisory Measures’ of the latter. Although the two laws were not formulated for response to carbon emission problem, the utilisation of these incentive measures can afford us lessons because energy crisis has implicit correlation with carbon emission problem.

2.2.3. Protection of Forest Resources

Forest resource is one of the most important resources in the world, and it is the foundation of biodiversity. Many forest resources are raw materials of human economic activities. Moreover, forest resource plays an important role in environmental protection, such as climatic regulation, water and soil conservation, prevention and alleviation of drought, flood, wind-blown sand and other natural disasters, air purification and noise elimination. In response to traditional environmental problem, protection of forest resource is always one of the most important methods. Similarly, in response to carbon emission problem protection of forest resource also plays an important role.

Protection of forest resources is always one important task of China in environmental protection. As early as 1979, *Forest Law of the People's Republic of China (for trial implementation)* was published; *Forest Law of the People's Republic of China* was issued in 1984 and it was revised in 1998. Although the law clearly indicates the function of forest resources in 'climatic regulation', the function mainly means the contribution made by forest to temperature, humidity, evaporation, transpiration⁶⁾ and rainfall but not the influential effect of forest on global climate change and carbon dioxide amount in the atmosphere.

Because of overcutting of forest in China for a long time, a series of severe consequences have been caused to the environment. As a result, legal responsibilities regulated in *Forest Law of the People's Republic of China* are severer than those regulated in other environmental protection laws. The legal responsibilities include great number of fine amount on illegal acts and they are closely associated with criminal law. In 1980, *Emergency Notice of the State Council on Resolute Prohibition of Deforestation* was issued. In the notice, the words and phrases of 'serious regulation', 'quick settlement', 'strict treatment' and 'severe punishment' demonstrate that the government attaches great importance to protection of forest resources and favor mandatory and sanction measures in protection of forest resources.

3. Comparison of Carbon Tax and Carbon Trading Market

Carbon taxation and carbon trading market are both important means to reduce carbon emission and cannot replace each other, but carbon trading market is more suitable for international corporation, faces less political resistance and more social acceptability.

On international perspective, at least four kinds of carbon tax have to be considered, a domestic tax to achieve a domestic target, an international carbon tax, internationally harmonized domestic taxes, and carbon tariffs. Carbon tariffs are more like retaliatory tariffs for some political purposes, rather than environmental taxes for environmental protection. The other three kinds of carbon tax have their own advantages and disadvantages. For example, Harmonized domestic taxes face distributional issues, free rider problem, and are not clear whether such taxes should be in addition to other domestic taxes compared to

internationally carbon tax, but politically more realistic to reach an agreement rather than setting up a necessary international institutional framework for an international carbon tax, and easier to monitor compliance⁷⁾.

Compare carbon tax and carbon trading market, they also have their own advantages and disadvantages. 1, Carbon tax may not provide a consistent and steady stream of revenue if the revenues are earmarked for tax reductions. 2, Carbon tax do not provide any binding cap on emissions. 3, Carbon tax in an open economy may have significant impacts on production and employment of energy- and export-intensive industries, so most carbon tax schemes include exemptions to save jobs by maintaining ‘international competitiveness’, but they make environmental policy more costly⁸⁾. 4, For developed countries like U.S., carbon tax is incompatible with efforts to bring the developing world into an international agreement. Even the firmest advocate of carbon tax have to admit it is only a ‘viable’ policy option⁹⁾. 5, Carbon tax faces more political resistance compare to carbon trading market, that is why both U.S. presidential candidates supported cap and trade during the 2008 election¹⁰⁾. In addition, significant levels of taxation on energy or carbon at the EU level have never been agreed¹¹⁾. 6, Carbon tax faces distributional issues, e.g., it reduces the volatility faced by nuclear generators, but raises that faced by fossil fuel stations, compare to carbon trading market¹²⁾. At the same time, although EU ETS Phase I is criticized broadly of being inefficient, some researchers suggest the Phase II shows signs of restoring market efficiency¹³⁾.

Endnotes

¹⁾ As what mentioned above, the present global CO₂ concentration is about 385ppm, and people may feel uncomfortable only under the circumstance where regional CO₂ concentration exceeds 1,000ppm.

²⁾ This is not surprising. Photosynthesis of plants must be conducted through absorption of carbon dioxide. Production of vegetable greenhouse which can be seen in vast rural areas of

China increases based on the characteristic of carbon dioxide.

³⁾ *Energy Conservation Law*, Article 1.

⁴⁾ *Renewable Energy Law*, Article 1.

⁵⁾ *Ibid.*, Article 13-14.

⁶⁾ ‘Evaporation’ means a physical process in which water evaporates back to the atmosphere after it drops on the ground; ‘transpiration’ means a life movement in which the plant emits water absorbed by its root from the earth through air hole of its leaves.

⁷⁾ Hoel, M.(1992), p.406.

⁸⁾ Böhringer, C. & Rutherford, T. F.(1997), p.189.

⁹⁾ Metcalf, G. E.(2008), p.81.

¹⁰⁾ Avi-Yonah, R. S. & Uhlmann, D. M.(2009), p.45.

¹¹⁾ Fawcett, T.(2010), p.347.

¹²⁾ Green, R.(2008), p.67.

¹³⁾ Montagnoli, A. & De Vries, F. P.(2010), p.1331.

Chapter II. Theory and Methodology

The chapter describes and discusses the methodologies the dissertation uses. It includes two main sections: legal theories and new institutional economics.

Basically, the first section is an overview of the legal theories which be employed to solve some current legal issues of carbon trading markets. It includes two relevant departmental laws: administrative law and civil law. The second section is an overview and development of part of new institutional economics which be employed to analysis the further legal deficiency in the construction of broader carbon trading markets, especially in the establishment of China's national carbon trading scheme. The section is not only a repeat of current new institutional economics, but also a further research on the relationship of transaction cost, organisation scale and law. The connection of some key concepts of these methodologies are discussed at the end, like rights, contracts, institutions and markets.

1. Legal Theories

1.1. Administrative Law Theories

In Chapter III, the dissertation analyses the legal attribute of carbon dioxide. The main analysis viewpoint is the legal basis of administrative behaviours which have be or may be applied to regulate carbon emissions. During the analysis, the major methodology comes from administrative law.

Overall, the methods to reduce carbon dioxide emissions can be divided into three

categories: carbon trading market based on the Coase theorem, carbon tax based on Pigouvian tax and other direct or indirect regulatory measures; but the methods can be divided into two categories of administrative behaviour and market behaviour from the perspective of jurisprudence. The market behaviour is generated spontaneously when human beings pursuing self interests, without strict legal basis. Laws play a role of protector in it; in other words, they can provide protection to avoid market failure. But administrative behaviour as a connection between administrative authorities and the counterparts requires strict legal basis, which is the focus of this part.

Legal basis of administrative behaviours comes from its theoretical basis. Law is a tool to adjust social relations. As the criminal law is devote to the adjustment of relationship between individuals and society and the civil law is used to adjust the relationship between individuals¹⁾, the administrative law aims to adjust the relationship between government and individuals, and between the superior government and the junior government. As the youngest of the above three major department laws, the administrative law is still divisive until now in many details. Among them, the three most important theories are the management theory, the power control theory and the balance theory. However, based on the analysis of the theoretical development, we find that some key problems have been recognized internationally.

In the former Soviet Union, Eastern Europe and other socialist countries, early developmental stage of the administrative law of civil law countries and China, the theory of the administrative law adopted the management theory. It held that the administrative law was the legal norm, which was used to manage the civil by the government based on the administrative power, and even was more broadly defined as the generic term of all laws and

regulations, through which the country could manage all aspects²⁾. According to the theory, the government had relatively big power and free administrative behaviour way and paid attention to efficiency. As development of China's economic, the enhancement of citizens' right consciousness and the rise of other theories, the management theory is gradually not suitable for legal practice as a whole and just remains research value.

The power control theory originated in the capitalist countries, and was popular in common law system and civil law system countries simultaneously. The theory holds that 'a first approximation to a definition of administrative law is to say that it is the law relating to the control of governmental power'³⁾, based on civil rights; more specifically, the administrative law is a legal department that can control the national administrative activities. It sets up the power of the administrations to regulate the principles of power exercise and provide legal remedies for people violated by administrative behaviours⁴⁾. The theory focuses on the control of government power. It holds that the administrative behaviour must be empowered, focus on democracy, and ignore efficiency to some extent. In China, the administrative law circle began to gradually receive the theory since the late 1980s.

The balance theory was the creative result that Chinese administrative law circle achieved through joint efforts and originated in essential research on the management theory and the power control theory by Professor Luo Haocai, who thought that modern administrative law should be the balance law, namely, the rights and obligations should keep balance as a whole in the relationship between the administrative organs and the counterparts⁶⁾. Later, many scholars contributed many bricks of the theory to the mansion of the balance theory. The theory gave consideration to both democracy and efficiency. It not

only emphasized the *OUGHT TO BE* state of balance, but also more focused on the *IS* process adjusted from imbalance to balance. Professor Luo supported this point with Marx's famous remarks: balance was always based on something; in other words, coordination always just could get rid of the current discordance⁷⁾. Up to now, the balance theory continues to be in debate and construction, but it has been recognized by China's administrative law circle.

The balance theory holds that the administrative behaviours that can have a direct impact on the rights and obligations of the counterparts are 'negative administrative behaviours', and the administrative behaviours that cannot have a direct impact on the rights and obligations of the counterparts are 'positive administrative behaviours'. The relationship between the former and law is same as that in the power control theory, namely, if laws have no corresponding clear terms (permitted), they are invalid; and the relationship between the latter and law is consistent with that in the management theory, namely, if laws have no corresponding clear terms (prohibited), they are valid. The view is consistent with both the theoretical foundation of the balance theory and the perceptual cognition of the general public, that is when the government makes the administrative behaviours that can have a direct impact on the rights and obligations of the counterparts, the individuals (or junior government) as the counterparts keeps unbalance in this relationship. Therefore, in this case, laws must clear prescribe the administrative behaviours to pursue balance.

Therefore, we can draw a conclusion: for the problem whether the administrative behaviour requires clear support from laws, the corresponding key is to clarify whether it can have a direct impact on the rights and obligations of the counterparts either according to the power control theory or the balance theory.

1.2. Civil Law Theories

In Chapter IV, the dissertation focuses on the initial delimitation of carbon emission rights, uses Japan's air pollution tort lawsuits to analyse the influences on transaction cost of legal institutions. The part does some critical analysis and improvement on the current relevant civil law theory and new institutional economics based on the analysis of real world. The current civil law theories on the delimitation of rights and liabilities during tort lawsuits are introduced as follows and the further improvements are discussed at Chapter IV.

In civil law theory, allocation of rights and liability in a tort dispute depends on three elements: harm, causation and negligence. In other words, the actor is liable if his behaviour is negligent and has caused harm to the victims. The judgment of these three elements has a logical sequence, and all three steps could be influenced by transaction costs.

Step 1. Harm

Harm is the easiest element to judge accurately, except in certain special cases. The harm caused is obvious if someone is stabbed; however, estimating harm when a person is poked by a needle with HIV-tainted blood is difficult. AIDS has an incubation period and is infectious; therefore, numerous unforeseeable issues may influence the actual degree of harm in this case. Before an AIDS attack, the victim may die of other reasons, may be cured through specific medications or may even infect more people. In most cases, the transaction cost, which hinders the judgment of harm, is reduced as society and technology develop.

Step 2. Causation

After the confirmation of harm, the judge should ascertain whether causation exists

between the behaviour of the actor and the harm caused. Given low transaction costs, this step is easy to perform through natural science and the logical extrapolation of experience.

Step 3. Negligence

The last step is to ascertain whether the actor was negligent when causation existed between the behaviour and the harm. In traditional tort disputes with low transaction costs, this step is the most difficult to execute. In the 1947 case of *United States v. Carroll Towing Co.*⁸⁾, Judge Learned Hand coined the famous Hand formula, 'PL>B', to determine the degree of 'reasonable care' and the extent of 'negligence' of the actor. The Hand formula uses cost-benefit analysis from economics, comparing the prevention cost of the actor with the weighted average benefit, to replace the relatively vague concept of 'negligence' from legal theory. Richard A. Posner extolled this formula and the concepts behind it⁹⁾.

2. New Institutional Economics

2.1. Overview: The Coase Theorem, Behavioural Assumptions and Two Important Corollaries

It is well known that the concept 'Coase Theorem' is not put forward by Ronald Coase himself, and he never gives the concept an exact expression. Coase thought Stigler is the scholar who presented and expressed 'Coase Theorem' first, and the main viewpoint of the theorem was initially put forward in *The Federal Communications Commission*. The viewpoint was restated in *The Problem of Social Cost*, and the assumption of zero transaction cost was emphasized¹⁰⁾.

In *The Problem of Social Cost*, Coase discussed the legal delimitation of rights and its

economical outcome with several imaginary situations and real lawsuit cases. He found that the cost of market transactions is obstacle of running of the pricing system. The result was very important and interesting so that this dissertation has to retell it to achieve a clearly understanding:

It is necessary to know whether the damaging business is liable or not for damage caused since without the establishment of this initial delimitation of rights there can be no market transactions to transfer and recombine them. But the ultimate result (which maximises the value of production) is independent of the legal position if the pricing system is assumed to work without cost.¹¹⁾

There are three key points could be learned from the paragraph above. Firstly, the rights won't be transferred effectively if no one knows the owner. The necessary establishment of initial delimitation of rights, in most situations, is made by law and regulations, and sometimes made by other institutions, like enterprises, families, manners and customs. Secondly, if the pricing system could work without cost, the establishment of initial delimitation of rights is still necessary for transaction, but has none of influences on production value maximisation. That means, it still influences distributive justice. Thirdly, if the pricing system works with cost, the establishment of initial delimitation of rights is not only necessary but also much more important to determine both the distributive result and production value outcome. But two questions were left: In real world, the pricing system works with cost inevitable, so how large influence the delimitation of rights have? If the core

part of institutions is the delimitation of rights, how to establish and assess it?

Douglass North answered the first question in his writing *The Rise of the Western World: a New Economic History*. He suggested that ‘efficient economic organisation is the key to growth’, and ‘the development of an efficient economic organisation in Western Europe accounts for the rise of the West’. He further explained as follows:

Efficient organisation entails the establishment of institutional arrangements and property rights that create an incentive to channel individual economic effort into activities that bring the private rate of return close to the social rate of return.¹²⁾

It’s worth noting that the rate of return is not a ratio here, but the sum of net receipts. Obviously, North believes that a perfect organisational institution may internalize the externality of the organisation members’ behaviours. The method is to establish a perfect delimitation of property rights.

Oliver Williamson answered the second question in his writing *The Economic Institutions of Capitalism*. In the methodology which he called ‘transaction cost economics’, he emphasized the significance of transaction cost economising. He said: ‘An accurate assessment of the economic institutions of capitalism cannot, in my judgment, be reached if the central importance of transaction cost economising is denied.¹³⁾’ Although the research objective is the capitalist economy, he expanded the thesis in a footnote later as follows: ‘Indeed, transaction cost economising is central to the study of economic organisations quite generally----in capitalist and noncapitalist economies alike.¹⁴⁾’

The approach to the study of economic organisation employed in the transaction cost economics is that of 'contractual man'. The concept of contractual man characterizes human nature by 'bounded rationality' and 'opportunism'. The former is a cognitive assumption, and emphasized both intended and limited rationality. Design and management of decision processes and governance structures are the transaction cost economising methods based on bounded rationality. The latter refers to the incomplete or distorted disclosure of information, and it's a source of behavioural uncertainty in economic transactions¹⁵). The dissertation adopts the same behaviour assumptions as Williamson's transaction cost economics, because of the powerful explanatory ability on the real world.

Williamson established a great and effective research viewpoint and methodology for the economic institutions. But his methodology lacks cognitive fidelity of the role of law and court ordering. The dissertation expands it and discusses the relationship among law, court judgment and transaction cost economics later, in the third part of this section.

The Coase Theorem shows a newness viewpoint of the relationship among institutions, rights, transaction cost and production value. North and Williamson gave the theorem two important corollaries for the real world: 1, Economic institutional arrangement, especially the delimitation of rights, is the key to growth and internalization of externality. 2, Transaction cost economising is the most important objective of economic institutions.

2.2. Transaction Cost and Its Forms

The Coase Theorem indicates that the transaction cost is a key factor in institution construction. But what is transaction cost and how to compare the influences on it of different

institutions? This part discusses the existing viewpoints and tries to establish a new model for the research on legal institutions.

In *The Nature of the Firm*, Coase asked why there is any organisation, and explained it by analysing of pricing system and the cost. He said: 'It can, I think, be assumed that the distinguishing mark of the firm is the supersession of the price mechanism.¹⁶⁾' He explained the thinking more detailed as follows:

The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism. The most obvious cost of 'organising' production though the price mechanism is that of discovering what the relevant price are. This cost may be reduced but it will not be eliminated by the emergence of specialists who will sell this information. The costs of negotiating and concluding a separate contract for each exchange transaction which takes place on a market must also be taken into account.¹⁷⁾

Coase defined the transaction cost as the information cost for the relevant price discovery and the negotiating cost for achieving contracts. Obviously this cost derives from information asymmetry.

But this definition of transaction cost was criticized for 'tautological reputation¹⁸⁾' and difficult to operate. Coase explained the existence of organisations, but he didn't explain the existence of diverse organisation types, and the relationship between such types and their scale. Steven Cheung suggested that the different types of transaction costs and how they will vary under different circumstances have to be identified¹⁹⁾.

Williamson classified the transaction costs as *ex ante* and *ex post* types. The *ex ante* transaction costs includes the costs of drafting, negotiating, and safeguarding an agreement²⁰). The *ex post* transaction costs includes the maladaptation costs, the haggling costs, the setup and running costs and the bonding costs²¹). Douglas Allen defined the transaction costs as the costs establishing and maintaining property rights²²). Jürg Niehans defined the transaction costs as the costs resulting from the transfer of property rights²³). Steven Cheung provided an interesting definition which may be seen as a combination of all the other definitions: transaction costs include any costs that are not conceivable in a 'Robinson Crusoe economy'²⁵). Obviously, this definition includes both the definition of Allen and Niehans, and it's the most accurately definition for achieving Coase's argument.

The main objective of Emission Trading Scheme is to make the emission rights flow to the users with higher productivity smoothly and create more values. The dissertation tries to study the influences of different legal institutions on this objective. For this purpose, two pairs of transaction costs, internal transaction costs and external transaction costs, as well as institutional transaction costs and contractual transaction costs, have to be distinguished.

Coase distinguished internal and external transaction costs substantially although he didn't describe them clearly:

...as a firm gets larger, there may be decreasing returns to the entrepreneur function, that is, the costs of organising additional transactions within the firm may rise. Naturally, a point must be reached where the costs of organising an extra transaction within the firm are equal to the costs involved in carrying out the transaction in the open market, or, to

the costs of organising by another entrepreneur.²⁶⁾

Coase provided a qualitative description of internal and external transaction costs. Internal transaction costs are the costs of organising transactions within the institution. External transaction costs are the costs of achieving transactions outside the institution and in the market. The equilibrium point of scale of the institution is the point where the marginal internal transaction costs equals the marginal external transaction costs.

Obviously, the marginal external transaction costs will rise along with the increasing of scale of transactions periodically. For example, imagine a pencil factory with the demand of timber. The entrepreneur may purchase the timber from where the marginal external transaction costs are the lowest first, like local market. The entrepreneur may be skillful in local language, expert in local laws and regulations, and experienced in local customs and market price, so he may establish a confidential relation with the local suppliers. The marginal external transaction costs may be constant at this stage. But the quantity supplied is limited in local market. The entrepreneur has to expand the procurement scope to the timber markets of other areas, even overseas, as long as the enterprise scale continues to expand. The disparity of many factors, like languages, laws, customs and trade usages, ask for more experiences and abilities. The marginal external transaction cost will increase along with the expanding.

The relationship between internal and external transaction costs explains the existence and the scale of institutions. But why the marginal internal transaction costs may rise, as the firm gets larger? And why the firms of the same industry may have different scale? The two questions should be answered by the classification of institutional and contractual transaction

costs.

There is no transaction costs in Robinson Crusoe's small island, until he saves a savage after living alone more than twenty years, whom named 'Friday' by Crusoe. If there is no any institutions, all the transaction costs between Crusoe and Friday are contractual transaction costs. These contractual transaction costs include not only the costs resulting from the transfer of property rights, but also the costs resulting from the attempt of rights transfer. Crusoe and Friday establish a trust relationship soon, partly friends, partly master and slave, and try to use the institutional transaction costs, the costs establishing and maintaining rights, to replace the contractual transaction costs. Friday mainly obeys Crusoe without question, and Crusoe provides Friday with means of production, knowledge and safety. They have a unwritten long-term contract substantially, as all the institutions are constituted by long-term contracts. This institution could be formed by many reasons. For example, in this case Friday deems he has to obey Crusoe because he has been saved by Crusoe and the latter has many experiences and outstanding achievements on desert island survival. Last but not least, Crusoe has guns. The initial establishment of the institution spends a certain amount of institutional transaction costs, but the contractual transaction costs will be saved later.

According to Coase's argument, the marginal internal transaction costs equals the marginal external transaction costs in the equilibrium point of the scale of institution:

$$MTC_{\text{ext}} = MTC_{\text{int}}$$

where:

MTC_{ext} = marginal external transaction costs

MTC_{int} = marginal internal transaction costs

In the institution, the institutional transaction costs are spent to reduce the contractual transaction costs. But the objective won't be perfectly achieved in any institution, and a certain amount of contractual transaction costs will remain for the organising of an extra transaction inside the institution. In the equilibrium point of the scale of institution, the relationship among them could be expressed as:

$$MTC_{ext} - \text{saved } MTC_{cont} + MTC_{inst} = MTC_{int}$$

where:

saved MTC_{cont} = saved marginal contractual transaction costs

MTC_{inst} = marginal institutional transaction costs

According to the two equations above, in the equilibrium point:

$$MTC_{inst} = \text{saved } MTC_{cont}$$

So that the scale of institutions depends on two factors. One of them is the exogenous factor, industry characteristic, which influences the external transaction costs directly. The other one is the endogenous factor, organisational system, which influences the institutional transaction costs and the saved contractual transaction costs.

Although the marginal external transaction costs will rise along with the increasing of institutional scale periodically, like the dissertation discussed before, that kind of costs could be assumed to be constant in a certain interval, to make the following figure simpler. Figure 2-1 shows the relationships among these kind of costs mentioned above and the scale of transactions, and the relationships won't be influenced under the assumption or not.

Figure 2-1a shows the relationships between the scale of transactions and the marginal transaction costs in one kind of industry. In a certain institution with some kind of certain

organisational system, the MTC_{inst} may stay low in a certain interval, but gets higher quickly along with the increasing of scale due to the increasing of transaction complexity. The more complicated design the institution has, the longer the constant interval will be, but accompanied with the higher initial demand of institutional transaction costs, which is shown in Figure 2-1b. The intersection point E of curve MTC_{int} and line MTC_{ext} has the same scale k as the intersection point E' of curve MTC_{inst} and line saved MTC_{cont} . That is inevitable because the difference value between MTC_{int} and MTC_{inst} always equals the difference value between MTC_{ext} and saved MTC_{cont} , which equals the remaining marginal contractual transaction costs (ΔY) within the institution.

Figure 2-1b shows the relationships among the scale of transactions, total institutional transaction costs and saved total contractual transaction costs in the same kind of industry. The institution of TC_{inst1} is a simple designed institution, like hand workshop. The institution of TC_{inst2} is consistent with the institution showed in Figure 2-1a, and it has a more complicated design, like modern corporation. To establish a modern corporation, larger initial institutional transaction costs have to be spent by the participants than a hand workshop, but the marginal institutional transaction costs will stay low in a longer period.

When transactions scale reaches k_1 , the handicraftsmen decide to employ apprentices so that hand workshops emerge. Modern corporations are still not exist until transactions scale reaches k_2 because institutional transaction costs are higher than saved contractual transaction costs before that point. The two types of institutions, hand workshops and modern corporations may exist in the market at same institutional scale, when it is between k_2 and k_1' , but only modern corporations could have a larger scale over k_1' . The participants of the

industry have to study and establish a more complicated and effective institution when they want to expand the institutional scale over k_2' .

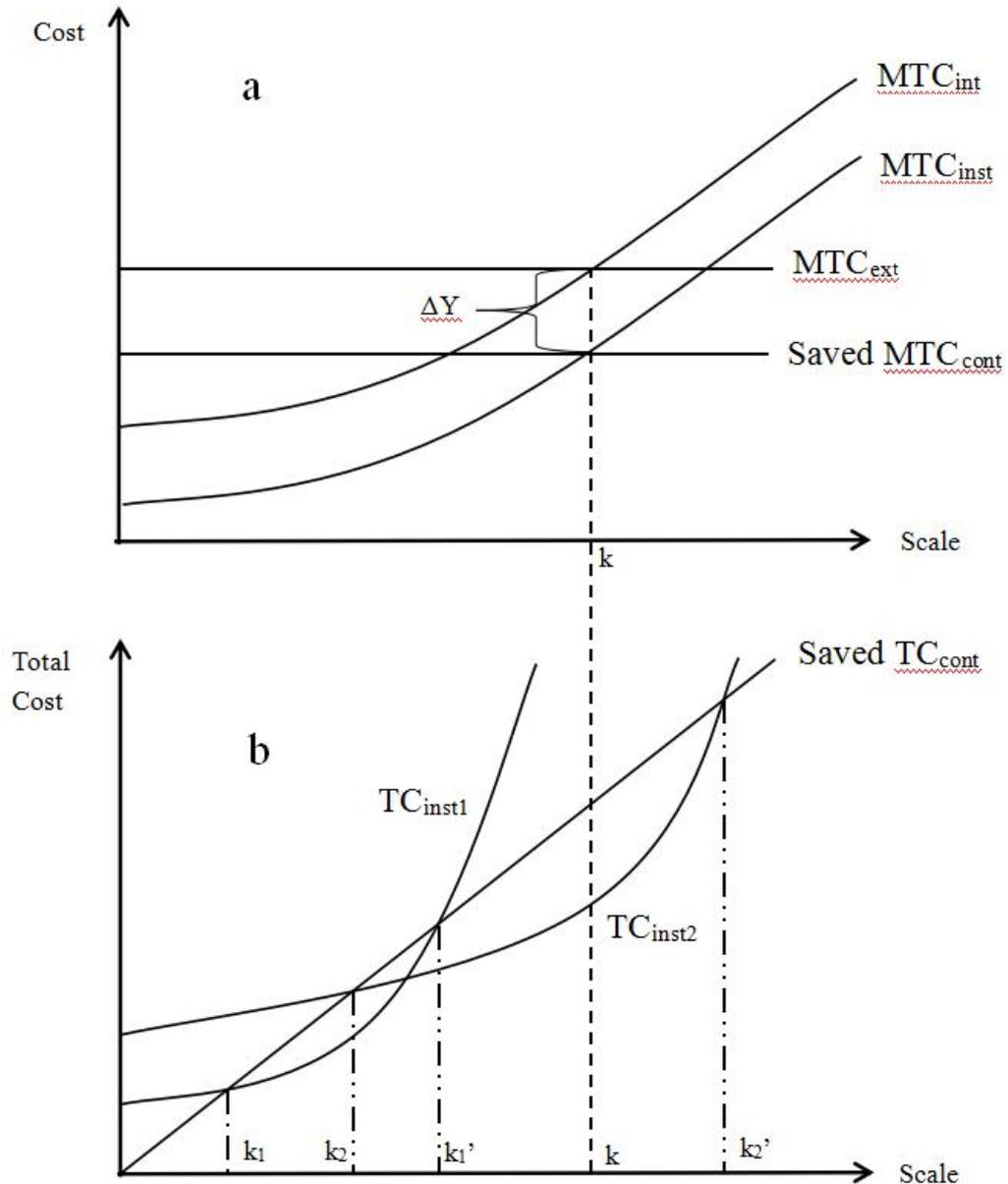


Figure 2-1. Transaction Costs and Institutional Scale

2.3. Legal Institutions, Asset Specificity and Fundamental Human Rights

This part discusses the connection of new institutional economics and laws.

The role of government regulation in market economy has always been a controversial

issue among economists and lawyers. North believes that the government regulation sometimes could establish a useful and better institution for the economic development, by protecting and maintaining effective arrangement of property rights at lower costs. He expressed the argument as follows:

Given the described assumptions about the way people behave, economic growth will occur if property rights make it worthwhile to undertake socially productive activity. The creating, specifying and enacting of such property rights are costly, in a degree affected by the state of technology and organisation. As the potential growth for private gains to exceed transaction costs, efforts will be made to establish such property rights. Governments take over the protection and enforcement of property rights because they can do so at a lower cost than private volunteer groups. However, the fiscal needs of government may induce the protection of certain property rights which hinder rather than promote growth; therefore we have no guarantee that productive institutional arrangements will emerge.²⁷⁾

The kind of costs of 'creating, specifying and enacting of property rights' are the institutional transaction costs mentioned last section. And the 'potential growth for private gains' is the saved contractual transaction costs. In fact, North described the emerging points of institutions, like points k_1 and k_2 in Figure 2-1b. The institutions have many forms, and it should be made sometimes by governments with legal tools, sometimes by private participants of the market. It depends on the comparative of necessary institutional transaction

costs. The problem is, the legal institutions can hardly be amended or even dissolved like private institutions. Another problem is like Allan Schmid said: ‘It can be observed that some managers of government agencies do not aggressively pursue cost-saving opportunities. They appear to try to maximise their budget total, which gives them larger salaries and prestige.’²⁸⁾

Williamson doubts the effects of legal institutions and believes that private ordering has relative merits in relation to court ordering²⁹⁾. He said that the transaction cost economics ‘place greater weight on the *ex post* institutions of contract, with special emphasis on private ordering (as compared with court ordering)’³⁰⁾. But he didn’t realise that sometimes the court ordering is not an alternative of solution, but a part of the institutional arrangement of property rights, that is, a precondition of private ordering. In Chapter IV, the dissertation discusses this argument further with Japan’s air pollution tort lawsuits.

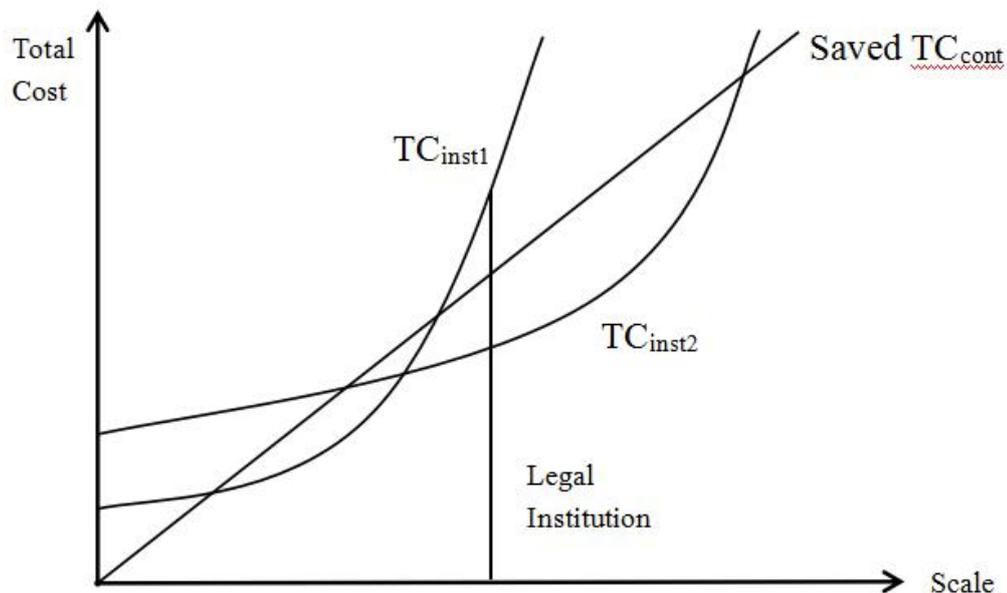


Figure 2-2. Legal Institution and Institutional Scale

At the same time, Williamson pointed out an important viewpoint of transaction cost economics: ‘assigning transactions (which differ in their attributes) to governance structures

(the adaptive capacities and associated costs of which differ) in a discriminating way' could economise transaction costs³¹). He suggested that the most important and most distinctive feature of the principal dimensions of transactions is asset specificity³²). In legal institutions, this argument is also correct and useful.

Figure 2-2 shows the relationship among legal institutions and institutional scale. The core divergence of different organisation forms is the arrangement of specific assets. Basically, legal institutions are difficult to change their controlled institutional scale (i.e., horizontal shift) by the legislatures. In most time, the change adapting to market should be made between different organisation forms (e.g., to change the institution from TC_{inst1} to TC_{inst2}), by the governmental administrative departments. The core measure is to change the asset specificity. Williamson mentioned four different types of asset specificity: site specificity, physical asset specificity, human asset specificity and dedicated assets³³). In Chapter V, this dissertation focuses on the verification and certification by the third parties during the transference of carbon emission rights, by analyses on the legal institutions and their asset specificity.

The last remaining question is, if the legal institutions could be seen as the same as economic institutions, then is there any 'private plot' for legal institutions? In other words, does the world still need laws if there is no transaction costs? The Coase Theorem doesn't concern distributive justice at all, that is, the initial delimitation of rights doesn't influence the social welfare maximisation if the transaction cost is zero, but does influence the benefit of individual participants. Subject to the bounded rationality and opportunism of human behaviour, the rights which are called fundamental human rights must be protected by legal institutions. These rights are also the precondition of the existence of markets, which are

discussed more detailedly in Chapter IV.

Endnotes

- ¹⁾ Individuals here and below include natural persons, legal persons and other organisations in a broad sense.
- ²⁾ Zhang, S. Z.(1986), p.1.
- ³⁾ Wade, H. W. R. & Forsyth, C. F.(2009), p.4.
- ⁴⁾ Schwartzs, B. & Xu, B.(Translator) (1986), p.1.
- ⁶⁾ Luo, H. C., Yuan, S.H. & Li, W. D.(1993), p.54.
- ⁷⁾ Marx, K. & Engels, F.(1973), p.604. Quoted from: Luo H. C. & Shen K.(1996), p.4.
- ⁸⁾ 159 F.2d 169 (2d. Cir. 1947).
- ⁹⁾ See Posner, R.A.(1992), Chap. 6.
- ¹⁰⁾ Coase, R. H.(1988), pp.157-158
- ¹¹⁾ Coase, R. H.(1960), p.8.
- ¹²⁾ North, D. C.(1973), p.1.
- ¹³⁾ Williamson, O. E.(1985), p.17.
- ¹⁴⁾ Ibid., p.18.
- ¹⁵⁾ Ibid., pp.43-49.
- ¹⁶⁾ Coase. R. H.(1937), p.389.
- ¹⁷⁾ Ibid., pp.390-391.
- ¹⁸⁾ Williamson, O. E.(1985), p.4.
- ¹⁹⁾ Cheung, S.(1983), p.4.
- ²⁰⁾ Williamson, O. E.(1985), p.20.
- ²¹⁾ Ibid., p.21.
- ²²⁾ Allen, D. W.(1991), pp.1-18. Quoted from Allen, D. W.(1999), p.898. Also see: Allen, D. W.(1998), p.116.

²³⁾ Niehans, J.(1987), 'Transaction Costs', in *The New Palgrave: A Dictionary of Economics*, London Macmillan, pp.676-679. Quoted from Allen, D. W.(1999), p.901.

²⁵⁾ Cheung, S.(1992).

²⁶⁾ Coase, R. H.(1937), p.394.

²⁷⁾ North, D. C.(1973), p.8.

²⁸⁾ Schmid, A. A.(1978), p.140.

²⁹⁾ Williamson, O. E.(1985), p.9.

³⁰⁾ Ibid., p.18.

³¹⁾ Ibid., p.18.

³²⁾ Ibid., p.52.

³³⁾ Ibid., p.55.

Chapter III. Legal Attribute of Carbon Dioxide

On September 25th, 2015, ‘U.S.-China Joint Presidential Statement on Climate Change’ mentioned that China planned to launch national carbon emission trading system in 2017. The system is supposed to be established based on the experiences of the 7 pilot provincial and municipal carbon trading markets.

But until now, the current pilot carbon trading markets are working without national law’s support. The latest version of *Air Pollution Prevention and Control Law*, which has been passed by National People’s Congress (NPC) on August 29th, 2015, still doesn’t give a clear definition to ‘pollutants’. It mentions ‘greenhouse gases’ once but doesn’t provide any legal basis for the administrative behaviours that are necessary for the carbon emission trading system.

Carbon dioxide (CO₂) is or is not air pollutant, which is same as *to be, or not to be* by Hamlet. The simple dichotomy often causes unimaginable complex arguments. Most scholars and social views thought that carbon dioxide was much different from the traditional pollutants, and should not be considered as pollutant. Satish suggested that CO₂ is an indoor pollutant because ‘direct adverse effects of CO₂ on human performance may be economically important and may limit energy-saving reductions in outdoor air ventilation per person in buildings’¹⁾. The Supreme Court of the United States judged that CO₂ is a pollutant in the case *Massachusetts v. EPA*²⁾ at 2007³⁾, and the Environmental Protection Administration of China’s Taiwan also formulated regulations to involve CO₂ and other greenhouse gases into air pollutants at 2012⁴⁾.

The chapter is divided into three parts, and demonstrates the feasibility and necessity of carbon dioxide as a statutory air pollutant from two perspectives of positive analysis and normative analysis. The first part respectively starts from the definition of pollutants in the context of environmental science, economics and jurisprudence, and makes positive analysis based on representative relevant laws of various countries. The second part focuses on the problem whether carbon dioxide should be considered as a statutory air pollutant, and makes normative analysis of various essential administrative behaviours and their legal basis in the means of carbon dioxide emission reduction to demonstrate the necessity to include carbon dioxide in *Air Pollution Prevention and Control Law*. The third part is the comments on the objections.

1. Positive analysis of CO₂ legal attribute

The part aims to discuss the common ground of carbon dioxide and ‘air pollutants’ in legal definition. However, ‘pollutants’ is a concept of environmental science and most of the regulatory means such as carbon tax and carbon trading market are based on research on economics, so the part also needs to consider the meaning of pollutants in the context of environmental science and economics.

1.1. ‘Pollutants’ in the Context of Environmental Science and Economics

In environmental science, research is based on pollution itself. Among it, ‘air pollution’ refers to the phenomenon that some substances in the atmosphere become harmful due to its enough content, so that they hinder the normal existence and development of human beings

and ecological system and cause damage to human body, ecology and materials. Based on it, 'air pollutants' refer to the substances harmful to environment and human beings resulting from human activities or natural emission into atmosphere. This is a very broad definition. Natural environment has the role of natural purification. So generally speaking, air pollution in the natural process can recover automatically as time goes on. Therefore, according to environmental science, air pollution is mainly resulted from human activities⁵). Carbon dioxide is consistent with the definition of air pollution in environmental science. In fact, carbon dioxide has been involved in the research of pollutant in a lot of literature on air pollution in environmental science.

In the classical economics, there is no description for pollutants, for pollutants were not commodity and had no value, which seems impossible to be regulated by the invisible hand. Until Marshall put forward the concept of external economies and Pigou proposed Pigouvian tax to adjust the supply of products with negative externalities, pollutants could be involved in economic analysis due to the characteristics of negative externalities. Later, Coase took pollution as a case, analysed property rights and transaction costs to put forward a method, by which the market could spontaneously adjust the products with negative externalities. Dales even directly proposed the theory of emissions trading. Therefore, the term of pollutant was officially widely studied by economists.

The part summarises the above-mentioned meaning of pollutants in the context of environmental science and economics to find out the obvious differences in them. Environmental science regards environment as its direct research objective, so its definition of pollutants contains the following three key factors:

i. They are resulted from human activities or natural processes and thus discharged into environment from the perspective of source;

ii. This substance should be required to reach a harmful level from the perspective of the judged boundary;

iii. Human body, materials and ecological system can be considered as the victims from the perspective of results.

But economics regards the social benefits maximisation as its research objective. It speaks of pollutants just in order to serve the objective. Therefore, compared with environmental science, the meaning of pollutants in economics is obviously different:

i. They are only resulted from human activities from the perspective of source;

ii. They can be summarised as the substance with negative externality from the perspectives of judged boundary and results.

In fact, pollutants in this context not just refer to tangible materials. The intangibles or even virtual concepts with negative externality resulted from human activities can all be involved in economic analysis along with the tangibles. For example, noises, high-rise buildings blocking out the sun, domestic cattle destroying farm crops in the neighbor farm, or even the infectious immorality of the elders who fall blackmailing the helpers can all be equally treated in economic analysis.

1.2. 'Pollutants' in the Context of Jurisprudence

Law is a tool to regulate social relations. Pollutants in the context of jurisprudence are consistent with those in the context of environmental science or economics on the whole; in

the meantime, the former is subtly different from the latter.

Air Pollution Prevention and Control Law implemented in China at present does not specifically define the term of air pollutants, which is an important pity. But *Water Pollution Prevention and Control Law* amended in 2008 made a specific definition of water pollutants, which has great reference value for the amendment of *Air Pollution Prevention and Control Law* in the same system. The relevant legal definitions of various pollution and pollutants in other countries or regions are also worth learning.

Based on the analysis of the relevant laws and regulations of countries and regions such as China, the USA, Canada and the EU, the part takes its essence and considers that the definition of pollutants in the environmental law should contain the following three core elements.

Firstly, environmental pollutants should specially refer to the substances resulted from human activities. Laws are social norms, which adjusts human behaviours to regulate social relations⁶⁾. Natural substances irrelevant to human activities can produce various impacts, but they should not be listed in the content of environmental laws and regulations. In China, *Water Prevention and Control Law* is shortage of this point in the definitions of water pollution and water pollutants⁷⁾, which will cause inconvenience in practice.

Secondly, environmental pollutants may be directly or indirectly harmful to the health, safety and welfare of humans, or human use for ecological environment in a reasonable expectation. Laws serve people in the end. If the content is missing or not clear, the definition of pollutants will become broad and empty; on the contrary, it will produce negative impact on legal practice, so is the definition of *Clean Air Act* in the USA⁸⁾, and thus trigger

everlasting legal disputes⁹). And the part imitates the relevant diction of the EU directives to use the term of ‘may be’¹⁰. In the case of replying principles, environmental pollution is gradually turning from post treatment to beforehand prevention. In most cases, if the relevant department does not identify pollutants until harm and causality become clear, it will be too late.

Finally, environmental pollutants should lead to the changes of the environmental characteristics such as physics, chemistry, biology or radioactivity and so on. When harm or causality is not yet fully clear, it is a relatively clear and easy standard to judge the boundary and can avoid the magnification of the objectives due to the principle of beforehand prevention.

The part combines the above-mentioned three points and applies them to air environment. Air pollutants refer to the substances, which come from human activities and enter into air environment to lead to the changes of the environmental characteristics such as physics, chemistry, biology or radioactivity and so on and can directly or indirectly produce negative impact on human health, safety and welfare, or human use for ecological environment in a reasonable expectation. Undoubtedly, carbon dioxide emitted from human activities belongs to air pollutant.

2. Normative Analysis of CO₂ Legal Attribute

The part answers one question: should carbon dioxide be defined as one of air pollutants? That is to analyse its necessity. It needs an analysis from bottom to top, namely, it should start from the means to reduce emissions, analyse the characteristics of the methods, and obtain the

legal basis as it needs.

2.1. Administrative behaviours in CO₂ Emission Reduction

Broadly speaking, carbon dioxide emission reduction involves many methods indirectly related to carbon dioxide such as energy conservation, the development and application of clean energy, and forest planting. The section excludes these methods.

The administrative behaviours included in various relevant emission reduction methods which will have a direct impact on rights and obligations of the counterparts are as follows:

Methods of Emission Reduction	Specific Administrative behaviours	Main Relevant Laws and Regulations at Present
Clean Development Mechanism (CDM)	Administrative licensing; Administrative penalty	<i>Management Measures of Clean Development Mechanism Project Operation</i>
Compulsory carbon trading market	Administrative licensing; Administrative collection; Administrative penalty	<i>Interim Management Measures of Carbon Emission Rights Trading</i> Local regulations formulated by local governments of pilot markets and other regulatory documents formulated by their subordinated

		departments
Voluntary carbon trading	Administrative licensing; Administrative penalty	<i>Interim Management Measures of Voluntary Emission Reduction Trading of Greenhouse Gases;</i> Other regulatory documents formulated by local Development and Reform Commissions of pilot compulsory carbon trading markets
Carbon tax	Administrative collection	Not available
Pollutants discharge standard	Administrative licensing; Administrative collection; Administrative penalty	<i>Environmental Protection Law;</i> <i>Air Pollution Prevention and Control Law;</i> National comprehensive emission standard and national industrial emission standard are uncrossed in the implementation process.
Environmental information	Administrative order;	<i>Environmental Protection</i>

disclosure	Administrative penalty	<i>Law;</i> <i>Cleaner Production</i> <i>Promotion Law;</i> <i>Measures of Environmental</i> <i>Information Disclosure</i> <i>(Trial)</i>
Environmental impact assessment	Administrative licensing; Administrative penalty	<i>Environmental Protection</i> <i>Law;</i> <i>Law on Environmental</i> <i>Impact Assessment;</i> Series of department regulations from Ministry of Environmental Protection
Carbon Capture and Storage (CCS)	Administrative licensing	Not available

**Table 3-1. Methods, Administrative behaviours and Relevant Laws on Carbon
Emission Reduction**

The administrative behaviours include abstract administrative behaviours and specific administrative behaviours. The former includes the relevant administrative legislation and other administrative behaviours, which aim at unspecific objects and can be used repeatedly, and are almost showed in every method to reduce emission in the above table. For example, local government sets up the total carbon emissions within its jurisdiction; Ministry of

Environmental Protection¹¹⁾ stipulates the pollutants discharge standards for the various industries. Therefore, the above table just refers to the specific administrative behaviours instead of the abstract administrative behaviours.

The far right column in the table lists the main relevant laws and regulations of various emission reduction methods in China. Among them, only obvious high-lever laws are listed.

CDM is one of the important components of the carbon trading market and the first trading mechanism adopted by China. In 2004, National Development and Reform Commission (NDRC), Ministry of Science and Technology, and Ministry of Foreign Affairs jointly released *Interim Management Measures of Clean Development Mechanism Project Operation*¹²⁾. After Kyoto Protocol officially went into effect, the above three ministries and Ministry of Finance jointly released *Management Measures of Clean Development Mechanism Project Operation*¹³⁾ in 2005, and four ministries modified it in 2011¹⁴⁾. Among them, the content involved the administrative licensing for the approval of the CDM project and the administrative penalty for the relevant improper behaviours of project implementation organisations. The legal hierarchy of the measures is departmental regulations.

Compulsory carbon trading market is 7 provincial and municipal pilot carbon market started in succession in 2013. The NDRC released *Interim Management Measures of Carbon Emission Rights Trading* in 2014¹⁵⁾. In the compulsory market, types of greenhouse gases, range of industries, confirmed standards for key emission units, and national quota allocation plan and others were subject to the interim measures and determined by the NDRC. Based on it, the local Development and Reform Commissions respectively determined the range of industries and allocation plan in its own market. The legal hierarchy of the interim measures

is departmental regulation.

Voluntary carbon trading is an exploration from the NDRC after 7 provincial and municipal pilot compulsory carbon trading market. The recorded emission reductions, called Chinese Certified Emission Reductions (CCER), can enter into the market as the supplement of the CDM project and compulsory carbon trading market. In 2012, the formulated *Interim Management Measures of Voluntary Emission Reduction Trading of Greenhouse Gases* was distributed to ministries and commissions under the State Council, departments directly affiliated to the State Council, Development and Reform Commissions of provinces, autonomous regions and municipalities directly under the central government in the form of notice¹⁶). Among them, it also included the administrative licensing for the investigation records of voluntary emission reduction projects, emission reductions, trading institutions and validation and certification institutions, and the administrative penalties for the violations of laws and regulations of trading institutions and validation and certification institutions. The legal hierarchy of the interim measure is departmental regulation. The Development and Reform Commissions of the 7 pilot provincial and municipal compulsory markets respectively formulated other regulatory documents for the connection with CCER.

At present, carbon tax in China is still under research and has no relevant laws. According to the principle of law-based taxation, tax elements must be clearly defined by laws. ‘The collection of tax or the cessation thereof, the reduction, exemption and refund of tax as well as the payment of tax underpaid shall be implemented in accordance with the law or the relevant provisions stipulated in administrative regulations formulated by the State Council, provided that the State Council is authorized by the law to formulate the relevant

provisions¹⁷⁾. In China, the current personal income tax, corporate income tax and vehicle and vessel tax are legalized by the NPC, and other taxes are specified by the administrative regulations stipulated by the State Council under the authority of laws. Therefore, if the country wants to levy carbon tax, the NPC shall make law or authorize the State Council to stipulate the administrative regulations. After all, since *Air Pollution Prevention and Control Law* has no content related to tax, even the country incorporates carbon tax into its regulation scope, it is still insufficient to provide the legal basis for carbon tax levy.

Pollutants discharge standard is the emission reduction method, which is the most widely used, in the environmental law; among it, air pollutants are jointly regulated by *Environmental Protection Law* passed and modified by the NPC in 2014 and *Air Pollution Prevention and Control Law* modified in 2015. Based on it, the Ministry of Environmental Protection and the local government formulated the emission standards of the national or local pollutants¹⁸⁾. The former is departmental regulation, and the latter is the local regulation. Among them, access to emission permits belongs to the administrative licensing¹⁹⁾, pollutants discharge fees levy belongs to the administrative collection²⁰⁾, and the relevant penalties belong to the administrative penalties²¹⁾.

Environmental information disclosure includes government information disclosure and corporate information disclosure, which here means that enterprises disclose information such as their own pollutants discharge and construction of environmental protection facilities. In addition to *Environmental Protection Law*, the NPC passed *Cleaner Production Promotion Law* in 2002 and modified it in 2012. Based on it, the State Environmental Protection Administration released *Measures of Environmental Information Disclosure (Trial)*²²⁾, which

included the administrative orders²³⁾ that local environmental protection department can demand serious pollution enterprises to disclose pollution information and the administrative penalty²⁴⁾ for the ones who refuse to do that. Pollutant release and transfer register (PRTR) is also one of environmental information disclosure.

Environmental impact assessment refers to the methods and institutions for analysing, predicting and appraising the impacts of programs and construction projects that might incur after they are carried out so as to propose countermeasures for preventing or mitigating the unfavorable impacts and make follow-up monitoring²⁵⁾. It is co-regulated by *Environment Impact Assessment Law* passed by the Standing Committee of the NPC in 2003 and *Environmental Protection Law*. Based on it, Ministry of Environmental Protection formulated a series of departmental regulations, which included the administrative licensing²⁶⁾ for the approval of project implementer and the administrative penalty²⁷⁾ for illegal behaviours.

Carbon capture and storage technology still grows. The countries such as Australia and the United States have occupied a leading position in the relevant legislation in the world. At present, China just tries few projects. If China promotes the projects extensively, it may involve administrative licensing behaviours such as the approval of capture projects implementation and storage site. The current laws have no part related to it, so the special legislation is necessary.

2.2. Analysis of legal basis

The measures to reduce carbon dioxide emissions mainly include administrative licensing, administrative collection, administrative penalty, and administrative order and other

specific administrative behaviours, and have a direct impact on the rights and obligations of the counterparts. Among them, administrative licensing and administrative penalty are specially regulated by specific laws of *Administrative Licensing Law* and *Administrative Penalty Law*, and administrative collection and administrative order are scattered in various laws and regulations. From the theoretical perspective of the administrative law, the specific administrative behaviours require the legal support. Administrative licensing can be enacted by laws or administrative regulations in accordance with *Administrative Licensing Law*²⁸; according to *Administrative Penalty Law*, laws can enact all kinds of administrative penalties; administrative regulations can enact administrative penalties except for restrictions on personal liberty; the local laws can enact administrative penalties except for restrictions on personal liberty and revocation of business license; departmental regulations and local regulations just can make specific provisions within the above norms; other regulatory documents cannot enact administrative penalties²⁹. Administrative collection and administrative order are not regulated by specific laws. Therefore, if there is no legal authority, administrative regulations and junior documents cannot make the relevant enactment.

Combined with the above analysis of administrative behaviours and their legal basis in the measures to reduce carbon dioxide emissions, the national legislation for the measures can be divided into three categories:

- i. Ones have had the legal basis provided by laws:

Environmental information disclosure and environmental impact assessment just need the departmental regulations from Ministry of Environmental Protection based on *Environmental Protection Law*, *Cleaner Production Promotion Law*, and *Environment Impact*

Assessment Law if they intend to incorporate carbon dioxide . The section has nothing to do with the situation whether carbon dioxide is pollutant.

ii. Ones still need special stipulated laws or administrative regulations:

Carbon tax and carbon capture and storage have no specific law. However, tax can be regulated by *Law Concerning the Administration of Tax Collection*, and administrative licensing contained in carbon capture and storage can be regulated by *Administrative Licensing Law*. The State Council has obtained the both authorization, and can regulate them in the form of administrative regulations. If there is no specific law or administrative regulation, the section cannot run legally even if carbon dioxide is incorporated in *Air Pollution Prevention and Control Law*.

iii. Ones should have special legislation or be incorporated in *Air Pollution Prevention and Control Law*:

Pollutants discharge standard has been stipulated by *Environmental Protection Law*, but *Air Pollution Prevention and Control Law* directly related to it did not clearly define the ‘pollutants’. Among them, Ministry of Environmental Protection and local government has been authorized to stipulate national standard and local standard³⁰); the State Council and local government can control the total amount³¹); the department in charge of environmental protection and other relevant departments of the local government can make administrative penalty³²). If carbon dioxide is incorporated in discharge standard and supplemented by the methods such as the relevant pollutants discharge fees levy, total amount control, administrative penalty, it should have the special legislation or is incorporated in air pollutants after the modification of *Air Pollution Prevention and Control Law*.

Another section refers to CDM, compulsory carbon trading market and voluntary carbon trading. According to the above analysis, the common characteristics of these three points are the situation that practice is far ahead of laws, and the most superior norms are just the departmental regulations formulated and issued by the NDRC. The three points contain administrative legislation and administrative licensing that set the total carbon quota amount and administrative penalty for various violations at least. But all the behaviours should not be set by departmental regulations. Therefore, in legal construction of the current carbon trading market, it is very urgent to provide legal basis for the departmental regulations and their administrative behaviours by laws or administrative regulations.

It is feasible to make a special legislation. For example, the direct corresponding laws such as *Law on Climate Change* and *Greenhouse Gas Management Law* can be stipulated. In fact, *Law on Climate Change* has been discussed for many years. Up to now, its first draft has come out; however, it is a long distance for the NPC to pass the final version.

Another feasible way is to incorporate carbon dioxide into air pollutants regulated in *Air Pollution Prevention and Control Law*. The amendment of *Air Pollution Prevention and Control Law* has been discussed many years from its previous version (2000), and finally passed by the NPC at August 29th, 2015, but many problems are still not solved. The general provision just mentions greenhouse gases once ---- ‘cooperative control of air pollutants and greenhouse gases’³³⁾, and just includes air pollutants³⁴⁾ without greenhouse gases in all of its provisions. And it still lacks a specific definition and interpretation of the most important concept of ‘air pollutant’. So is the relationship between greenhouse gases and air pollutants on earth coordinate or subordinate? If coordinate, why doesn’t the law mention it later after

the general provision? Is one of the legislative objectives to control greenhouse gases? All answers are unknown. Undoubtedly, the current version should be amended drastically again.

The new current also has a major breakthrough, namely, total pollutants discharge control and pollutants discharge licensing have been expanded to the country from the two control areas³⁵), and air pollutants emission rights trading has been mentioned³⁶). From another perspective, if the revised draft can make a clear definition of air pollutants, or clearly incorporate greenhouse gases into air pollutants, it can provide a meaningful legal basis for the national compulsory carbon trading market.

3. Comments on objections

Most scholars who oppose to define carbon dioxide as a statutory pollutant view from the perspective of natural science and hold the following several main basis: 1) carbon dioxide is not toxic; 2) carbon dioxide is necessary for life; 3) carbon dioxide is one of the main components in natural atmospheric environment..

Environmental law comes from the cross of natural science and jurisprudence. Undoubtedly, whether carbon dioxide should be classified as a statutory pollutant must be related to the results of natural science. However, law is different from natural science. Society is the sum of social relations originated in human intercourse based on material production. And the law is an artificial tool and results from the game playing of politics, economy, and culture and others, contributes to the adjustment of social relations, and has clear purposes. As productive forces continues to grow, production relations are constantly changing and have adverse effect on productive forces. Obviously, as an important tool to

adjust production relations, the law also should continue to make the corresponding adjustment so as to make production relations match the development of productive forces. Since the industrial revolution, compared with the laws in feudal society, the laws in **any** countries have been changed and corrected in a more and faster way, which is a strong proof. Carbon dioxide promotes the global warming and causes a series of serious consequences, so it is the best time to define carbon dioxide as the statutory pollutant. What's more, if we examine the impact of materials on human beings and environment from the perspective of dialectics, we will find that the nature of the impact depends on many factors, and the above-mentioned objection of metaphysics is also untenable.

Firstly, the same material may have a completely different impact on human beings in different places, which clearly manifests the law of the unity of opposites. Urea, a nitrogen compound widely existing in nature are the best proof. Nitrogen is a component of amino acid, protein, and chlorophyll and other important life materials. Therefore, nitrogen fertilizer can improve the yield and quality of agricultural products, and urea is widely used in China's agricultural industry. However, once excessive urea enters into water bodies, it will lead to the situation that algae and other plankton breed in quantity and dissolved oxygen in water bodies declines in quantity, and then a large number of fish and other creatures die, which is water body eutrophication as we often say. Since the 1980s, water body eutrophication caused huge losses to the fishery in many areas in China, and later was controlled after strict governance. Therefore, urea is the important productive material in the land environment, but it is considered as one of the pollutants in the water environment. *Water Pollution Prevention and Control Law* specifically stipulated how the agricultural producers should use chemical

fertilizers³⁷⁾.

Secondly, things grow from quantitative change to qualitative change basically. Quantitative change is the necessary preparation for qualitative change, and qualitative change is the inevitable result of quantitative change. Under the premise of proper time, place and quantity, carbon dioxide is undoubtedly nontoxic and harmless and one of the important substances necessary for life. However, since the industrial revolution, carbon dioxide was discharged in large amount and accumulated in atmospheric environment by the countries around the world and thus turned to a qualitative change from quantitative change. If we ignore the relation in it and just discuss about the nature of carbon dioxide under normal circumstances, we are caught in metaphysics. In fact, in some cases, even if oxygen is sufficient, the increased carbon dioxide concentration will produce toxicity harmful to human body, which is not rare in the industrial production³⁸⁾. Of course, carbon dioxide in the atmosphere is far from a tool to directly cause human poisoning, but it has been enough to prove that it is invalid that carbon dioxide should not be a statutory pollutant due to its non-toxicity and necessary for life.

In addition, *Water Pollution Prevention and Control Law* used the term of ‘intervention’ to define the pollutants, so some scholars thought the term indicated that the pollutants must be the substances that did not exist in the natural environment itself when they regarded it for reference; they made the analogy to the atmospheric environment, carbon dioxide, so one of main components of atmospheric environment, should not be considered as a pollutant. For this view, the case of *S. D. Warren Co. v. Maine Board of Environmental Protection et al.* adjudicated by the U.S. Supreme Court in 2006 is quite meaning.

S. D. Warren Co. made hydroelectric power through dam in Maine. The Federal Energy Regulatory Commission believed that the discharge behaviour³⁹⁾ was regulated by *Clean Water Act*. Therefore, the company should apply to Maine Department of Environmental Protection for discharge permission in advance before it applied for power generation permission. Because the dam of S. D. Warren Co. failed to meet some requirements, Maine Department of Environmental Protection refused to issue permission. The company thought it just put the stored water into the river bed through the turbine to generate power, which did not belong to discharge behaviours. After it lost lawsuit twice, it appealed to the Supreme Court in February, 2006.

Clean Water Act did not make a specific definition of ‘discharge’⁴⁰⁾, so the key to this case was whether the behaviour that S. D. Warren Co. put the stored water into the river bed through the turbine to generate power can be called as the discharge behaviour. The Supreme Court held in its verdict that the behaviour of restricting the water flow and releasing stored water through the turbine had an inherent risk of changing water quality, and was consistent with the definition of ‘pollution’ in *Clean Water Act*, ‘man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water’⁴¹⁾, therefore should be considered as a ‘discharge’ behaviour⁴²⁾.

It could be seen that the case was attributed to the blurry definition of the relevant laws, but the verdict from the Supreme Court similarly reflected the three elements of pollutants that the paper focused on. According to China’s *Water Pollution Prevention and Control Law*, heated waste water discharge should take corresponding measures to guarantee that the temperature of waters is in line with the water environment quality standards⁴³⁾. It can be thus

seen that when the water is in accordance with the three elements of the pollutants and be discharged into river, it may become pollutant even if it comes from the river and is not artificially added to any materials. So under normal circumstances, carbon dioxide that just accounts for 0.03% of the volume ratio in the atmospheric environment has no reason to feel unequal.

4. Conclusion

In the popular theory of the administrative law, both the power control theory and the balance theory require clear legal basis on the administrative behaviours which have a direct impact on the rights and obligations of the administrative counterparts. Main measures to reduce carbon dioxide emissions include various administrative behaviours. Among them, environmental information disclosure and environmental impact assessment have had legal basis; carbon tax and carbon capture and storage, still under the research, require special legislation in its implementation, and has nothing to do with *Air Pollution Prevent and Control Law*; for pollutants discharge standards, CDM projects, compulsory carbon trading market and voluntary carbon trading, the legal basis for their relevant administrative behaviours are not clear or completely missing. One of the solutions is to make special legislation for them. Since special legislation causes heavy work and uncertain time, it is the fastest and most convenient solution to combine with the emendation of *Air Pollution Prevent and Control Law* to incorporate carbon dioxide into air pollutants.

Endnotes

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- ¹⁾ Satish, U., et al.(2012), p.1671.
- ²⁾ 549 U. S. 497 (2007).
- ³⁾ 127 S. Ct. 1438 (2007), 1460.
- ⁴⁾ Decree of Environmental Protection Administration, No. 1010038277.
- ⁵⁾ Liu, P. T.(1995), pp.16-18.
- ⁶⁾ Zhang, W. X.(2007), pp.76-77.
- ⁷⁾ *Water Pollution Prevention and Control Law*, Article 91.
- ⁸⁾ *Clean Air Act*, Sec. 302. (g).
- ⁹⁾ See *Massachusetts, et al., Petitioners v. Environmental Protection Agency, et al.*, 549 U. S. 497 (2007).
- ¹⁰⁾ *Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 Concerning Integrated Pollution Prevention and Control*, Article 2, 2.
- ¹¹⁾ A large number of standards were released in the era of State Environmental Protection Agency and State Environmental Protection Administration.
- ¹²⁾ Decree of National Development and Reform Commission, Ministry of Science and Technology, Ministry of Foreign Affairs, 2004 (10).
- ¹³⁾ Decree of National Development and Reform Commission, Ministry of Science and Technology, Ministry of Foreign Affairs, and Ministry of Finance, 2005 (37).
- ¹⁴⁾ Decree of National Development and Reform Commission, Ministry of Science and Technology, Ministry of Foreign Affairs, and Ministry of Finance, 2011 (11).
- ¹⁵⁾ Decree of National Development and Reform Commission, 2014 (17).
- ¹⁶⁾ Notification of *Interim Management Measures of Voluntary Emission Reduction Trading of Greenhouse Gases* distributed by National Development and Reform Commission, Decree of National Development and Reform Commission of Climate Change, 2012 (1668).
- ¹⁷⁾ *Law Concerning the Administration of Tax Collection*, Article 3.
- ¹⁸⁾ *Environmental Protection Law*, Article 16; *Air Pollution Prevention and Control Law*, Article 9.

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- ¹⁹⁾ *Environmental Protection Law*, Article 45; *Air Pollution Prevention and Control Law*, Article 19.
- ²⁰⁾ *Environmental Protection Law*, Article 43.
- ²¹⁾ *Environmental Protection Law*, Article 59-60; *Air Pollution Prevention and Control Law*, Article 98-123.
- ²²⁾ Decree of State Environmental Protection Administration, 2007 (35).
- ²³⁾ *Environmental Protection Law*, Article 55; *Cleaner Production Promotion Law*, Article 17.
- ²⁴⁾ *Environmental Protection Law*, Article 62; *Cleaner Production Promotion Law*, Article 36.
- ²⁵⁾ *Environment Impact Assessment Law*, Article 2.
- ²⁶⁾ *Environmental Protection Law*, Article 19.
- ²⁷⁾ *Environmental Protection Law*, Article 61; *Environment Impact Assessment Law*, Article 31 & 33.
- ²⁸⁾ *Administrative Licensing Law*, Article 14.
- ²⁹⁾ *Administrative Penalty Law*, Article 9-14.
- ³⁰⁾ *Air Pollution Prevention and Control Law*, Article 9.
- ³¹⁾ *Ibid.*, Article 21.
- ³²⁾ *Ibid.*, Article 98-123.
- ³³⁾ *Air Pollution Prevention and Control Law*, Article 2.
- ³⁴⁾ The term of air pollutants has appeared 74 times.
- ³⁵⁾ Acid rain control area and sulfur dioxide control area.
- ³⁶⁾ *Air Pollution Prevention and Control Law*, Article 21.
- ³⁷⁾ *Water Pollution Prevention and Control Law*, Article 48.
- ³⁸⁾ Du, X. Q.(2010), p.273.
- ³⁹⁾ *Clean Water Act*, Sec. 401. (a) (1).
- ⁴⁰⁾ It is worth noting: *Clean Water Act* includes the definition of ‘discharge of a pollutant’ and ‘discharge of pollutants’. So in fact, the place just discusses the neutral term of discharge, but the connotation of the term undoubtedly refers to pollution behaviours.

⁴¹⁾ *Clean Water Act*, Sec. 502. (19).

⁴²⁾ 547 U.S. 370 (2006), 385-386.

⁴³⁾ *Water Pollution Prevention and Control Law*, Article 31.

Chapter IV. Ownership of Carbon Emission Rights

Emission Trading Scheme includes compulsory carbon trading market and voluntary emission reduction programs. Generally, in a compulsory carbon trading market, carbon emissions regulation can be divided into two parts: ‘cap’ and ‘trade’. ‘Cap’ primarily represents administrative behaviour, which involves the allocation of carbon emission amounts within jurisdictions, the range of enterprises included in the market and their initial government quotas. ‘Trade’ primarily represents market behaviour—spontaneous transaction behaviour—by enterprises or individuals for benefit maximisation, which is based on the aforementioned allocation according to their supply and demand. Some Japanese researchers suggested to see carbon emission allowance as an obligation which is given to organisations meeting certain conditions rather than a right¹⁾, based on Japanese administrative laws, for example, the periodic report obligation which is given to the plants appointed by Minister of Economy, Trade and Industry based on energy usage amount²⁾. Apparently, this opinion is not suitable for carbon trading markets, because it cannot explain the positive value of carbon emission allowance in the markets and is incompatible with reductions from voluntary emission reduction programs. In fact, the object of transactions is carbon emission rights, and the format contains the quota of compulsory carbon trading markets, Carbon Emission Reductions (CERs) derived from the Clean Development Mechanism (CDM), Verified Emission Reductions (VERs) and others. The essence of market behaviour is the circulation of rights, the premise of which is the clear definition of rights, which depends on the analysis of its legal basis and institutional objects. This paper discusses the issue of the ownership of

carbon emission rights from the perspective of legal theory and new institutional economics. It contains two sections. The first section provides a theoretical analysis of environmental law and international law, discusses the fragmentation and integration of the right to development and the right to use environmental capacity and concludes that carbon emission rights should be divided into two parts: the rights of natural persons and those of countries. The second section discusses the role of rights distribution in economising transaction costs through a case analysis of Japan's air pollution tort lawsuits and concludes that legal institutions should endow rights to parties with more members, looser organisation and less information. Whether legal persons should receive rights depends on their industry and organisational characteristics.

1. Carbon Emission Rights in Legal Theory

What kind of rights are carbon emission rights? The answer to this question remains under discussion in academia because a variety of explanations exist for this problem given the differences in legal systems, research purposes and study fields.

Civil law systems pay more attention to the theoretic study of this problem. Pei etc. considered carbon emission rights as real rights through research on the CDM mechanism³); the research report of the Kyoto Protocol and Japanese domestic law, which is issued by Japan's Ministry of Environment, claimed that carbon credit is a type of movable property whose relative right is a real right—an intangible property right⁴). Deng believes that a carbon emission right is a quasi-real right, similar to a pollution emission right because the object of

the right is environmental capacity⁵). Yang points out that a carbon emission right belongs to the right to development according to international law⁶); Wang believes that a carbon emission right has the attributes of both a quasi-real right and the right to development, with dialectical unity⁷).

The common law system focuses more on practice issues. Hepburn considers that a carbon right is a novel property in light of the relative techniques and law in Australian Carbon Capture and Storage. Specifically, it is a unique land interest attached to forestland⁸). Regarding how the US government deals with the negotiation of international carbon emissions reduction, Posner opposed the inclusion of carbon emission rights in the right to development after analysing distributive and corrective justice but without clarifying definitively the views on its property⁹).

To summarise, the views involve four theories: intangible property rights, land interest as a property right, the right to use environmental capacity as a quasi-real right and the right to development. Among these rights, the view of intangible property rights has not been widely approved. Japan's Ministry of Environment expressed in its report that even if carbon credits are defined as movable property, a considerable gap exists in Japanese law regarding the concept of movable property¹⁰) at 2006. Later a report for carbon trading system on Japanese civil law suggested a surprising and incomprehensible opinion that the carbon emission rights is a 'special property rights', which is different from the real rights in Japan's *Civil Code*. All the owners of this 'special rights' only have the right to transfer or withdraw, but not the right to utilise and benefit¹¹). If no one can use or benefit from the rights, why is there any price and transaction? The view on land interest only exists in Australia, where the

Carbon Capture and Storage system is relatively developed. Therefore, this section focuses primarily on two views: the right to use environmental capacity as a quasi-real right and the right to development.

1.1. Right to Use Environmental Capacity as a Quasi-real Right

1.1.1. Real Right and Quasi-real Right

The right object of a real right is a certain thing, traditionally it limits to *res corporales*. Given productivity development and changes in the production relation, various novel rights arise whose objects are intangible. For example, intellectual property rights are difficult to include in the aforementioned system. Countries with a civil law system usually normalise these novel rights through individual legislation. Wang insists that creating confusion over the concept is possible if intangibles are involved as objects of real rights. As a result, intangible property should be legislated separately¹²). Later, Wang added that listing all intangibles in a real rights law is unnecessary because too many exist to be enumerated. Instead, defining the essential attributes and basic features of the object or unsteadily broadening the concept of a civil rights object is suggested¹³).

For this problem, the concept of a quasi-real right is a powerful complement to traditional real rights. The proper range and standard of judgment is still controversial in the field of law; however, as its name implies, a quasi-real right is a civil right that is not completely a traditional real right (a mining right, a water gavel or a hunting right, among others). Some researchers believe that the difference arises from the object of a quasi-real right being intangible or uncertain; others believe that a quasi-real right must be generated

through administrative action; and some distinguish a quasi-real right from the domination, exclusiveness and priority of a right. In conclusion, a quasi-real right is a collective name for a series of rights rather than a certain right with a single property.

1.1.2. Right to Use Environmental Capacity

The concept of ‘environmental capacity’ is derived from environmental science, which refers to ‘the maximum pollution amount afforded by a certain environmental unit’, limited to the self-clearance ability of the natural environment. The legal limitation of the maximum amount should be analysed according to the definition of pollution matter. Hence, a judgment should be made based on human health, safety and benefit, which may be directly or indirectly affected by a change in environmental characteristics within reasonable expectations, or based on the harmful effect caused by the human utilisation of the ecological environment.

On the basis of the dual character of socialisation and ecologicalisation of the real right, Lv brings out the concept of the ‘environment real right’ and creatively complements the standards of judgment of the object value, which is ‘whether it generates economic benefit to the subject’. Furthermore, Lv points out that the right to use environmental capacity is to develop and utilise the ecological value of an environmental resource, which is the right of ownership, utilisation and benefit from environment capacity by the legal environment user¹⁴⁾. Deng summarises the features of environmental capacity: 1) integrity and relative independence, 2) scarcity, 3) stability and 4) regional variations. Furthermore, he develops the theoretic base of Lv, which views environmental capacity as the object of pollution emission rights given its perceptibility, relative domination and determinability, and to a certain extent,

is able to satisfy the relative characteristics of a real right object, but that differs from a traditional real right object and therefore, should be included as quasi-real right¹⁵⁾.

At the same time, Lv notices that ‘for a natural person, certain environmental capacity is required for the survival of biological human beings, so that the right of a natural person to obtain or occupy a certain capacity that is necessary for self survival should be distributed automatically, without any legal procedure or approval’. In addition, ‘it is necessary to limit the right to obtain or occupy a certain environmental capacity of a legal person or civil subject engaged in production and business activities, which should be authorized by legal procedure’¹⁶⁾.

Total volume control is a application for this theory. China exercises total volume control over the discharge of key air pollutants¹⁷⁾. Japan also uses it in many environmental fields, like for chemical oxygen demand in Seto Inland Sea¹⁸⁾, for air pollutants in the area where plants concentrates¹⁹⁾, and for water pollutants in public waters²⁰⁾.

From this definition and analysis, given the background of global warming being partially caused by the over-accumulation and emission of carbon dioxide, carbon emission rights can be included as a right to use environmental capacity with quasi-real right attributes, similar to pollution emission rights. The main difference between carbon emission rights and types of traditional pollution emission rights is the insignificant regional variation because carbon emissions from anywhere in the world influence global warming. This feature of carbon emissions forms part of the theoretical base for the global carbon trading market. As a result, the right object is the global air capacity of carbon dioxide. This object’s ownership and relative bundle of rights is distributed to countries through international agreements, and

the whole or part of the rights (for example, obtain, utilise, benefit, dispose) are distributed to civil subjects by countries.

In this theory, carbon emission rights, which are distributed through international agreements, should belong to the country, as do other natural resources. However, because natural living persons inevitably contribute to carbon dioxide emissions, a certain amount of carbon emission rights is necessary for the survival of natural persons, meaning that a certain amount of relative rights should be guaranteed as being automatically obtained by them. Therefore, what is the difference between this part of carbon emission rights and the rights that must be obtained through a legal procedure? For this part of the rights, should natural persons automatically obtain complete ownership? For example, can they abandon the rights voluntarily or sell them? These questions are yet to be answered.

1.2. Right to Development

The right to development was termed ‘the third generation of human rights’. In 1979, the UN Economic and Social Council and its subordinated Commission on Human Rights claimed that the right to development is a type of human right, and the equal opportunity to development is the right of countries and individuals²¹⁾, which was emphasized in the 34th General Assembly through resolutions during the same year²²⁾. In 1981, the organisation of African Unity adopted the *African Charter on Human and People’s Rights*, which mentioned that ‘all peoples shall have the right to their economic, social and cultural development with due regard to their freedom and identity and in the equal enjoyment of the common heritage of mankind’²³⁾. In 1986, the 41st General Assembly claimed in the *Declaration on the Right*

to Development that ‘the right to development is an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realised’²⁴). Further, at the World Conference on Human Rights held in Vienna in 1993, representatives of more than 180 countries discussed and adopted the *Vienna Declaration and Programme of Action*, which reaffirmed the right to development, as established in the *Declaration on the Right to Development*, as a ‘universal and inalienable right and an integral part of fundamental human rights’²⁵).

Carbon dioxide is primarily produced from the utilisation of fossil fuels; therefore, carbon emission rights are closely related to human development. China’s National Development and Reform Commission and concerned departments formulated *China’s Policies and Actions for Addressing Climate Change*²⁶) as issued by the State Council. The policies declared that ‘climate change is not only an environment problem but also a development problem, ultimately affecting development’. Many Chinese researchers agree with the view that carbon emission rights are a type of right to development because these rights are a type of human right according to this theory. Thus, China, with the largest population in the world, deserves more carbon emission rights.

However, one significant drawback to this theory is the non-transferability of human rights, which leads to the collapse of the foundation of the legal principle in the carbon trading market. John Locke claimed in his famous *Two Treatises of Government*, published in 1690, ‘For man, not having such²⁷) an arbitrary power over his own life, cannot give another man such a power over it²⁸)’, which laid the foundation for the ‘first generation of human

rights’, as promoted in the bourgeois revolution. In 1776, the *Declaration of Independence* noted the ‘unalienable rights’ of life, liberty and the pursuit of happiness, which are created equal²⁹⁾. The *Universal Declaration of Human Rights*, adopted by the United Nations General Assembly in 1948, in addition to reaffirming ‘the first generation of human rights’, created ‘the second generation of human rights’, including work and education and others requiring the active participation of countries and, in particular, still used the term ‘inalienable’³⁰⁾. A similar description of the right to development has been previously explained. ‘Inalienable’ means indivisible, undeprivable, irreplaceable and undestroyable. In relation to legal theory, right owners do not have complete ownership but only have the right to occupy, utilise and benefit, rather than transfer or destroy.

1.3. Analysis of Legal Attributes and Ownership of Carbon Emission Rights

Developing theoretical defences to the concept of carbon emission rights as a quasi-real right or a right to development is not difficult. However, in practice, carbon emission reductions, particularly in the carbon trading market, face serious problems. These problems include the right to development leading to the non-transferability of carbon emission rights, and the theory of quasi-real rights resulting in insufficiently ensuring human rights³¹⁾. To resolve these two problems, we must consider and analyse both separately and integrally.

1.3.1. Fragmentation of the Quasi-real Right and the Right to Development

It is impossible to absolutely unify the two theories given the significant difference in the way that rights are obtained and circulated. Because any right has an origin and direction, it is

necessary to further analyse and find its source rather than simply classifying its ownership.

Among rights, human rights are the only exception.

The source of human rights differs from the influence of nations, peoples and religions. Most western jurists influenced by the bourgeois revolution and Christianity agree with the theory of natural rights. For example, John Locke's analysis is based on Christian theology, and the *Declaration of Independence* considers that human rights are endowed by the 'creator³²⁾', which people in different religions describe as God or nature or others. However, westerners guided by these theories still commit numerous crimes on other nations, religions or peoples. Richard Rorty points out that human rights come from 'rationality', which labels dissidents as non-rational who need to be deprived of their human rights. As a result, he raises the concept that human rights should be directed from 'sentimentality'³³⁾. Karl Marx believes that human rights are generated historically rather than being natural born. Many modern jurists also raise the view of 'human rights endowed by law'. Finally, the United Nations General Assembly agreed to avoid the question of 'endowed by who' in the *Universal Declaration of Human Rights* and only express that '(everyone) has reason and conscience'³⁴⁾, thus describing human rights through both rationality and sentimentality.

However, a quasi-real right is different, with the relative bundle of rights requiring a definite route regarding its source and direction to enable it to be ruled and protected in various aspects. If carbon emission rights, which are required for natural persons' survival, are considered as a type of right to use environmental capacity, the right object—the environmental capacity owned by a country—in that condition, even if 'being obtained automatically', makes it impossible to skip the procedure of being 'obtained automatically'

from the country. As a result, the country's ownership of this part of environmental capacity should be reflected (perhaps by imposing or reclaiming the right) through administrative behaviour in certain conditions.

In conclusion, this paper states that we must confront and admit the fragmentation of carbon emission rights, which are required for natural persons' survival. That is, viewing this part of carbon emission rights as a right to use environmental capacity is inappropriate. This right should only be viewed as a right to development, the legal ownership of which should be absolutely consistent with other basic human rights; individuals have the right to obtain, utilise and benefit rather than transfer or withdraw. The country plays no important role in this part of carbon emission rights.

1.3.2. The Integration of Quasi-real Rights and the Right to Development

The fragmentation of quasi-real rights and the right to development resolves the issue of human rights being ensured in carbon emission rights, and the remaining 'non-transferability' should be considered from the integration viewpoint. The section focuses on investigating the real characteristics of the right to development through an analysis of its relationship with other human rights.

'The third generation of human rights' theory raised by Karel Vasak is still controversial, and many other researchers bring out various methods of categorisation. However, such categorisation does not mean that these human rights are separated, and this study does not discuss this concept in detail. Instead, this study highlights several representative and important human rights and discusses their relationships.

The three famous factors in the first generation of human rights—life, liberty and the pursuit of happiness—are declared in the *Declaration of Independence*. Obviously, the former two factors stress condition, whereas the latter focuses on behaviour. Pursuit of happiness has the same meaning as pursuing the maximisation of benefits, among which the use of force is excluded for the purpose of protecting life and liberty. That is to say, to pursue benefit maximisation should not betray another person's will, but it provides the economic foundation for life and liberty, thus ensuring human rights. Economically, the bourgeois revolution ensured the existence and maintenance of a free market by protecting these three factors.

Different from the 'passive' first generation of human rights, the second generation of human rights require the country and government to 'actively' ensure certain rights, such as the right to work and education as raised in the *Universal Declaration of Human Rights*³⁵). The protection of these rights would ensure social benefit maximisation, which is to increase labour input and labour productivity (through education). At the same time, individuals can also realise the pursuit of self-benefit maximisation by performing these rights. Therefore, these parts of human rights are not only the foundation of the first generation of human rights, but also are extensions of society. Explanations of China's current constitution contain the dual character of right and obligation³⁶, which is the emphasis of individuality and sociality.

The third generation of human rights, represented as the right to development, have gone further and are sometimes termed 'collective human rights'. Zhang believes that the right object must only be the individual³⁷); meanwhile, Li considers that collective human rights exist relatively; individual human rights are the basis of collective human rights and collective

human rights are to ensure individual rights³⁸). Some researchers believe that previous human rights also contain collectivity. This study states that the feature of this type of human right is that it should be realised collectively even though the object is individual. The relationship of this type of human right to other human rights is characterised as interconnected and interdependent, and they form the basis for insurance for each other, as did the previous two generations of human rights. On the one hand, as noted in the *Declaration on the Right to Development*, the purpose of the right to development is to completely realise all human rights and basic liberties. On the other hand, development itself is one of the purposes of the individual pursuit of happiness.

Because the right to development contains the dual characters of method and purpose, the integration between the right to development and a quasi-real right is abundantly clear. This study believes that it is wrong to equate carbon emission rights to the right to development. The efficient utilisation of a relative bundle of carbon emission rights is the essence of the right to development, which involves the legal and economic utilisation of partial carbon emission rights as a quasi-real right. Carbon emission is an important method of realising development, but it is not the only method. Countries or enterprises with high carbon intensity have different requirements for the resources needed for self-development compared with low carbon intensity countries or enterprises, and they must redistribute resources through the carbon trading market to achieve co-development. This right to administer freely is also an essential reflection of the right to development and other basic human rights emphasised by international society. Additionally, the right to transfer this part of carbon emission rights is part of the right to development.

1.3.3. Conclusion

Regarding the problem of legal attributes and ownership of carbon emission rights, through analysis of the two theories of quasi-real rights and the right to development, this paper concludes that carbon emission rights should be divided into two parts. First, it is required for the survival of natural persons, which is not the right to use environmental capacity as a quasi-real right, but it is the right to development, a basic human right reflecting the purpose of the right to development and ensuring the efficient maintenance of other basic human rights. Natural persons have the right to obtain, utilise and benefit, rather than transfer or withdraw. Second, carbon emission rights, which are rights to use environmental capacity with the object as the air environmental capability owned by countries, similar to quasi-real rights for wireless spectrum, fishing and mining. Natural persons and legal persons can utilise, benefit, transfer and withdraw these rights through certain administrative procedures or civil contracts, which reflect the right to development as a method.

2. Emission Rights Delimitation and Transaction Costs Economising

The transaction cost, which hinders the effective transfer of rights through market behaviour, is the result of many factors. In the air pollution tort disputes that emerged significantly in the 20th century, the main reasons for increasing transaction costs are numerous participants and information asymmetry. The carbon emission issue goes further on these two factors, making it more difficult for participants to measure the benefits or communicate with others. Because law is a scale-constant institution, the designer should

consider the ownership of carbon emission rights based on institutional economics and the objective of institutions.

In the next section, this paper studies Japan's nine air pollution tort lawsuits, their judgments and after-effects, to prove that the traditional analytical method of the three elements is unsuitable for issues with high transaction costs. The judgments by courts do not act as final decisions; instead, they transmit signals, reduce transaction costs between participants and prompt them to come to agreements by themselves.

2.1. Case Analysis of Japan's Air Pollution Tort Cases

Number/Name	Judgment Date	Causation	Claim for Cessation of the Infringement	Follow-up
#1/Chiba Kawazasaki Steel Co. pollution	1988.11.17	Affirm	Ignore	Compromise after appeal
#2/Osaka Nishiyodogawa pollution 1 st lawsuit	1991.3.29	Partial affirm; Partial negate	Ignore	Compromise with the factory parties after appeal
#3/Kawasaki pollution 1 st lawsuit	1994.1.25	Partial affirm; Partial negate	Ignore	Compromise with the factory parties after appeal

#4/Kurashiki pollution	1994.3.23	Affirm	Ignore	Compromise after appeal
#5/Osaka Nishiyodogawa pollution 2 nd ~4 th lawsuit	1995.7.5	Affirm	Dismiss	Compromise with the road parties after appeal
#6/Kawasaki pollution 2 nd ~4 th lawsuit	1998.8.5	Affirm	Dismiss	Compromise with the road parties after appeal
#7/Amagasaki pollution	2000.1.31	Partial affirm; Partial negate	Approve	Compromise with the factory parties before judgment; Compromise with the road parties after appeal
#8/Nagoya-Nanbu pollution	2000.11.27	Partial affirm; Partial negate	Approve	Compromise after appeal
#9/Tokyo pollution	2002.10.29	Partial affirm; Partial negate	Dismiss	Compromise after appeal

Sources: #1, Judgment of the 2nd Civil Division, Chiba Distinct Court, 17/11/1988.

#2, Judgment of the 9th Civil Division, Osaka Distinct Court, 29/3/1991.

#3, Judgment of the Civil Department, Kawasaki Branch, Yokohama Distinct Court,
25/1/1994.

- #4, Judgment of the 2nd Civil Division, Okayama Distinct Court, 23/3/1994.
- #5, Judgment of the 9th Civil Division, Osaka Distinct Court, 5/7/1995.
- #6, Judgment of the Civil Division, Yokohama Distinct Court, 5/8/1998.
- #7, Judgment of the 5th Civil Division, Kobe Distinct Court, 31/1/2000.
- #8, Judgment of the 3rd Civil Division, Nagoya Distinct Court, 27/11/2000.
- #9, Judgment of the Tokyo Distinct Court, 29/10/2002.

Table 4-1. Japan's Air Pollution Tort Lawsuits

This paper chooses Japan's air pollution tort lawsuits as research objects because the reversion of the burden of proof principle is not adopted in Japan, and the disputes over causation are more obvious. More than thirty air pollution lawsuits exist in the LEX/DB database³⁹); a majority of them were not chosen for the following reasons. First, they are not exclusively air pollution cases. For example, the Date thermal power plant pollution event includes water and noise pollution disputes and the Amagasaki asbestos plant pollution event includes an occupational injury that should be ruled by labour law. Second, some cases are yet to be decided, such as Japan's national route 2 pollution event. This paper selects nine representative lawsuits from 1988 to 2002, which have distinct characteristics compared with other types of tort lawsuits.

- i. Causation is the main dispute between the two parties.

Traditionally, an air pollution tort lawsuit has multiple plaintiffs and defendants, and causation between the air pollutant emitted from every source and the intake of every victim must be proven, which is very difficult and is limited to current research on natural science methods. Most air pollution accumulates over a long period of continuous emission and is widely spread; its distribution changes in different natural and cultural environments.

Generally, plaintiffs' claims in relevant cases are almost impossible to prove if the court distributes the burden of proof using the principle of 'who claim, who quote' from traditional tort law because victims markedly lack the relevant scientific knowledge and analytical ability. China addresses this problem by adopting the reversion of the burden of proof principle, meaning that plaintiffs must still prove harm, but the defendant has the liability of proving whether causation exists. Additionally, the negligence of the defendant is extended to an obligation, except for exemptions, in principle with liability and without fault.

However, Japan still adopts the burden of proof principle from traditional tort law in air pollution tort lawsuits, meaning that the plaintiff has the liability to prove causation. Because of the difficulty that plaintiffs face in providing evidence in juridical practices, Japan adopted practices from Germany to reduce the burden of proof on the plaintiff. Among these practices, the core principle is the degree of probability that only requires a certain degree of probability of causation between a particular fact and a particular result⁴⁰. Another practice is the statistical inference and causal analysis of epidemiology, which divides causation into two parts: emission and pollutant concentration, and pollutant concentration and disease incidence and progression.

Under the guidance of these theories, the sources of evidence for causation judgments are very limited in the aforementioned lawsuits, mainly from long-term investigation of academic institutions or governments and data on animal experiments. However, for the courts to judge causation is difficult because of various differences in the plaintiffs, such as residence, age, career, smoking history, disease and so on. For example, the causation between NO₂ (solely or as a compound with other materials) and chronic bronchitis, asthma

or emphysema is negated in lawsuits #2 and #3, affirmed in lawsuits #4–6, negated again in lawsuits #7 and #8, affirmed for some of the plaintiffs and negated for the other plaintiffs in lawsuit #9. What requires special attention is that lawsuits #2 and #5, and #3 and #6 are two judgments for one event, but the causation between the pollutants emitted by the road and the plaintiffs' disease was judged to be antipodal.

ii. Most judgments confirmed partial liability for damage, but showed varying attitudes towards the claims for cessation of infringement of the plaintiffs.

The plaintiffs made claims for both compensation for damages and cessation of infringement in all of the lawsuits. Without the abstruse knowledge of legal theory, it is easy to imagine that more restrictive proof is required for compensation for damages compared with cessation of infringement because the latter only needs the existence of 'infringement' and the former also needs to prove 'damages' of the 'infringement'. In other words, in traditional tort disputes, if the courts approve the claim for compensation for damages to the plaintiffs and the infringement continues, theoretically the claim for cessation of infringement of the plaintiffs should be approved simultaneously. However, the judgments in the previously described cases are not so. The courts approved the claim for compensation for damages of all plaintiffs when the causation was affirmed, but did not approve the claims for cessation of infringement of plaintiffs at the same time in seven of the nine cases. The courts ignored the claims by reason of unlawful claims in lawsuits #1–4 and dismissed the claims in lawsuits #5–6 and #9, although they were considered lawful. The main reason for the latter action is the theory of 'tolerable limit'. In other words, the courts considered that the behaviour of the defendants involved considerable publicness, indicating that the 'tolerable limit' of the

plaintiffs should exceed that of the general case.

Obviously, the judgment of publicness and a tolerable limit are applications of the Hand formula, in other words, the benefits to both parties were weighed to determine whether the defendants have the liability of cessation of infringement. However, the judgment does not explain why the defendants still have the liability of compensation for damages. The courts actually set two different tolerable limits for the plaintiffs on a single behaviour of the defendants. The lower limit offers the plaintiffs the right to ask the defendants for compensation, but the higher limit stops the plaintiffs from asking the defendants for cessation of infringement.

iii. Although these cases went through prolonged court proceedings and received court decisions, the participants reached a compromise by themselves.

It is certainly favourable for both parties of a civil dispute when they come to an agreement by themselves; however, entering into a lawsuit itself shows that such an agreement cannot be reached because of high transaction costs. The court's decision should reflect an outsider's judgment, and it represents an enforcement agreement of the benefits to both parties by an impartial third party regardless of whether the judgment was made in accordance with traditional tort law or the legal and economic analysis as represented by the Hand formula. If the court's attempt fails, the discontented party or both parties will appeal until the court succeeds or gives in and comes to a better agreement through a trial class system.

The above nine lawsuits each achieved a special outcome; one or both parties appealed after the court decision because they were unsatisfied. However, the parties then came to an

agreement by themselves before the decision in the second trial. This situation is rare in other tort lawsuits. The only explanation is that the court decisions decreased transaction costs. If transaction costs do not change or even increase after the court decision, then both parties can either come to an agreement before the first trial or wait for a satisfactory agreement from the second trial court through a judgment, or a final trial.

2.2. Discussion

2.2.1. The Weakness of the Hand Formula

The Hand formula, an ex-post institution, is a balance and a compromise between corrective justice and distributive justice. Rather than giving up the traditional three elements analysis, it underlines a prerequisite that harm and causation are determined. In contrast, in air pollution tort disputes with high transaction costs, causation is the most difficult part to determine of the three elements and is also the most essential part in influencing the final judgment on the basis of the three elements analysis. Discussing negligence without the determination of causation is meaningless. In the Hand formula, the variable P is used as the mean of the probability of loss, but causation is according to pre-behaviour—the possibility that behaviour directly causes the harm—and not post-behaviour or the possibility of harm caused by the defendant's behaviour. In other words, this P is not equal to the causation that needs consideration in the three elements analysis of a court, which makes the Hand formula difficult to use in cases with over-complicated causation.

Another problem is the cost-benefit analysis of the Hand formula. For high-transaction cost issues, participants are not able to objectively examine the benefit behind the behaviour,

but instead the utility. Although the judge as a third party precisely determined the cost and benefit, it was not enough to satisfy the lawsuit participants. If the benefit considered by the judge differs significantly from the utility views of the litigants, the three elements analysis according to corrective justice may lead to endless argument and appeal, or may seek to solve the problem in an extra-legal manner. In lawsuit #9, for example, the court only supported the compensation claims from seven plaintiffs but dismissed most plaintiffs' requests because of undefined causation, indicating that the court considered that even without the pollution emission behaviour of defendant, those rights such as the personality rights claimed by plaintiffs will not increase. However, the plaintiffs are far from satisfied given their subjective judgments and still seek sanctions for the pollution emission behaviour of the defendants instead of agreeing with the court on causation. As a result, after the court decision, the plaintiffs not only continued to appeal but also expended influence by parading, petitioning and engaging in other methods to achieve their goals, ultimately succeeding in coming to an agreement with the defendants five years later. This resolution benefitted all asthmatic patients in Tokyo⁴¹). Similarly, in cases #2 and #3, the court believed that the country and the road community had no responsibility. However, the cases led to the generation of cases #5 and #6, and both sides in the dispute failed to reach an agreement until the road community accepted liability.

Williamson's theory on the economic institution provides us with a suggestion for solving the problem. He stated that 'indeed, transaction cost economising is central to the study of economic organisation quite generally—in capitalist and non-capitalist economies alike'⁴²). His view implies the precondition that it is difficult and unnecessary to find

participants' effects through the institution's designer. Therefore, the institution's designer should target reducing transaction costs and ensuring that market participants are likely to reach a voluntary agreement on right transfers. Although Williamson focused on the institution of economic organisation, law is a scale-constant institution, as mentioned previously; therefore, the theory is also suitable for legal institutions. According to the theory, the court judgment is not only an ex-post institution that complements market behaviour as per the Hand formula, but it also plays the role of an ex-ante institution, which is more obvious and important in high transaction cost issues.

2.2.2. Methods to Economise Transaction Costs

To reduce transaction costs, we examine the distribution of liabilities and rights from the perspective of entering into a contract. Entering into a contract should entail two behaviours: expression of an offer and expression of acceptance. The one who is distributed with liability (does not own the right) for the will of fulfilling (or eliminating) the liability and obtaining rights is encouraged to be the offeree and to engage in a cost-benefit analysis on the available options, and then to find a counterparty with which to negotiate⁴³). The influence of high-transaction costs in air pollution tort disputes primarily reflects the difficulty in determining causation and discovering the subjective utility of participants. The main factors leading to high transaction costs are the numerous participants and information asymmetry. As a result, to reduce transaction costs, the institution should ensure that the liable party has the following characteristics:

- i. relatively few members;

ii. more rigorously organised; and

iii. more available information.

Liability contains not only substantive liability but also procedural liability. For example, in the reversion of the burden of proof in China's environmental pollution tort disputes, numerous plaintiffs were loosely organised and lacked scientific knowledge. Reducing transaction costs is effective when defendants have fewer members, are tightly organised and have sufficient information. Similarly, medical negligence tort disputes occur. Japanese courts also found this point in practice. In the decision for case #5, given the available options for the defendants in preventing infringement, making a judgment for the plaintiffs is difficult because of a lack of correct scientific knowledge and information. Limited by an absence of the reversion of the burden of proof in Japan's civil law, the court adopted presumptions, such as indirect disproof and a high degree of probability for analysing causation to solve disputes, but still failed to make a decision that appeased both sides in the disputes.

On the substantive distribution of liability, cases #2 and #3, and #5–9 are representative examples. In these seven lawsuits, the plaintiffs claimed that the motor vehicles running on the roads emitted pollutants that infringed their relative rights, and the defendants were the national government, the city council and the road company. Regarding the motor vehicles' pollution issue, many options are available that may resolve the disputes: the victims can move from the pollution area, vehicle owners can switch to using mini cars or reducing usage, road owners can control traffic or incur charges, the government can adopt administrative behaviours and so on. The plaintiffs gave up selecting the vehicle owners as defendants because they knew that it was impossible for numerous counterparties to be effective. In

lawsuits #2 and #3, the courts decided that the government and road owners had no liability. As a result, the plaintiffs continued to appeal, whereas in cases #5–#9, the court judged that the government and road community are liable; therefore, an agreement was reached. All of these can be explained by the theory of transaction costs, economised by choosing an offeree. For vehicle owners or plaintiffs to choose behaviour is impracticable because they are numerous and lack information, whereas the government and road owners are relatively well organised and have sufficient information. Therefore, when they measure the available options of behaviours and consequences, ultimately an agreement that solves the problem can be reached. This process does not require the court to consider causation, and the gap between benefit and utility is also burdened by participants in disputes that they resolve by themselves⁴⁴).

2.2.3. Ownership of Carbon Emission Rights

The main difference between carbon emission rights and traditional pollution emission rights was previously mentioned as existing in the insignificant regional variations that stand on the side of the emitters—also one of the essential theoretical bases for the global carbon trading market. However, from the victims, although the greenhouse effect is global, the harm is not simultaneous and equal.

In the case of *Massachusetts et al., Petitioners, v. Environmental Protection Agency et al.*⁴⁵), as supportive evidence for plaintiff eligibility, Massachusetts claimed that global sea levels rose by between 10 and 20 centimetres during the 20th century due to global warming and have already begun to swallow the state's coastal land. The case suggests that variations

exist (from time to extent) in the harm caused by global warming in different areas. The harm actually results from carbon emissions that involve everyone, but Massachusetts and other plaintiffs also realised that selecting EPA as the defendant was beneficial in achieving their demands. As a result, according to the three factors for rights distribution, a natural person obviously owns his carbon emission rights, whether or not required for survival; otherwise, transaction costs will be too high for an effective right transaction, which then becomes meaningless. Although it is likely to be an economic explanation for human rights, the difference in legal theory is that the standard of judgment is not the legal attribute of a right but a comparison of number, organisation and information of the actor and the victim. To a legal person, the characteristics of number, organisation and information should be considered relative to the victim to judge whether he owns carbon emission rights. An essential standard is to judge the industry involved, which should be regulated when the victim changes because of time and geography.

3. Conclusion

This chapter discusses the ownership issue of carbon emission rights from the points of view of legal theory and new institutional economics.

In legal theory, carbon emission rights have dual attributes of right to use environmental capacity as a quasi-real right and right to development as a type of human right. These types of rights have integration and are simultaneously fragmented. This paper holds that carbon emission rights should be divided into two parts. One part is required for individual survival and includes the right to development –a kind of fundamental human right and one that

ensures the efficient maintenance of other fundamental human rights. Individuals have the right to obtain, utilise and benefit, rather than the right to transfer or withdraw. The other rights are the right to use environmental capability, with the object being the atmosphere environmental capacity owned by countries. Natural persons or legal persons can obtain the right to utilise, benefit, transfer and withdraw through certain procedures or contracts.

Regarding new institutional economics, this paper uses Japan's relevant air pollution tort lawsuits as research objects. The result is that for high-transaction cost issues, such as carbon emissions, causation is difficult to confirm. The ex-post corrective function of legal institutions is weakened, and the ex-ante incentive function is more important. In other words, legal institutions should focus on economising transaction costs to prompt both parties to reach agreements by themselves. Specifically, legal institutions should endow rights to parties with more members, looser organisation and less information, and should bestow liabilities on parties with fewer members, better organisation and more information. Thus, natural persons should obtain the right to emit carbon regardless of necessity. For legal persons, having the right depends on their industry and organisation characteristics.

Regarding the problem of which industries should be involved in the present carbon trading market, on the basis of this paper, further investigations are required using the different conditions faced by countries.

Endnotes

¹⁾ Ministry of the Environment, Government of Japan(2009), pp.25-27.

²⁾ *Order of Enforcement of the Act on the Rational Use, etc. of Energy (Japanese)*, Article 15.

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- 3) Pei, Q., et al.(2009), pp.16-18.
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- 5) Deng, H.F.(2005), pp.59-66.
- 6) Yang, Z.W.(2011), pp.41-42.
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- 14) Lv, Z.M.(2001), pp.282-283.。
- 15) Deng, H.F.(2005), p.60.
- 16) Lv, Z.M.(2001), p.285.
- 17) *Air Pollution Prevention and Control Law of the PRC*, Article 21.
- 18) *Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea (Japanese)*, Article 12.3.
- 19) Air Pollution Control Act, Article 5.
- 20) Water Pollution Control Act, Article 4.
- 21) See *Official Records of the Economic and Social Council, 1979, Supplement No.6* (E/1979/36), chap. XXIV, sect. A.
- 22) U.N. General Assembly, 34th session, *Alternative approaches and ways and means within the United Nations system for improvising the effective enjoyment of human rights and fundamental freedoms* (A/RES/34/46).
- 23) African Union, 1981, *African Charter on Human and Peoples' Rights*, Article 22.1.
- 24) U.N. General Assembly, 41st session, *Declaration on the Right to Development* (A/RES/41/128), Article 1.1.

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- 25) U.N. 1993, *Vienna Declaration and Programme of Action*, I.10.
- 26) No. 17 Document of the State Council (2007).
- 27) This refers to ‘an absolute, arbitrary power one man has over another, to take away his life whenever he pleases’.
- 28) Locke, J.(1965), Chap. XV. 172, pp.301.
- 29) U.S. 1776, *Declaration of Independence*, Paragraph 2.
- 30) U.N. General Assembly, 3rd session, *Universal Declaration of Human Rights* (A/RES/217(III)A), Preamble.
- 31) For natural persons, selling carbon emission rights outright equals selling life because they have to emit carbon dioxide by breathing.
- 32) U.S. 1776, *Declaration of Independence*, Paragraph 2.
- 33) Savic, O.(Ed.)(1999), pp.67-83.
- 34) U.N. General Assembly, 3rd session, *Universal Declaration of Human Rights* (A/RES/217(III)A), Article 1.
- 35) Article 23 & 26.
- 36) *Constitution of the People’s Republic of China*, Article 42 & 46.
- 37) Zhang, W.X.(1991), p.27.
- 38) Li, B.Y.(1994), p.14.
- 39) Provided by TKC Co..
- 40) Judgment of the 2nd Petty Bench, Japan’s Supreme Court, 10/24/1975.
- 41) There are some conditions, i.e., reside in Tokyo over 1 year, nonsmoker, etc.. See the *Record of Settlement* of the 8th civil division, Tokyo High Court, 8/8/2007.
- 42) Williamson, O.E.(1985), p.18.
- 43) The counterparties may be the rights owner, or third parties like supplier of emission reduction devices.
- 44) This institutional theory of solving problem is possibly an explanation of ‘majority’ democratic system, which is a plain democratic system generated in previous condition of

undeveloped science, asymmetric information and high-transaction cost. Later as the information revolution, in particular from the second half of 20th century, transaction cost reduced widely, this institution is changed gradually. But in the new issues like air pollution, the effect of transaction cost resurfaces again, and assign practical value to this system.

⁴⁵⁾ 127 S.Ct. 1438 (2007).

Chapter V. Verification of Carbon Emission Rights

This chapter focuses on the verification of carbon emissions rights, which is the most important process during the circulation of the rights. The verification is the affirmation process of carbon emission amounts and the prerequisite of initial delimitation of carbon emission rights, and it may alleviate the information asymmetry among market participants and government at the same time.

EU and China both have their own characteristic legal institutions and disadvantages on verification in carbon trading market. In EU ETS, the counterparty of verifiers is the enterprises, and the verification faces some fraud problems. In China's carbon trading market, the counterparty of verifiers is the government, and the fiscal expenditure may be unaffordable when unified nation-wide market is established.

For the effectively and efficiently operation of verification system, the chapter analyses the relevant legal institutions from the perspective of transaction costs economising, especially the effects of relevant asset specificity. The result shows that China shall enlarge the human asset specificity of verifiers by legal institution and change the counterparty of verifiers from government to enterprises.

The second section introduces the current legal institutions of carbon trading markets in EU and China. The third section discusses the theoretical relationship between asset specificity and institutions. The fourth section analyses the existing practical problems of the market, and make the policy suggestions. Final section is the conclusion.

1. Current Institutions

This section introduces the current monitoring, reporting and verification institutions of carbon emissions in EU and China.

1.1. Verification Institution in EU

1.1.1. Legal Resources

There are mainly three forms of enforcement legal documents in EU: regulations, directives and decisions. Among them, the regulations are similar to domestic laws, but must be applied in its entirety across the EU. The directives set out goals that all EU countries must achieve, but the countries have to design and lay down their own domestic laws to reach the goals. The decisions are the legal documents about some special issues, and the applicable objects are specific countries or civil subjects.

EU's current legal institutions on monitoring, reporting and verification of carbon emissions have two parts. One part is the greenhouse gas monitoring and reporting system of EU and Member States. The other part is the monitoring, reporting and verification (MRV) system in EU ETS. Specifically, it includes the monitoring and reporting system and the accreditation and verification system. The relevant legal documents of the latter are as follows:

Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme of greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (2003/87/EC);

Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009

amending 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (2009/29/EC);

Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council (600/2012, AVR);

Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (601/2012, MRR);

Commission Regulation (EU) No 206/2014 of 4 March 2014 amending Regulation (EU) No 601/2012 as regards global warming potentials for non-CO₂ greenhouse gases (206/2014);

Commission Regulation (EU) No 743/2014 of 9 July 2014 replacing Annex VII to Regulation (EU) No 601/2012 as regards Minimum frequency of analyses (743/2014).

1.1.2. Objectives and Contents

EU ETS is the key mechanism for reducing carbon emissions cost-effectively of EU. For the effective operation of EU ETS, the robust, transparent, consistent and accurate monitoring, reporting and verification institutions are essential.

European Commission issued directive to establish a greenhouse gas emission allowance trading scheme at 2003 (2003/87/EC), and amended the directive to improve and expand the scheme at 2009 (2009/29/EC), after experience accumulation. For the quality assurance of reports and the accuracy of relevant data provided by the participants covered by the scheme, European Commission issued regulations for monitoring and reporting (601/2012, MRR) and

for verification and accreditation of verifiers (600/2012, AVR) separately at 2012.

In addition, for the improvement of administration efficiency of Member States, the unification of statistical method, and the connection between MRR and AVR, European Commission also released a series of guidance and templates, which includes emissions reports, verification reports and improvement reports, etc.

The industrial installations and aircraft operators have to monitor and report their greenhouse gas emissions annually. The data in the annually emissions report have to be verified by an accredited verifier before 31 March of the next year. After the verification, the operators have to surrender the equivalent number of allowances before 30 April. This annual process of greenhouse gas monitoring, reporting and verification and relevant procedures is called 'Compliance Cycle' of the EU ETS.

The operators with reporting obligations also have other obligations as follows: 1) establish and maintain written procedures for data flow activities¹⁾; 2) establish, maintain and monitor an effective control system, and improve it when the system is found to be ineffective²⁾; 3) check, calibrate and adjust the relevant measuring equipment and measurement standards³⁾; 4) design, test and maintain an effective control system of information technology⁴⁾; 5) ensure the conflicting duties segregation in all data flow activities and control activities⁵⁾; and 6) do internal reviews on data to identify inherent risks and control risks⁶⁾. The operators shall keep all relevant data and information for at least ten years, and make these documents available to the competent authorities and verifiers when required⁷⁾.

1.1.3. Relevant organisations and Personnel

The relevant organisations and personnel of the EU ETS's greenhouse gas monitoring, reporting and verification system include Member States' National Accreditation Body (NAB), National Certification Authority (NCA), the verifiers accredited by the NAB, the verification teams and independent reviewers assembled by the verifiers for each particular verification engagement, and EU ETS lead auditors, auditors and technical experts included in the verification teams.

The NAB is established and authorized by Member States for the authentication of European harmonised standard. The major responsibility of NAB is to assess and accredit the authorization requests of verifiers. The assess contents includes whether the verifiers and their personnel⁸⁾: 1) have the competence to carry out verification; 2) are performing the verification in line with AVR; and 3) meet the requirements in AVR which covers competence, impartiality, procedures, documentation and further requirements stated in EN ISO 14065⁹⁾. The NAB have to assess these requirements not only during the initial accreditation process, but also during surveillance, reassessment, extraordinary assessments, and when the scope of accreditation is required to extend¹⁰⁾.

The verifiers are legal persons or other legal entities carrying out verification activities, accredited by the NAB. Their responsibilities include: 1) carry out the verification and other activities to check whether the report is reliable for its users¹¹⁾; 2) carry out the verification in public interest, keep independence and impartiality¹²⁾; 3) carry out the activities with attitude of professional skepticism to identify the potential risk of material misstatements¹³⁾; 4) aim to provide a verification report free from material misstatements with reasonable assurance¹⁴⁾,

etc.. The competence and actual performance of the verifiers have to be monitored through annual surveillance, and be reassessed in five years at most, by NAB.

The verification teams are assembled by the verifiers for each particular verification engagement. A verification team consists of, at least, an EU ETS lead auditor, a suitable number of EU ETS auditors and technical experts. The team also have to include at least one person with the technical competence and understanding related to the activities carried out by the operator, and one person who is able to communicate with the language in the Member State where the verification is carried out¹⁵.

An EU ETS auditor shall have the knowledge of the relevant regulations, standards and guidelines issued by the EU and Member State where the verification is carried out. The auditor shall also have knowledge and experience of data and information auditing methodologies, inherent risks and control risks analysis, sampling techniques, relevant systems and activities assessment, etc.. An EU ETS lead auditor shall not only meet the requirements of auditors, but also have competence to lead the team and to be responsible for the verification activities¹⁶.

Other than the verification method of verifiers authorized by the NAB introduced above, The NCA may authorize natural persons to be the verifiers. The natural person have to meet all the requirements about EU ETS lead auditor, EU ETS auditor, specific technical competence and specific language mentioned above.

1.2. Verification Institution in China

1.2.1. Legal Resources

China belongs to Non-Annex I countries of UNFCCC, which means it has obligations to report national greenhouse gas inventories on the base of UNFCCC COP-2 signed in 1996.

According to relevant guidelines of IPCC, in 2004, China completed and submitted the *China Initial National Communications on Climate Change*, the core of which was the national greenhouse gas inventories in 1994. The State Council enacted *China National Plan for Coping with Climate Change*¹⁷⁾ in 2007. The NDRC launched the second stage of preparation, and in 2012, they completed and submitted the Second National Communication on Climate Change of China, its core was the national GHG inventory of 2005.

In March 2011, the 11th session of the NPC adopted the *12th five-year plan for national economic and social development of the PRC* at the fourth meeting, in which the section (21st) of ‘actively responding to global climate change’ was added for the first time, the first section mentioned to establish and improve the system of statistical accounting of greenhouse gas emissions targets.

In October, the Office of NDRC released the notice on implementing carbon emissions trading pilot¹⁸⁾, it approved the pilot project in Beijing, Tianjin, Shanghai, Chongqing, Hubei Province, Shenzhen City, Guangdong Province to develop carbon emissions trade.

In December of the same year, the State Council issued the *Work Programme for controlling greenhouse gas emissions during the 12th five-year plan*¹⁹⁾, in which the 14th Article proposed to establish a basic statistical index system on greenhouse gas emissions and include it into the statistical systems of the government, while for key emission units, the request proposal is to improve the account record about greenhouse gas emissions and energy consumption. The 15th Article in the proposal of strengthening GHG emissions accounting

and building basic statistical and accounting systems concerning greenhouse gas emissions at the national, local and enterprise level, including the regular preparation of national and provincial greenhouse gas emission inventories as well as key enterprises' direct submission of energy and greenhouse gas emissions data systems. In the 18th Article, it is proposed to enact emission reduction accounting methods as well as norms and rules. Besides, it also proposes to strengthen qualification check of carbon trading institutions and the third party, to conduct stringent vetting criteria and procedures, and strengthen the construction of supervision management and capacity.

In May 2013, under the guidance of the above policies and legislation, the State Development and Reform Commission and National Bureau of Statistics formulated *The Opinions on Strengthening statistics Work to Address Climate Change*²⁰⁾, which divided the statistics management system of climate change into three parts:

i. Statistical and accounting system on greenhouse gas emissions in conjunction with government statistics index. This system constituted of such three levels as national, local and key enterprises, and matched with the greenhouse gas inventories.

ii. Statistical data release system on addressing climate change. Statistical data are published by the National Bureau of Statistics and the NDRC in the form of bulletin, and NDRC submitted national data communication containing greenhouse gas emissions inventory to the UNFCCC secretariat according to the requirements of the UNFCCC.

iii. Management and security system of related data.

In January 2014, NRRC released the notifications²¹⁾ about organising and implementing reporting work for greenhouse gas emissions of key enterprises (business) and public

institutions. Such three-level procedures as the report parts submit, the provincial authorities verify and the provincial authorities compile and submit, at last, it notes the importance of third party verification.

Thus, the policies and regulations of statistical accounting in China over climate change are divided into three inter-cross-and-support system.

The First Part is about the preparation process of the local (provincial) greenhouse gas inventory.

Provincial-level greenhouse gas inventory is an important supplementary for national greenhouse gas inventories, executive office of NDRC issued the related matters over notification on launching preparation work of provincial greenhouse gas inventory²²⁾ in September 2010, requesting each province enact work plans and preparation plans so as to organise the preparation of greenhouse gas inventories.

In May 2011, the climate change bureau of NDRC organised experts to compile *the provincial guidelines for the preparation of greenhouse gas inventories (for trial implementation)*²³⁾.

In January 2015, the NDRC issued *the circular on carrying out the next phase of the preparation of greenhouse gas inventory at the provincial level*²⁴⁾.

The second part is the accounting and reporting system of greenhouse gas emission of key enterprises.

NDRC compiled accounting methods and reporting guidelines of enterprises' greenhouse gas emission of first ten industries²⁵⁾ in October, 2013. Industries include electricity generation, power grid, steel production, chemical production, aluminum

electrolysis production, magnesium metallurgy, flat glass production, cement production, ceramic production and civil aviation.

*Notice on organising the Work of Key Enterprises' or Institutions' Greenhouse Gas Emission*²⁶⁾ was issued by NDRC in January, 2014.

Related methods and guidelines of the second batch of four industries²⁷⁾ were compiled in December, 2014. Industries include oil and gas production, petrochemical industry, independent coking and coal production.

NDRC issued *Notice on Submitting Related Data of Key Enterprises' or Institutions' Carbon Emission*²⁸⁾ in January, 2015.

Related methods and guidelines of the third batch of ten industries²⁹⁾ were compiled in July, 2015. Industries include papermaking and paper product industry, other non-ferrous metal metallurgy and calendaring industry, electronic equipment manufacturing, mechanical equipment production, mine, food, tobacco and wine, drinks and refined tea, public building operation, road transport, fluorine chemical and other industrial enterprises.

The third part is the third party verification system.

The method of third party verification mechanisms and inspectors management of carbon emission has been compiled and improved one after another in pilot cities and provinces of carbon trading market and other cities and provinces since the year 2014.

*Notice on the Key Work of Launching the National Carbon Emission Trading Market*³⁰⁾ was issued by NDRC in January, 2016, which points out that local competent department should arrange third party verification mechanisms to verify enterprises' carbon emission data after they finish accounting and reporting work.

1.2.2. Objectives and Contents

The scope of the report and the preparation of provincial-level greenhouse gas inventory mainly include emissions of greenhouse gases produced during energy activity, industrial processes, agriculture, land-use change, forestry and waste disposal.

Key liability subjects to submit greenhouse gas emissions report are corporate enterprises (institutions) with and over 13000 tons of carbon dioxide equivalent of greenhouse gas emission in 2010, or corporate enterprises (institutions) with and over 5000 tons of integrated energy consumption in 2010, or independent accounting units that should be treated as a body corporate. Specific lists should be identified by the provincial, district and municipal authorities, who are charge of climate change, and submitted to the NDRC.

Companies and institutions included in the list should report greenhouse gas emission to provincial climate change offices according to their own situations and in accordance with 14 industry accounting methods and reporting guidelines compiled by NDRC. Provincial Climate Change Department is responsible for report assessment and verification, and require unqualified report bodies rectify within a prescribed time and resubmit the report, besides, it is also required to summarise qualified data reports to the NDRC.

As for the selection of third-party verification institutions and their personnel, as well as third-party verification programs, relevant policies should be made by local Development and Reform Commission. Meanwhile, NDRC also provided reference conditions and guidelines in the annex to the decree 2016 (57).

2. Asset Specificity and Institutions

In the last section, the affirmation institutions of carbon emissions have been introduced. EU, Japan and China have different relevant legal institutions. The problem is, how to assess these legal institutions? In Chapter II of this dissertation, the author pointed out that governmental administrative departments may adjust the legal institutions to the market by changing the asset specificity, base on Williamson's transaction cost economics. But the relationship between asset specificity and institutions has to be reviewed, before application of this methodology. This section discusses the principal dimensions with respect to which transactions differ, the relationship between asset specificity and vertical integration, and their application in legal institutions.

2.1. Dimensions

Williamson suggested that the factors responsible for differences among transactions should be identified and explicated into three dimensions: asset specificity, uncertainty, and frequency³¹). Part of his theory is accurate and creative, part is debatable. To exactly distinguish the influences of these dimensions on transactions and institutions, the original definition of transaction costs has to be recalled. In other words, the influences on relevant price discovery of these dimensions has to be examined.

It is easy to understand that the increasing of transactions' frequency may hinder the price discovery process. In other words, the increasing of transactions' frequency may lead to the increasing of transaction costs, because the participants have to bargain with counterparties more times, just like another kind of 'shoe-leather cost'. In most time when

frequency increases, the participants may tend to establish a long-term contract instead, to save the contractual transaction cost.

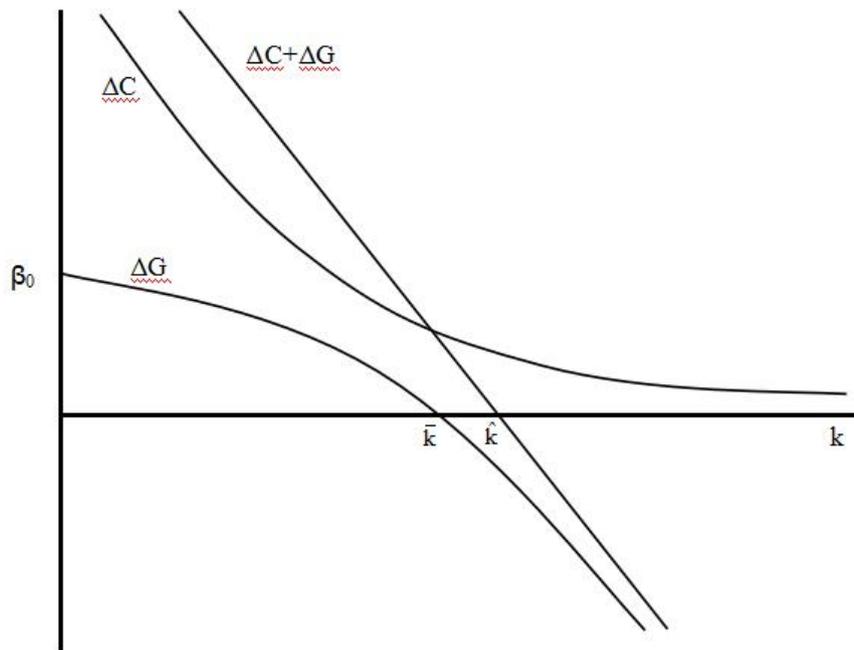
The uncertainty which derives from bounded rationality and opportunism of human behaviours may have the similar influences on transaction costs and price discovery process. The *ex ante* uncertainty may hinder the contract establishment directly, and the *ex post* uncertainty may ask the participants to consider protection mechanism and bargain with counterparties for it.

The core difference between the theory adopted by this dissertation and Williamson's theory is the viewpoint on the asset specificity. Williamson thought that the asset specificity is a natural characteristic of transactions, and derives from special purpose technology³²⁾. He suggested that the asset specificity is the principal factor to explain vertical integration³³⁾, by analyses of governance cost and production cost. The next section focuses on the asset specificity, tries to discuss the relationship between asset specificity and institutions, and reach a different viewpoint by analyses of transaction costs and price discovery.

2.2. Asset Specificity

Williamson thought that the asset specificity may influence both governance costs and production cost. Specifically, when asset specificity is greater, the difference between bureaucratic costs of internal governance and the corresponding governance costs of markets (ΔC) may decrease, as well as the difference between production cost of producing to one's own requirements and of procuring the same item in the market (ΔG). The former difference may be negative after a switchover value of asset specificity, but the latter difference is

positive throughout. Then the business decisions will be made based on the this model. In a short word, the greater the asset specificity is, the more advantage the internal organisation enjoys, and the firms will be more integrated into components³⁴). The relationship is shown as Figure 5-1, where k is an index of asset specificity.



Source: Williamson, O.E.(1985), p.93.

Figure 5-1. Williamson's Theory of Comparative Production and Governance Costs

This corollary is debatable because some facts are misunderstood. Firstly, increasing asset specificity will not increase contractual transaction costs, but just the opposite, it will decrease contractual transaction costs. In other words, the production price will be easier to discovered when the asset specificity is greater, and the contracts will be easier to achieved. The idea that 'price of non-standardized transaction is harder to be discovered' implies the influence of asymmetric information, which has been included into 'uncertainty' in this model and should not be considered tautologically. If the information is not asymmetrical, the lower asset specificity will lead to higher contractual transaction costs, and require effective

institution design. For example, a flight is suitable for many kinds of passengers, whether they are backpackers with lower willingness to pay, or millionaires who are anxious to attend a business negotiation. The airlines are not able to negotiate with every potential consumer individually, so they usually have a well-designed institution for tickets selling. On the contrary, bus services have greater asset specificity than flight, and they usually have clear prices, because the willingness to pay of their potential consumers are easier to discovered. Obviously, a millionaire who are anxious to attend a business negotiation is unlikely to buy the bus service.

Secondly, asset specificity is not only a natural characteristic of transactions, but also could be adjusted by institutions, especially by the legal institutions. In fact, the essence of vertical integration is to increase the asset specificity artificially. Just like the methodology mentioned in Chapter II, the initial establishment of institution spends a certain amount of institutional transaction costs, but the contractual transaction costs will be saved later.

Now the differences between the theory this dissertation adopted and Williamson's theory are all presented. (1), The decision of integrate or not is not depends on the sum of 'governance costs' and 'production cost', but the sum of 'institutional transaction costs' and 'contractual transaction costs'. (2), The 'governance costs' of Williamson's theory is similar with institutional transaction costs, but the 'governance costs of markets' is a misconception and should be included into the contractual transaction costs. So the ΔC value Williamson mentioned should be positive throughout, and increases with the increasing of asset specificity. (3), The difference between internal and external contractual transaction costs is always negative, but increases with the increasing of asset specificity.

The corollary is, the lower the asset specificity is, the more advantage the internal organisation enjoys, and the firms will be more integrated into components. For example, most firms have their own legal department to solve some universal legal problems, and the personnel even don't need a qualification. But they will seek help from specialized law firms and qualified lawyers when they face specialized legal problems.

3. Discussion

This section discusses the different verification legal institutions of carbon emission rights in EU and China, analyses the relevant asset specificity, government regulation and free markets. It shows that EU and China have two different strategies of institution design. It is also shown that China's relevant legal institution have obvious disadvantages and need a reconstruction.

3.1. Two Orientations

Verification is one of the most important process in the circulation of carbon emission rights. It contributes to the initial and subsequent delimitation of relevant rights, and devotes itself to weaken the information asymmetry. To economise the transaction costs and ensure the verification could work efficiently and effectively, there are two orientations for establishment of legal institutions, which adopted by EU and China respectively. The core mark of distinction between the two orientations is the counterparty of verifiers.

3.1.1. Free Market

In EU, the counterparty of the verifiers is the operators, that means, the EU leans towards the free market on verification process. The method which EU adopted on transaction costs economising is to enlarge the human asset specificity of verifiers. The purpose is to keep both institutional transaction costs and contractual transaction cost low. For example, the constitution of verification teams and the competence requirements of the relevant personnel are regulated in detail.

The problem is, the current human asset specificity of verifiers in EU ETS is still not large enough. Many reports issued by accounting firms, government departments and NGOs have pointed out that fraud, misstatement and the involvement of organised crime are significant problems in the EU ETS, like *Carbon Credit Fraud: The White Collar Crime of the Future* and *Carbon Credit Fraud - An Update* issued by Deloitte and *The Integrity and Implementation of the EU ETS* issued by European Court of Auditors.

3.1.2. Government Regulation

Different from the EU, the counterparty of verifiers in China is the government. In other words, China leans towards to government regulation but not free market on verification process. The method which China adopted is to include the verification contract itself into the legal institutions. The purpose is to make contractual transaction costs less with the requirement of more institutional transaction costs, compared with the EU. Then the asset specificity of verifiers may keep low, but the government has to pay more attention on the integrity and competence of verifiers and investigate them in every single transaction.

In current pilot carbon trading markets limited in size, this method works. But it has several inevitable problems in the future, when China's ETS is expanded to a nation-wide market. Firstly, the current requirement of asset specificity of verifier accreditation is very simple, so the quantity of verifiers is increased dramatically. If the accreditation will not be controlled and the trend continues, the institutional transaction costs of government supervision will become too large to be accepted. At the same time, the design and establishment of third-party verification institution will lose their significance.

Secondly, the government has much more bargaining power than enterprises in China, so the current contract amount of verification has too much instability, sometimes even cannot support the sustain existence of verifiers. For example, GDR Carbon Co. Ltd is a verifier in Shenzhen's pilot carbon trading market, and its operating income of verification obtained from Shenzhen Development and Reform Commission was only about 70 thousand CNY (10.7 thousand USD) per month from January to September of 2015³⁵). The contract amount is too small for a verifier with the minimum requirement of eight full-time personnel, obviously. In such situation, the verifiers have to seek for other profits, even manage the carbon assets in other pilot carbon trading market directly, like the GDR Carbon³⁶). When China's current pilot carbon trading markets become unified, such behaviours of verifiers have to be forbidden, then most verifiers may quit the verification market and cause market confusion over a period of time. If government raises the contract amount, then the total fiscal expenditure for verification among the nation-wide carbon trading market will be unaffordable because most allowance will be free allocated for a long time, and it may cause rent-seeking of the verifiers.

3.2. Policy Suggestion

To avoid the dilemma which has been mentioned last section, China's future unified carbon trading market has to find another solution. The theoretical approach is to enlarge the asset specificity of the verifiers by legal institution, and change the counterparty of verifiers from government to enterprises.

Recall Williamson's classification of asset specificity. The best choice of China's carbon trading market is to enlarge the human asset specificity of the verifiers. It means that China should learn from the relevant legal institution of the EU, and go further to avoid the fraud problem which the EU is facing.

The policy suggestions of the dissertation are as follows:

Firstly, the constitution of verification teams should be regulated more detailed, and the obligation and responsibility should be regulated more clearly.

Secondly, the education, training and accreditation of personnel of verifiers should be unified.

Thirdly, the counterparty of verifiers should be changed from government to enterprises. It means that the verification relationship should be established by the market participants voluntarily rather than allocated by the Development and Reform Commission.

It is a simple feasible package solution to turn the whole work over to the Chinese Institute of Certified Public Accountants (CICPA), since verification work has a very strong correlation with auditing work. The lower contractual transaction costs could be guaranteed by the considerable human asset specificity of CPA firms and CPAs, and it is much easier to

cultivate relevant personnel with competence and integrity from CPAs than from others.

4. Conclusion

The verification institution is the core part of carbon trading market for the efficiently and effectively operation of the market. But current relevant legal institutions of EU and China both have some disadvantages.

EU's strategy is to enlarge the asset specificity of verifiers to reduce the contractual transaction costs, so the counterparty of verifiers is the enterprises with the market. But the effort is not enough, and fraud problems are still exist. China's strategy is to reduce the contractual transaction costs with high institutional transaction costs, so the counterparty of verifiers is the government, specifically the Development and Reform Commission. It may works in the pilot carbon trading markets now, but will not work effectively during the establishment of nation-wide unified carbon trading market. On one hand, The current contract amount makes the verifiers to seek for other profits and reduces their competence and integrity. On the other hand, the total fiscal expenditure among the nation-wide carbon trading market will be unaffordable if the government increases the contract amount, and it may cause rent-seeking.

For such large unified market composed of many local markets, like China, the best solution is to enlarge the human asset specificity of verifiers by legal institutions. The constitution of verification teams should be regulated more detailed, and the obligation and responsibility should be regulated more clearly. The education, training and accreditation of personnel of verifiers should be unified. And the verification relationship should be

established by the market participants voluntarily rather than allocated by the Development and Reform Commission. CICPA may be suitable for the comprehensive arrangement of the verification process.

Endnotes

¹⁾ MRR, Article 57.1.

²⁾ Ibid., Article 58. 1&4.

³⁾ Ibid., Article 59.

⁴⁾ Ibid., Article 60.

⁵⁾ Ibid., Article 61.

⁶⁾ Ibid., Article 62.1.

⁷⁾ Ibid., Article 66.

⁸⁾ AVR, Article 44.

⁹⁾ A greenhouse gas programme neutral standard.

¹⁰⁾ European Commission(2012), *The Accreditation and Verification Regulation - Explanatory Guidance*, p.44.

¹¹⁾ AVR, Article 6.

¹²⁾ Ibid., Article 7.3 & 42.

¹³⁾ Ibid., Article 7.2.

¹⁴⁾ Ibid., Article 7.1.

¹⁵⁾ Ibid., Article 36.

¹⁶⁾ Ibid., Article 37.

¹⁷⁾ Decree of the State Council, 2007 (17).

¹⁸⁾ Decree of National Development and Reform Commission of Climate Change, 2011 (2601).

¹⁹⁾ Decree of the State Council, 2011 (41).

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- ²⁰⁾ Decree of Climate Change Office of National Development and Reform Commission, 2013 (937).
- ²¹⁾ Decree of Climate Change Office of National Development and Reform Commission, 2014 (63).
- ²²⁾ Decree of Climate Change Office of National Development and Reform Commission, 2010 (2350).
- ²³⁾ Decree of Climate Change Office of National Development and Reform Commission, 2011 (1041).
- ²⁴⁾ Decree of Climate Change Office of National Development and Reform Commission, 2015 (202).
- ²⁵⁾ Decree of Climate Change Office of National Development and Reform Commission, 2013 (2526).
- ²⁶⁾ Decree of Climate Change Office of National Development and Reform Commission, 2014 (63).
- ²⁷⁾ Decree of Climate Change Office of National Development and Reform Commission, 2014 (2920).
- ²⁸⁾ Decree of Climate Change Office of National Development and Reform Commission, 2015 (207).
- ²⁹⁾ Decree of Climate Change Office of National Development and Reform Commission, 2015 (1722).
- ³⁰⁾ Decree of Climate Change Office of National Development and Reform Commission, 2016 (57).
- ³¹⁾ Williamson, O.E.(1985), p.52.
- ³²⁾ Ibid., p.32.
- ³³⁾ Ibid., p.90.
- ³⁴⁾ Ibid., pp.90-95.
- ³⁵⁾ GDR Carbon Co. Ltd.(2016), *Public Transfer Statement*, p.79.

³⁶⁾ Ibid., p.179.

Chapter VI. Conclusion and Outlook

1. Conclusion

The methodology adopted by this dissertation is a combination of administrative law, civil law and new institutional economics. The theoretical innovation includes the introduction of one pair of concepts, the institutional transaction costs and the contractual transaction costs, and the relationship among these kinds of transaction costs, legal institutions, institutional scale, asset specificity and fundamental human rights. The theoretical discovery includes:

i. The comparison of institutional transaction costs and contractual transaction costs is the endogenous factor of institutional scale;

ii. The asset specificity is the most important factor which influences the institutional transaction costs and contractual transaction costs and could be adjusted by legal institutions;

iii. The lower the asset specificity is, the more advantage the internal organisation enjoys, and the institutions will be more integrated into components; and

iv. Subject to the bounded rationality and opportunism of human behaviour, some rights which are called fundamental human rights must be protected by legal institutions.

The dissertation studies the relevant legal issues of the subject matter CO₂, ownership of carbon emission rights and the verification process of carbon trading market, which are all the important legal institutions of the initial delimitation and affirmation of carbon emission rights and the preconditions of an effectively carbon trading market. The research findings and policy suggestions are as follows.

Firstly, for pollutants discharge standards, CDM projects, compulsory carbon trading

market and voluntary carbon trading, the legal basis for their relevant administrative behaviours are not clear or completely missing. One of the solutions is to make special legislation for them. Since special legislation causes heavy work and uncertain time, it is the fastest and most convenient solution to combine with the emendation of Air Pollution Prevent and Control Law to incorporate carbon dioxide into air pollutants.

Secondly, the carbon emission rights should be divided into two parts. One part is required for individual survival and includes the right to development –a kind of fundamental human right and one that ensures the efficient maintenance of other fundamental human rights. Individuals have the right to obtain, utilise and benefit, rather than the right to transfer or withdraw. The other rights are the right to use environmental capability, with the object being the atmosphere environmental capacity owned by countries. Natural persons or legal persons can obtain the right to utilise, benefit, transfer and withdraw through certain procedures or contracts.

Thirdly, in the carbon trading market, the legal institutions should endow rights to parties with more members, looser organisation and less information, and should bestow liabilities on parties with fewer members, better organisation and more information. Thus, natural persons should obtain the right to emit carbon regardless of necessity. For legal persons, having the right depends on their industry and organisation characteristics.

Last but not least, the current verification legal institution of China may work in pilot carbon trading markets limited in size, but may have several inevitable problems in the future, when China's ETS is expanded to a nation-wide market. The best solution is to enlarge the human asset specificity of verifiers by legal institutions, including regulate the constitution of

verification teams, the obligation and responsibility more detailed and clearly, unify the education, training and accreditation of personnel of verifiers. At the same time, the verification contracts should be made by the market participants voluntarily rather than allocated by the Development and Reform Commission. The CICPA may be suitable for the comprehensive arrangement of the verification process.

2. Outlook

Subject to the competence and time of the author, the dissertation is miles away from solving all the legal issues in the emerging carbon trading markets. Initial delimitation of carbon emission rights, i.e. the precondition of the market has been studied in the dissertation. But many follow-up researches are still urgently required.

Firstly, the legal institution of the trading agreements hasn't yet been well-studied. After the initial delimitation of carbon emission rights, the rights and the relevant agreements both have many forms, like the CERs purchase agreement in CDM project and on the Voluntary Carbon Trading Market, the quota trading contract on the compulsory carbon trading market, and the standard contract in carbon trading exchange, etc.. The relevant legal institution has to regulate such kinds of agreements and ensure the carbon emission rights could be transferred smoothly among different forms.

Secondly, the legal institution of the contract disputes also need to be studied. For traditional pollution rights, due to the small influence range and obvious regional differences, the trading market is limited in a small-scale area. The contract disputes are generally within an unifying legal institution. For the emerging carbon trading market, whether the EU ETS

constituted by many countries, China's nation-wide market which will be established based on seven pilot local markets, or an international ETS that may occur in the future, the guarantee and dispute handling after the contract will definitely arouse many procedural and substantial problems.

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