Water Governance and State Governance: A Transaction Cost Perspective of China's Unitarianism[*]

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Abstract: Unitarianism (*da yi tong*) is both an important characteristic of Chinese civilization and a key to understanding it, yet there are still issues about China's unitarianism that remain a puzzle. The theory of the water governance school as represented by Karl Mark, Karl Wittfogel and Ray Huang is perhaps the most useful explanation of why China embarked on unitarianism more than 2000 years ago. This paper attempts to deduce this theory by using the transaction cost approach, and constructing a choice model of governance structure based on the relevant literature. Using the framework of this model, the paper adopts historical materials as evidence for the structure choice in China's water governance and then explains how the hierarchical structure of water governance led to a unitary empire, and how it can be used to interpret the mechanism of the formation, operation and disintegration of China's unitarianism. The study suggests a move away from a unitary system towards a federal system of state governance in contemporary China.

I   Introduction

China is the only representative of the major ancient civilizations that continues to thrive today. Chinese civilization is distinct, and one of its most prominent particularities is unitarianism (*da yi tong*). Although splits and turmoil have occurred at certain intervals since China's first emperor unified the country during the Qin Dynasty, unitarianism has remained the political rule of Chinese society. All other ancient civilizations existed in a state of segmentation, and unification as empires to overcome the dispersiveness of petty agricultural economics was, in most cases, a temporary phenomenon. It is astounding that China was able to realize a unified empire more than 2000 years ago and to make this powerful unified power last throughout ancient society.[1] Unitarianism is therefore both one of the most important

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[1] In the more than 2000 years since the Qin Dynasty, unity has prevailed for two-thirds of the time and disunity for the remaining third. However, even during periods of disunity, popular feeling supported unity, and thus unity has been a constant state in China. The stable centralized system that has continued for more than 2000 years is unique in world history.

features of China's ancient social structure and a key to understanding the secrets of Chinese civilization. As Yang Songhua points out, the unitary system was the fundamental factor that decided the economic and social development of ancient China and the key that unlocks the Needham Puzzle.[2] Furthermore, unitarianism has lasted into contemporary times, and China is currently the only large country in the world that still has a unitary political system.

The unitary system of China carries with it a string of puzzles regarding three important issues: why China embarked on a course of unitarianism more than 2000 years ago whereas Europe, which is of a similar size, has only just begun a similar process; why unitarianism has lasted for thousands of years into the present day; and why unitarianism continued through a dozen dynasties without being destroyed. Many famous historians, such as Mark, Toynbee, Weber, Wittfogel, Needham and Fairbank, have studied the 'China phenomenon' from various angles. In examining the last two issues, Jin and Liu put forward an 'Ultra-stable System Hypothesis' of ancient Chinese society,[3] which is highly interpretative. Many scholars have attributed the early development of a unitary system in China to the inherent relations between China's early unification and the natural conditions of the country. One of the most influential schools of thought on this issue is the water governance school as represented by Marx and Wittfogel, and despite strong attacks over the past few decades, the views of this school cannot be ignored in the search for the essence of Chinese civilization.

Marx put forward the concept of the 'Asiatic mode of production' and emphasized the importance of irrigation projects in Asiatic society. He states that "in the Orient where

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[2] Yang Songhua, *Dayitong yu zhongguo xingshuai (Unitary System and China's Prosperity and Decay)* (Beijing: Beijing chubanshe, 2004).

[3] Jin Guantao and Liu Qingfeng, *Xingsheng yu weiji － zhongguo fengjian shehui de chaowending jiegou (Ascendancy and Crisis: On the Ultra-stable Structure of Chinese Feudal Society)* (Changsha: Hunan renmin chubanshe, 1984).

civilization was too low and the territorial extent too vast to call into life voluntary association, the interference of the centralizing power of Government. Hence an economical function devolved upon all Asiatic Governments, the function of providing public works".[4] Wittfogel went a step further to argue that the purpose of water governance was the primary cause of despotism in China. Wittfogel called social structures that were dependent on large-scale irrigation projects 'hydraulic societies' that were characterized by despotism and a centralized bureaucratic administrative system.[5]

Wittfogel's theory has been much disputed, and contrary to his central thesis it is now commonly accepted that there is not necessarily a link between aridity or the relative scarcity of water and authoritarian political and economic power relations.[6] Recently, however, Ray Huang presented new evidence that overcomes the limitations of Wittfogels's thesis. He puts greater stress on the prevention and control of floods, rather than the irrigation projects that Marx and Wittfogel held to be so important, arguing that the floods of the Yellow River were so serious that local efforts alone could do nothing and only a centralized government that was in control of all of the river's sources and was even-handed to all of the parties concerned could guarantee the safety of the people who lived under the constant threat of flooding, and that "this alone is enough to show that centralization of power is inevitable in China". Nevertheless, Huang states that the flooding of the Yellow River is not the only interpretative variable, although it is the most important, and adds 'work relief' and 'national defence' to the

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[4] Karl Mark, "The British Rule in India," *New-York Herald Tribune,* 25 June 1853.
[5] Karl A. Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven: Yale University Press, 1957).
[6] Erik Swyngedouw, *Power, Water and Money: Exploring the Nexus* (Background Paper, United Nations Development Report, 2006), p. 17.

factors that led to the centralization of power.[7] All three of these factors are determined by the natural geography of China, which is why Huang is firm in his belief that natural force was the more decisive factor behind the unification of China.

This paper attempts to give a modern interpretation of the water governance school through the approach of new economic history, which is designed to re-interpret history using modern economic theories. Pioneered by Douglass North, new economic history has not only expanded the areas to which economics is applied, but has also led to a series of thought-provoking conclusions that differ from the traditional views of history. This paper uses the theoretical achievements of New Institutional Economics to re-interpret the views of the water governance school and to derive new propositions that enrich and develop the water governance theory. This work answers the first of the puzzles of China's unitarianism, and also has a certain degree of interpretative power for the second and third, providing a new perspective and views for solving them.

The remainder of this paper is divided into seven parts. Part II outlines the various types of water governance structure and state governance structure. Part III reviews the literature concerning transaction cost theory, which provides the methodological foundation for the construction of the model. Part IV is devoted to a choice model that is constructed based on the literature, Part V interprets why China opted for a hierarchical water governance structure using the economics model, Part VI further interprets how the hierarchical water governance structure led to a centralized political structure and presents three propositions on the formation, operation and disintegration of unitarianism in China, and the final part

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[7] Ray Huang, *Hexun hepan tan zhongguo lishi (Telling Chinese History by the Hudson River)* (Shanghai: Shanghai sanlian shudian, 2002), pp. 6-10.

addresses the implications for changes in the political structure of contemporary China.

II Continuum of Governance Structure

This paper follows North in defining 'structure' as the institutional framework of the sum of institutional arrangements.[8] Water governance structure refers to the institutional framework on which collective action over water development, utilization and conservation is based; state governance structure refers to a political system of a country or political relationship between countries, or the political form that derives from the allocation of resources and decision-making powers. The aim of both structures is to make collection action effective. This paper approaches the model of collective action from the perspective of decentralization and centralization, and considers the disparities in governance structures to be the result of differences in the allocation of the rights of residual control at different policy-making levels.[9] For simplicity, we present only two policy decision-making levels in the governance structure: the relations of super and subordination.

We now turn to the types of water governance structure. As water and its basin unit form a logical unit, water governance involves the interests of all of the areas in the basin. The prevention of the negative externalities that are caused by trans-boundary damage and the expansion of positive externalities require the collective action of all of the areas concerned. The model of collective action that is used in such areas may take one of the five basic forms

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[8] Douglass C. North, *Institutions, Institutional Change and Economic Performance* (Cambridge: Cambridge University Press, 1990).

[9] The term 'residual control rights' is often used in the theory of the firm. Advanced by Grossman and Hart, it is one of central ideas of the incomplete contract theory (see Sanford J. Grossman and Oliver D. Hart, "The costs and benefits of ownership: a theory of vertical and lateral integration," *Journal of Political Economy*, Vol. 94 No. 4 (1986), pp. 691-719). The concept was later applied to the study of hierarchical structures of social organization (see David Lake, "Anarchy, hierarchy, and the variety of international relations," *International Organization* Vol. 50, No. 1, (1996), pp. 1-33). In reality, the holding of residual control rights is a general method for judging the level of centralization of a structure. Usually, the greater the concentration of residual decision-making powers in the upper levels, the greater the degree of centralization.

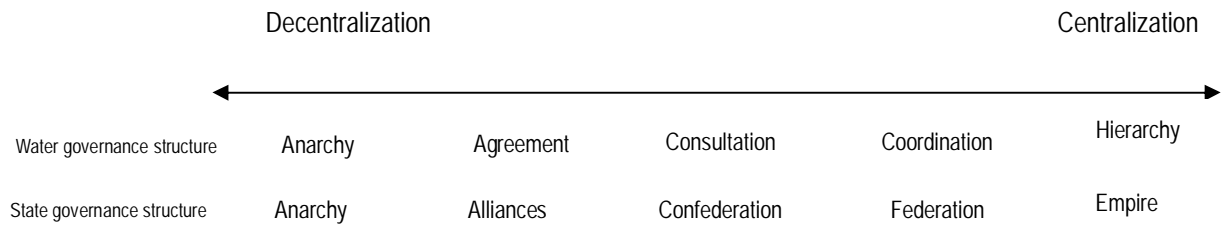that are shown in Figure 1, which range from decentralization to centralization.

Decentralization   Centralization

| Water governance structure | Anarchy | Agreement | Consultation | Coordination | Hierarchy |
| State governance structure | Anarchy | Alliances | Confederation | Federation | Empire |

Figure 1: Continuum of Governance Structure

The first form is anarchy, which refers to a type of international relations in which each area follows its own course without interfering in the affairs of others. This model is applicable to rivers that do not cause much harm or externalities in the use of water, such as international rivers.

The second form is agreement, in which the regions in a river basin conclude agreements in the common interest and take collective action according to these agreements. This model has been extensively applied in the governance of international rivers and even within countries, especially in federal states.

The third form is consultation. To better oversee the implementation of river governance agreements or to resolve trans-boundary problems in a more flexible way, consultation organizations may be set up to coordinate the actions of the various regions. This method has been extensively adopted in the governance of rivers, both international and domestic.

The fourth form is coordination. When it is difficult to reach unanimity, it is necessary to introduce a coordination mechanism that is coercive in nature. This model often involves the establishment of official organizations that have varying degrees of coercive powers, and is often adopted in federal states.

The fifth form is hierarchy.[10] If the coordination model is not sufficient to settle the problem of collective action amongst the various regions, then a more powerful centralized model is required in which the government or quasi-governmental authorities directly intervene in trans-boundary water affairs. This model is often seen in centralized states. The most typical manifestation of this model is found in China, where the central government has traditionally played a dominant role in water governance affairs.

We now come to state governance structure. Political science divides states into central and federal states according to the allocation of power between central and local authorities. Elazar divides federalism into League, Condominium, Associated Statehood, Federacy, Confederation, Federation and Union,[11] and this paper follows that categorization division by classifying state governance structure into five types.

The first type is again anarchy, which refers to international relations in which states follow their own course and have little to do with each other. The second type is alliance, which refers to discrete polities that are created through formal agreement，such as NATO, the Arab League and ASEAN.

The third type is confederation, which means a common government that is formed by the joining together of several existing polities (for strictly limited purposes that are usually related to foreign affairs and national defence) that remains dependent upon its constituent polities. Some current examples of this form of governance structure include the Caribbean Community, the European Union (EU) and Senegambia. Historically, confederations either

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[10] This paper regards hierarchy as a condition of relational power in which a dominant polity "possesses the right to make residual decisions while the other party – the subordinate member – lacks this right" (see Lake, "Anarchy, hierarchy, and the variety of international relations," p. 7. and Alexander Cooley, *Logics of Hierarchy: The Organization of Empires, States, and Military Occupations* (Ithaca and London: Cornell University Press, 2005), p. 5).

[11] Daniel J. Elazar, *Exploring Federalism* (Tuscaloosa: University of Alabama Press, 1987), p. 60.

disintegrated or were constituted as consolidated states, but the recent emergence of the EU presages a revival of confederal government.[12]

The fourth type is federation. A federation is a polity that consists of strong constituent entities and a strong general government, but with local governments sharing part of the power as prescribed in the constitution. Modern federalism as created by the United States two centuries ago was widely emulated in the nineteenth century, with the result that, according to Elazar, nearly 40 percent of the world's population now lives within polities that are formally federal, and another third lives in polities that apply federal arrangements in some way.[13]

The fifth type is empire, which describes an extensive polity that incorporates various previously independent units that are ruled by a dominant central polity.[14] In such a structure, the central government holds almost all of the residual control rights and establishes and provides the terms of reference for local governments at will, rather than providing for them in the constitution. China is the largest centralized state in the world, and the unitary system with which this paper deals is one such large centralized system.

These basic forms of collective action for water governance and state governance are not vastly different in practice, but even within the same kind of structure there are differences in the degree of centralization. Figure 1 shows the continuum of governance structure in chart form, and presents a continuum that develops from anarchy to hierarchy with levels that are measured by the relative allocation of residual control rights. It can be seen that the degree of

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[12] Ibid, p. 7. and p. 51.

[13] Ibid, p. 6-7.

[14] The main difference between federations and empires is that federations typically are new entities that are created from the bottom up, whereas empires are imposed by a dominating established polity (see Jack Donnelly, "Sovereign inequalities and hierarchy in anarchy: American power and international society," *European Journal of International Relations*, Vol. 12, No. 2 (2006), p. 139-170.

centralization increases progressively from left to right, with the residual control rights being concentrated at higher levels of centralization. The anarchy model is the least centralized, and under this system each decision-making polity holds all of its own residual control rights. In contrast, a hierarchy or empire has the greatest degree of centralization, with the central polity monopolizing almost all of the residual control rights.

Of course, the types of water governance structure and state governance structure do not strictly correspond to each other: they merely indicate the rough relations with the degree of decentralization and centralization. However, there are inherent relations between water governance structure and state governance structure, because water governance is a public matter that involves the interests of the same people that come under the governance of the state. In most countries the state governance structure is exogenous to the water governance structure, and has a major impact on the choice of water governance structure, because the water governance structure is chosen only after the state governance structure has taken shape. Conversely, due to the particularities of the water problem in the early period of Chinese civilization, such as frequent droughts and the severe flooding of the Yellow River, the choice of water governance structure had a decisive impact on the choice of state governance structure.

III Methodology of Transaction Cost Analysis

Coase first advanced the concept of transaction costs as the fundamental factor that leads to the existence of firms. He pointed out that firms use hierarchical directions to replace voluntary market transactions, and noted that the size of a firm is determined by its

transaction costs.[15] In the 1970s, Williamson picked up Coase's core argument and developed it into what is now known as 'transaction cost economics'. Williamson makes the transaction the basic unit of analysis, and points out that when transaction costs are too high, the market will no longer be the most effective governance structure and it becomes necessary to design a new structure.[16]

Transaction cost economics has made much progress in the theory of the firm since the work of Coase and Williamson, and it is now accepted that regardless of the type of firm or market, each organizational form has transaction costs, the size of which is determined by the degree of mutual replacement. As a firm expands, its agency costs may increase until the internal marginal gains are equal to the marginal costs of integrated management, at which point the firm has reached the optimal scale. In new institutional economics, a multiple-tier organization is also called a hierarchy, which is an alternative form of organization to the market. Generally speaking, economic organizations are designed by the identification of transaction features as governance structures that seek economies of transaction costs.[17]

Transaction cost analysis has also been applied to the study of non-economic organizations. Coase argues that transaction cost analysis can be used to explain many kinds of social arrangements, including markets, firms and governments, and their evolution.[18] Moe suggests that as new institutional economics has made revolutionary contributions to the understanding of hierarchical structure in private areas, it should also be conducive to

[15] Ronald H. Coase, "The nature of the firm," *Economica*, Vol. 4, No. 3 (1937), pp. 386-405.
[16] Oliver E. Williamson, *Markets and Hierarchies: Analysis and Anti-trust Implications* (New York: Free Press, 1975), pp. 4-7.
[17] Ibid.
[18] Ronald H. Coase, "The problem of social cost," *Journal of Law and Economics*, Vol. 3, No. 1 (1960), pp. 1-44.

understanding the hierarchical system of public systems.[19] The work by North in 1990 heralded the emergence of transaction cost politics,[20] and since then more and more studies, such as the excellent work of Dixit, Epstein and Halloran, had used the analytical framework of transaction cost economics to analyse political problems.[21]

Transaction cost analysis has also been applied to the study of international relations and politics to examine such issues as why countries adopt different forms of cooperation with other countries. Lake uses transaction cost analysis to explain why some countries have resorted to relatively loose cooperation over state security, whereas others prefer hierarchical cooperation. In his model, Lake uses governance costs and the expected costs of opportunism to explain the options for inter-country relations, and suggests that governance costs rise as the level of hierarchy increases, whereas the expected costs of opportunism rise as the level of hierarchy decreases, and that together they decide the optimal relations between countries.[22] Weber and Cooley have carried out similar work using the same methodology.[23]

At this point it might be asked why transaction cost analysis has been so widely applied to economic, political and social organizations. Perhaps Williamson gives the answer when he states that the basic unit of analysis is the transaction or the contract, and thus any relations that involve a contract can be approached from the angle of transaction cost economics.[24] Economic activities, political activities and the relations between regions or countries can, in

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[19] Terry Moe, "The new economics of organization", *American Journal of Political Science*, Vol. 28, No. 4, (1984), pp. 739-777.

[20] Douglass C. North, "A transaction cost theory of politics," *Journal of Theoretical Politics*, Vol. 2, No. 4 (1990), pp. 355-367.

[21] See Avinash K. Dixit, *The Making of Economic Policy: A Transaction Cost Perspective* (Cambridge: MIT Press, 1996) and David Epstein and Sharyn O'Halloran, *Delegating Powers: A Transaction Costs Politics Approach to Policy Making under Separate Powers* (New York: Cambridge University Press, 1999).

[22] Lake, "Anarchy, hierarchy, and the variety of international relations," pp. 15-22.

[23] , Katja Weber, "Hierarchy amidst anarchy: a transaction costs approach to international security cooperation," *International Studies Quarterly,* Vol. 41, No. 2 (1997), pp. 321-340; Cooley, *Logics of Hierarchy*.

[24] Oliver E. Williamson, "The economic institutions of Capitalism", *Markets and Hierarchies: Analysis and Anti-trust Implications* (New York: Free Press, 1975),Williamson, 1985

fact, be regarded as transactions between individuals or groups that can be examined from the contract angle. The hidden nature of most contracts means that the transaction costs of drawing them up and performing them are huge, which affects the design of organizational form and institutions. Transaction cost theory is useful for the analysis of many kinds of social organizations, and can therefore be used to explain macro governance structures, such as water governance structures and state governance structures as in this paper. This is because governance structure is an institutional framework that is constituted by various institutional arrangements, and can be regarded as the aggregate of all of the contract relations in a society.

IV Choice model of governance structure

As Epstein and Halloran summarize, different governance structures affect the magnitude of a variety of transactions costs, and thus the task of transaction cost analysis is to predict how optimal governance structures will change as transaction costs change.[25] The existing literature of transaction cost theory reveals that the choice of governance structure is determined by the minimization of the overall transaction cost. The general logic of the choice of governance structure can therefore be regarded as that of minimizing transaction costs (governance costs) under given environmental constraints. According to this logic, and with particular reference to the models of Lake, this paper constructs a governance structure choice model with which to explain the choice of water governance structure and state governance structure.

We define governance structure as the variable e, with a higher value of e denoting a

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[25] Epstein and Halloran, *Delegating Powers,* p.37.

greater degree of centralization on the continuum. We then define transaction costs as moving

in the opposite direction. On the governance structure continuum, we denote transaction costs

that increase with the degree of centralization, such as principal-agency costs, as management

costs (C_m), and call transaction costs that increase as the degree of centralization decreases,

such as negotiation costs, call cooperation costs (C_n). Governance costs (TC) are the sum of

the total transaction costs, that is, the sum of the total cooperation and management costs.

Management costs C_m and cooperation costs C_n are both functions of governance

structure e, that is, $C_m = L(e_i)$, $C_n = I(e_i)$. We define the marginal management costs

curve as $MC_m = L'(e)$ and the marginal cooperation costs curve (absolute value) as

$MC_n = -I'(e)$. For simplicity, we regard MC_m and MC_n as linear functions. Figure 2 shows

that the two marginal costs curves cross at $e*$, which is the minimum value point of the

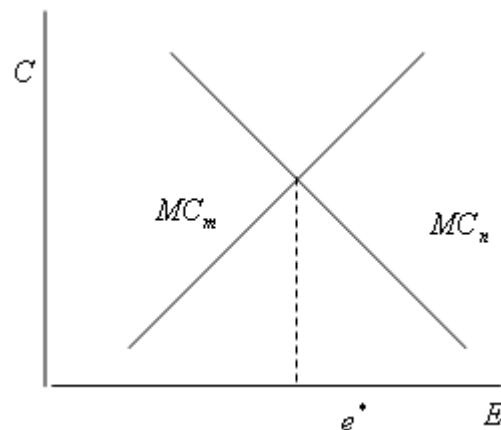governance costs and also the equilibrium point of the governance structure.

Figure 2: Optimal Equilibrium Model of Governance Structure

Cooperation costs

A lesser degree of centralization in the structure pushes up the cooperation costs, which

include the cost of collecting information about cooperation partners, the cost of reaching agreements and the cost of carrying out the agreements. Cooperation costs originate in the opportunism of the participants in collective action, and are similar to transaction costs in the sense that is used by Coase of utilizing the market mechanism. Here they refer to the costs of taking advantage of political negotiations.

In our model, cooperation costs are a function of the governance structure, and increase as e decreases. The marginal cooperation costs are also a function of e and decrease as e increases. In a flat structure, each participant holds a fairly large amount of residual control rights, therefore making it more possible for opportunism to take place and pushing up the cooperation costs. If the cooperation costs of collective action are too high for society to pay, then the only way to avoid conflict is to increase the degree of centralization to reduce the possibilities for opportunism and therefore the cooperation costs.

Although we regard cooperation costs as a function of governance structure, there are many other factors that affect cooperation, such as the number of participants, the characteristics of the participants, the asset specificity that is involved in the cooperation and the cultural tradition of the society, whether collective or individualist. In the framework that is provided by our model, the factors that affect the cooperation costs serve to change the gradients of the marginal cooperation cost curve, as shown in Figure 2.

Management costs

A greater degree of centralization increases the management costs, which derive from the principal-agent relations between the super and subordinate decision-making polities. The

objective functions of the subordinate polities and the principal – or superordinate polity – are different. The superordinate polity must use resources to control, supervise and coordinate the subordinate agents to prevent their opportunism and enable them to achieve the objectives of the principal.

Our model also regards management costs as a function of e, in that they increase as e increases, in contrast to the marginal cooperation costs, which decrease as the value of e decreases. The price of reducing the cooperation costs is a progressive increase in management costs as the degree of centralization increases, largely because the residual control rights of the subordinate polities are reduced when the degree of centralization increases and their incentive thus lessens, which exacerbates the principal-agent problem. The lower the efficiency of a centralized structure, the faster the management costs rise and the steeper the gradient of the marginal management costs curve.

As with cooperation costs, management costs are subject to the influence of environmental variables, such as the number of agents and the degree of information asymmetry. The factors that affect management costs serve to change the gradient of the marginal management costs curve, as shown in Figure 2.

Equilibrium governance structure

The choice of governance structure is a trade-off between the management costs and cooperation costs that are brought about by changes that have been made to the degree of centralization to minimize the overall transaction costs. When the marginal cooperation costs are equal to the marginal management costs, the governance structure reaches an equilibrium

and the governance costs are the most economical. The combined cooperation and management costs curve determines the equilibrium governance structure. Environmental constraints influence the cooperation and management costs curves and thus the choice of equilibrium government structure. Statically, if the marginal curve of cooperation and management costs can be largely fixed, then the point at which the two curves cross is the point of equilibrium. Dynamically, the two curves will change subject to changes in the influencing factors, which will cause both the marginal curve and the equilibrium point to move.

V China's Particularities in the Choice of Water Governance Structure

According to our model, the choice of water governance structure is determined by a comparison of the cooperation and management costs. China's particularities in the choice of water governance structure in the early period were caused by the high cooperation costs of carrying out collective action on an equal and cooperative basis to supply the large-scale public service of flood prevention and work relief. There are correspondingly high cooperation costs under a decentralized governance structure.

First, let us examine the options for collective action in fighting the floods. China's monsoon climate and natural geography make the conditions of hydrology and water resources very complicated. Floods and drought happen frequently, especially in the areas that are drained by the Yellow River, which carries a huge amount of sand downstream every year, forcing the course of the river in its lower reaches to change frequently. The need for

large-scale collective action initially arose during the Qin Dynasty, but the extremely low level of productivity and the frequent conflicts between minor states made such collective action impossible without a highly authoritative organization to coordinate matters. This is demonstrated by the historical literature. In the Western Zhou period, dykes had already been constructed across the lower reaches of the Yellow River, which made collective action between the various regions even more vital. During the Spring and Autumn periods, various kingdoms around the lower reaches of the river began to build more dykes, often to the detriment of neighbouring states, and some states went so far as to harbour the intention of using their neighbour's fields as an outlet for their own overflow. The need for a contract between the minor states to prevent this use of water as a weapon therefore arose. In 651 B.C., Qi Huan Gong called all of the dukes of the minor states to a meeting in Kuiqiu, where he made them swear under oath not to build dykes secretly and banned the use of dykes as defence works. In signing up to the agreement, the dukes were trying to protect themselves from the floods. However, dykes on the lower reaches of the Yellow River continued to proliferate up to the Warring States period. Jia Rang of the Western Han Dynasty describes in his "Strategies to Tame the Rivers (*Zhihe sance*): "the building of river dykes started in the Warring States period to protect against river floods, but all for their own (individual states) interests. The State of Qi shared a river with the State of Zhao and the State of Wei, which were set against the mountains. The State of Qi built a dyke along the river that extended 12.5 kilometres so that the river flowed eastward towards the State of Qi. Threatened by floods in the west, the State of Zhao and the State of Wei also built dykes that extended 12.5

kilometres".[26] In 332 B.C., the State of Zhao engaged in a war with the State of Qi and the State of Wei and breached the Yellow River dyke to flood them. This shows that the dukes were unable to unanimously take collective action, and that pledging an oath and signing an agreement was no sure guarantee of cooperation. Finally, when Qin Shi Huang, the first emperor of the Qin Dynasty, unified the country, he also unified the affairs of water governance, and removed all of the military installations that obstructed the flow of water and all of the passes that blocked communications to link up the dykes that had been built by various states.[27]

The difficulty in cooperating on an equal footing can be seen not only in the issue of flood control along the Yellow River, but also in disaster relief after both drought and floods. As natural disasters occurred in all of the different states almost every year, there was a need for a mutual aid mechanism through which to share the obligations of disaster relief. If famine struck a state and neighbouring states obstructed relief, then war would usually be the result. At the aforementioned Kuiqiu meeting, the participating states also promised not to obstruct relief during famine, but this promise was in fact very feeble and relief obstruction still took place from time to time. The "Record of History (*Zuo zhuan*)" records that when famine struck in the State of Jin in 647 B.C., the State of Qin came to the rescue, but the following year when famine struck the State of Qin, the State of Jin obstructed relief and war broke out. There were many such wars during the Spring and Autumn period, and the situation continued for several hundred years until the desire for unification began to gradually arise as it was realised that, as Ray Huang states, "a unified big state could get more resources under control

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[26] See *Hanshu: gouxuzhi* (*Book of Han: History of the Waterways*).
[27] See *Shiji: qinshihuang benji* (*Records of History: Chronicles of Qin Shi Huang*).

and make disaster relief more efficient".[28]

The particularities of China's water governance structure were thus caused by the need for large-scale collective action in the very early period of civilization as a result of the particular natural geographical conditions of China. However, the costs of collective action that was based on equal cooperation were very high due to the low level of productivity at that time. As expressed in our model, the marginal cooperation cost curve MC_n is very steep. This leads to a highly centralized equilibrium water governance structure e^* (see Figure 3), and indicates that it is exactly the governance structure that China needed. In other words, the grave threat of floods in the early period of Chinese civilization created a powerful intrinsic driving force for choosing a hierarchical structure of water governance, as this option was the most economical in terms of transaction costs and optimal for coping with the challenges of nature at the contemporary level of productivity.

In the ancient European continent in the early period of Western civilization, there were neither such capricious hydrological conditions as in China nor such disastrous floods as those brought by the Yellow River, and thus there was no need for large-scale joint efforts to control flooding. There was no other public service that needed large-scale cooperation, which means that there were few cooperation costs in the provision of public services such as the management of water, as is shown in the very flat marginal cooperation costs curve $MC_n^{'}$. The optimal governance structure was therefore a very low degree of centralization $e^{'}$ (see Figure 3).

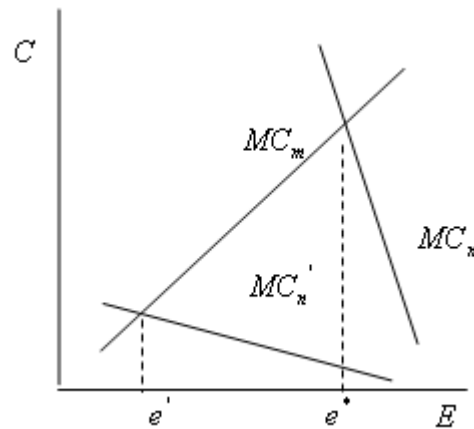[28] See Ray Huang, *Telling Chinese History by the Hudson River,* pp. 6-10.

Figure 3: Economic Explanation for Choice of Water Governance Structure

Differences in the natural geographical conditions have determined the choices of water governance structure in China and the West. The great differences in the demand for a concerted effort towards water control resulted in diametrically opposed cooperation costs, and hence a great difference in the equilibrium structures of water governance. This comparison helps us to understand that it is the result of the excessively high cooperation costs that are involved in joint efforts to regulate trans-boundary issues such as water control that give rise to the need for a highly centralized and unified system that will minimize the excessively high costs of political negotiation.

Nevertheless, even the highly centralized structure that prevailed after the unification of China by the Qin, with its ability to mobilize the entire society, was not enough to ensure safety from floods under the contemporary economic and technical conditions of the agrarian society. In the 23 years of the rule of Zheng Guan (*Zhenguan zhizhi*) of the Tang Dynasty the Yellow River flooded in eight years, and during the 134 years of the rule of Kang Qian (*Kangqian shengshi*) of the Qing Dynasty it flooded in 47 years.[29]

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[29] Author's statistics according to the *Flood Chronicles of the Yellow River Basin (Huanghe liuyu dashui juyi nianbiao)* (see the Yellow River History editorial office of the YRCC, *History of the Yellow River Vol. 2*

VI Formation and Operation of China's Unitarianism

Just as the water governance school holds that the need for a centralized system of water governance provided the intrinsic driving force for the unification of China, this paper suggests that the demand for a hierarchical structure of water governance gave birth to a unitary empire. The hierarchical structure is not only the equilibrium structure of water governance, but also the equilibrium structure of state governance. In the Western Zhou period, China was carved up into more than 100 states and the state governance structure was flat and unstable relative to the equilibrium structure. The intrinsic driving force for an equilibrium structure led the country towards unitarianism step by step in a protracted gaming process of transition from an instable governance structure to a stable structure. As Ray Huang states, "the 500 years before Qin unified the country was a long internecine period, with the number of states reduced from the original more than 100 to dozens and then to 13 and further down to 7 in the last 200 years of the period. In the end, Qin annexed the other six to complete the unification. There has never been a centralized movement of such a scale in world history...Natural force is, doubtlessly, the most deciding factor behind the unification of the country".[30]

As is shown in the framework that is provided by our model, the natural force behind the unification movement that reduced the more than 100 minor states to one state after more than 500 years of war was the high cooperation costs inherent in cooperative efforts to manage trans-boundary affairs among the states. The unstable flat governance structure provided Chinese society with a powerful intrinsic driving force to lower governance costs, which

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(Huanghezhi juan 2) (Henan: Henan renmin chubanshe, 1998)).

[30] See Ray Huang, *Telling Chinese History by the Hudson River,* pp. 6-10.

eventually led to a highly centralized governance structure in the form of a stable empire system. This turbulent 500-year process is shown in $e^0 \to e^*$ in Figure 4, which gradually converges from a point far away from the equilibrium point to the optimal equilibrium point.

In essence then, the formation of a hierarchical structure was born of the need to reduce the excessively high costs of cooperation. However, this was achieved at the price of higher management costs. A centralized structure always carries higher governance costs, which increase progressively as the degree of centralization increases. Management costs make up the bulk of the governance costs in a hierarchical structure, and the proportion rises as the degree of centralization increases. To lower its governance costs, a hierarchical government must lower its management costs, which causes the marginal management costs curve to move inward as shown in $e^* \to e^{**}$ in Figure 4, and moves the equilibrium point towards a new equilibrium point with an even greater degree of centralization.

The foregoing analysis reveals that a hierarchical structure results from the reduction of cooperation costs, but is concomitant with higher management costs, and thus the sustainability of such a structure is preconditioned by the extent to which it can effectively lower its management costs. This means that a hierarchical structure must have a self-strengthening mechanism, regardless of whether it is a water governance system or a unitary empire.

The foregoing is a re-explanation of the theory of the water governance school using the economic model. It is not merely a repetition of existing thought, but makes new propositions that are deduced from existing theories by employing a modern economics model, propositions that serve to enrich and develop the existing theories. In the following, three

major propositions are detailed that take the ideas of the water governance school to a new level.
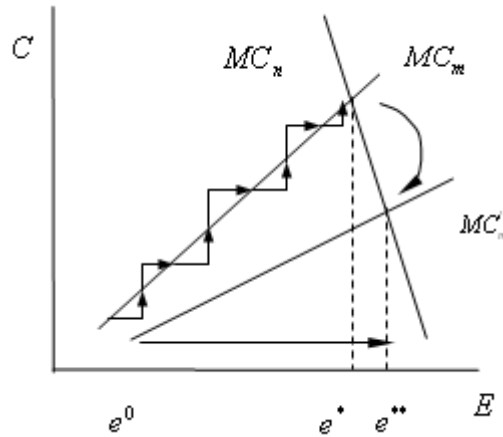
Figure 4: Mechanism of the Formation and Operation of A Unitary Empire

The first proposition is that China's unitarianism resulted from the reduction of transaction costs (cooperation costs). An empire is the optimal institutional arrangement for reducing high cooperation costs, and replaces horizontal political deals with vertical administrative control. This proposition is similar to Coase's theory of the firm, which holds that the emergence of a firm is the result of replacing voluntary market transactions with coercive administrative directions. And furthers this paper asserts that the empire system is the product of the replacement of political deals with administrative control, rather than simply the product of the need for the centralization of power to manage water affairs advocated by the water governance school. Also this paper reveals more clearly the exact meaning of this need, which is to lower the cooperation costs that are involved in trans-boundary affairs. A unitary system is, in essence, a model of collective action that is characterized by the centralization of power and a vertical mandate, in contrast to the model of collective action that is characterized by the separation of power and horizontal

associations. The unitary system in China is therefore the result of the efforts by early civilization to cope with the challenges of nature and reduce transaction costs.[31]

The second proposition is that China's unitary system had a strong motivation to continually lower transaction costs (management costs) to maintain its stability, and had to come up with institutional arrangements, a cultural orientation and an ideology that were compatible with the centralized system to effectively lower management costs. This explains why almost every dynasty adopted a series of measures to reinforce the centralized system. For instance, after unifying China, the Qin Dynasty replaced the feudal fief system with the 'prefectures-counties (*junxian*)' system and unified the measurement system and the written language. The Western Han Dynasty introduced the policy of banning all schools of thought but Confucianism (*bachu baijia, duzun rushu*) to make the country more unified ideologically. These institutional arrangements were all aimed at lowering management costs. Later dynasties drew on the experience of their predecessors and introduced new institutional arrangements to lower management costs further. The Sui and Tang dynasties introduced the imperial examination (*keju zhi*) system to select officials as spokesmen for the ruler, and the Tang dynasty set up the system of three chancelleries and six ministries (*sansheng liubu zhi*) to improve administrative efficiency and reinforce the central power. After the Tang dynasty, the centralization of power was further intensified. The Song Dynasty started the reform of the official system, reducing the power of the prime minister and placing greater power in the

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[31] Alesina and Spolaore develop an interpretative model of the size of a country that holds that the optimal size for a country is determined by a cost-benefit trade-off between the benefits of size and the costs of heterogeneity. In a large country, the per capita costs may be low, but the heterogeneous preferences of a large population make it hard to deliver services (see Alberto Alesina and Enrico Spolaore, *The Size of Nations*, (Cambridge: MIT Press, 2003)).This model may serve as a supplement to this paper, because a centralized governance system has a huge demand for such public services as flood control, disaster relief and national defence, and a larger size of territory may lower the costs of the providing such services.

hands of the emperor. Later, the post of prime minister was abolished from the first emperor Zhu Yuanzhang in the Ming Dynasty. This totalitarian system was further intensified in the Qing Dynasty, during which the ideal of one man ruling (*yiren zhi tianxia*) was achieved through the establishment of a military intelligence section (*jun ji chu*) by Emperor Yong Zheng. The constant reinforcement of the central power has been the general trend in Chinese history since unification, as is implied in the theoretical model.

The third proposition is that the disintegration of China's unitarianism was the result of an inability to effectively control rising transaction costs, because the effective lowering of management costs is a pre-requisite for maintaining a unitary empire. Management costs are mainly the costs that are incurred in entrusting agents, that is, the cost of the operation of the entire bureaucratic system. At the beginning of a dynasty interest groups were destroyed or weakened, and it was easy for the ruler to lower management costs yet achieve a fairly efficient bureaucratic system. However, as time passed new interest groups began to emerge, and the operation of the bureaucratic system became less efficient and even rigidified, with corruption and bad practice running wild, which resulted in a rapid rise in management costs. When the management costs became too high to be borne by the centralized governance structure, there would be a drastic increase in refugees, artificial and natural disasters and invasion by outsiders, which would drive the dynasty to destruction. However, as the motivation for national unity was still in place, the inertia of civilization – or the path dependence of institutional change – meant that the tendency for reunification after separation remained. This is another explanation for the cyclic change in dynasties in ancient China.

VII Conclusion: Implications for the Evolution of the State Governance Structure

Chinese civilization is distinct, and quite different from Western civilization. One of the reasons for this difference was the need in China for large-scale collective action in the very early period, a demand that was non-existent in the West civilization in the same period. The process of the integration of Europe that started with the birth of the European Community half a century ago points to a trend of rising centralization of the governance structure in the European continent. In the macro-historical sense, although Europe has just started its unification process, it is similar to that of China more than 2000 years ago. The intrinsic mechanism for the unification of Europe, according to our model, is the rapidly rising demand of all modern countries on the continent for mutual dependence and the rapid increase in collective action in the management of trans-boundary affairs (such as national defence, diplomacy, unified markets, financial and monetary systems and the development of science and technology). This has led to a rise of the cooperation costs in a flat governance structure, and has thus driven the marginal cooperation cost curve upward. In contrast, modern conditions mean that the trend is for the management costs in a centralized structure to decrease, which drives the marginal management cost curve downwards. The combined effect of the movement of the two curves is that the equilibrium governance structure moves in the direction of a greater degree of centralization. In other words, under contemporary environmental constraints, Europe has found it necessary to put in place a more centralized governance structure. The development of the EU is precisely the process of moving towards a new equilibrium governance structure. Limited by the upward

movement of management costs, the current equilibrium governance structure of Europe is a kind of confederation or federation that lies somewhere between an alliance and an empire.

In contrast, in contemporary China the new environmental conditions that have been created by industrialization and the development of a market economy and an information society have led to a decrease in the cost of cooperation between regions, thus driving the marginal cooperation costs curve downwards. At the same time, the multiple interests of the new society have caused the marginal management costs curve, which was much reduced under centralization, to move upwards. The combined effect of the movement of the two curves is that the equilibrium governance structure is moving in the direction of a lesser degree of centralization, which indicates a trend towards a federal model of state governance. As it is impossible for a highly centralized system to keep its marginal management costs down for long, such a system will in the end be unable to escape the cycles of stability and disturbance that are caused by increasing governance costs. If China is really to realize its goal of long-term peace and stability (*changzhi jiuan*), then it will be necessary for the state governance structure to move away from centralization to a certain extent by delegating power to the regions and empowering them with great autonomy in economic and social decision-making to stimulate civil society to improve its ability to self-govern. Changing the system from a 'top-down' model to a 'bottom-up' model that achieves an institutional balance of power between centralization and the regional delegation of power in all areas of state governance should be the basic orientation of China's political reform.

Appendix

Proof 1: The crossing point of the two marginal cost curves is the minimum value point of the governance costs.

In accordance with the definition, assume that $e \in [0,1]$, $e = 0$ is completely flat, $L(0) = 0$; $e = 1$ is completely centralized and $I(1) = 0$; $I(e) > 0$, $L(e) > 0$, where $0 < e < 1$.

Further assume that $L'(e) = k_1 e$, $I'(e) = k_2(e-1)$, where k_1 and k_2 are the slopes of MC_m and MC_n, respectively. By definition, if C_m is a monotonic increment function of e and C_n is a monotonic decrement function of e, then,

$$k_1 > 0, \quad k_2 > 0.$$

Note that $TC = C_m + C_n = L(e_i) + I(e_i)$,

The first order-condition for TC to achieve an extreme value is $L'(e) + I'(e) = 0$.

As $L'(e) = MC_m$, $-I'(e) = MC_n$, then $MC_m(e^*) = MC_n(e^*)$,

which means that in Figure 2 the crossing point $e*$ of the two marginal costs curves is the minimum value point of the governance costs.

The second-order condition for TC to achieve a minimum value at point $e*$ is $TC''(e^*) > 0$.

As $TC''(e) = L''(e) + I''(e) = k_1 + k_2 > 0$,

$e*$ is the minimum value point of the governance costs and also the equilibrium point of the governance structure.

Proof 2: A centralized governance structure has higher governance costs.

$$TC = C_m + C_n = L(e) + I(e) = \frac{1}{2}k_1 e^2 + \frac{1}{2}k_2(e-1)^2$$

$$I' + L' = 0 \iff k_2(e-1) + k_1 e = 0 \implies e^* = \frac{k_2}{k_1 + k_2}, \text{ then}$$

$$TC_{min} = \frac{1}{2}k_1 \left(\frac{k_2}{k_1 + k_2}\right)^2 + \frac{1}{2}k_2 \left(\frac{k_2}{k_1 + k_2} - 1\right)^2 = \frac{k_1 k_2}{2(k_1 + k_2)}.$$

Suppose that k_1 is a constant, as

$$\frac{dTC_{\min}}{dk_2} = \frac{k_1^2}{2(k_1 + k_2)^2} > 0.$$

If $k_2 \uparrow$, then $TC_{\min} \uparrow$,

Therefore, when $e_1 > e_2$, $TC(e_1) > TC(e_2)$, the governance costs increase as the degree of centralization of the governance structure increases.

Figure 3 implies that the governance costs are higher at e^* than at e'.

Proof 3: The characteristics of a centralized governance structure necessitate a self-strengthening mechanism.

Suppose that k_2 is a constant, as $\dfrac{dTC_{\min}}{dk_1} = \dfrac{k_2^2}{2(k_1 + k_2)^2} > 0$,

If $k_1 \uparrow$, then $TC_{\min} \uparrow$.

As a centralized governance structure leads to higher governance costs, the reduction of $TC_{\min}$ requires the reduction of k_1, that is, the marginal management costs curve must move

downwards. This leads $e^* = \dfrac{k_2}{k_1 + k_2}$ to increase, and thus the governance structure tends to

become more centralized. Figure 4 shows the adjustment process from e^* to e^{**}.

Once a centralized governance structure has been formed, it will tend to become more centralized to lower its governance costs. The degree of centralization that can be achieved depends on the environmental constraints.

We can also prove that a high degree of centralization is needed for a hierarchical structure to achieve the same governance costs as a flat structure.

As with k_1 and k_2, suppose that k_1' and k_2' are the slopes of MC_m' and MC_n',

$k_1' > 0, k_2' > 0$.

$TC_{\min}^B$ denotes the governance costs at e' in Figure 3, and $TC_{\min}^C$ the governance costs

at e^{**} in Figure 4.

If $TC_{\min}^C = TC_{\min}^B$, then

$$\frac{k_1' k_2}{2(k_1' + k_2)} = \frac{k_1 k_2'}{2(k_1 + k_2')} \Rightarrow k_1' = \frac{k_1 k_2 k_2'}{k_1 k_2 + k_2 k_2' - k_1 k_2'} = \frac{1}{\dfrac{1}{k_2'} + \dfrac{1}{k_1} - \dfrac{1}{k_2}}.$$

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In a hierarchical structure, $k_2 > k_1 \implies \dfrac{1}{k_1} - \dfrac{1}{k_2} > 0 \implies k_1' < k_2'$, which

means that the marginal management costs must be kept very low to achieve the same level of governance costs as would be achieved under a flat governance structure. Thus, if

$$e^{**} = \frac{k_2}{k_1' + k_2} \text{ , then}$$

$$k_2 \, \mathbf{f} \, k_2' \implies k_2 \, \mathbf{f} \, k_1' \implies e^{**} = \frac{k_2}{k_1' + k_2} = \frac{1}{\dfrac{k_1'}{k_2} + 1} \to 1.$$

We can further prove that as the degree of centralization increases, both the governance costs and the management costs tend to decrease, and the proportion of management costs in governance costs tends to rise.

In a flat structure, $k_2 > k_1$,

$$\frac{dC_m\left(e^*\right)}{dk_1} = \frac{k_2^{\,2}\left(k_2 - k_1\right)}{2\left(k_1 + k_2\right)^3} > 0,$$

If $k_1 \downarrow$, then $C_m\left(e^*\right)\downarrow$.

In an equilibrium structure, the ratio of management costs to governance costs is

$$\frac{C_m\left(e^*\right)}{TC_{\min}} = \frac{k_2}{k_1 + k_2},$$

Therefore, management costs make up the greater part of the governance costs, and

if $k_1 \downarrow$, then $\dfrac{C_m\left(e^*\right)}{TC_{\min}}\uparrow$.

Proof 4: Proof of the direction of movement of the equilibrium governance structure for modern Europe and contemporary China

The equilibrium governance structure $e^* = \dfrac{k_2}{k_1 + k_2}$.

For modern Europe, if $k_1 \downarrow$ and $k_2 \uparrow$, then $e^* = \dfrac{k_2}{k_1 + k_2} = \dfrac{1}{\dfrac{k_1}{k_2} + 1}\uparrow$,

which means that the equilibrium governance structure moves to greater degree of centralization.

For contemporary China, if $k_1 \uparrow$ and $k_2 \downarrow$, then $e^* = \dfrac{k_2}{k_1 + k_2} = \dfrac{1}{\dfrac{k_1}{k_2} + 1}\downarrow$,

which means that the equilibrium governance structure moves to lesser degree of centralization.