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Contemporary Social Sciences aims to present the most outstanding research and achievements in the field of social sciences in China. The scopes of research fields for consideration include, but not limited to political science, economics, literature, linguistics, journalism and communication, education, sociology, philosophy, history, law, and interdisciplinary research. *Contemporary Social Sciences* enhances the international discourse of China and seeks to promote communication and cooperation between scholars from China and the rest of the world.

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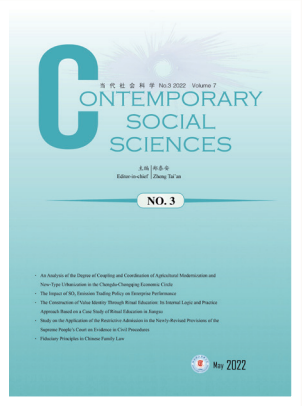

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E-mail: css1639@163.com
邮箱: css1639@163.com

Tel: (028) 61352442
办公室电话: (028) 61352442

Address: No. 155, West Section 1, First Ring Road, Qingyang District, Chengdu, Sichuan Province, China
地址: 中国四川省成都市青羊区一环路西一段155号

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An Analysis of the Degree of Coupling and Coordination of Agricultural Modernization and New-Type Urbanization in the Chengdu-Chongqing Economic Circle

Wu Xiaoxuan and Liu Hang*

Party School of Sichuan Committee of C.P.C

Abstract: Based on the panel data (2005-2019) of cities (prefectures) in the Chengdu-Chongqing Economic Circle, we have developed an evaluation system for agricultural modernization and new-type urbanization that measures the development level of each city and applies the coupling and coordination model to calculate their coupling and combination levels. The results indicate that the level of comprehensive order parameters of agricultural modernization in various cities (prefectures) in the Chengdu-Chongqing Economic Circle generally displays an upward trend. The areas with high-degree agricultural modernization were mainly distributed in Chengdu from 2005 to 2010, and the center of agricultural modernization was shifted to western areas after 2010, with a stable upward trend in the level of comprehensive order parameters of new-type urbanization. In terms of coupling degree, there was an overall upward trend. Except for Nanchong and Dazhou, other cities (prefectures) progressed from "Undeveloped Coordination" to "Intermediate Coordination." The imbalanced development of agricultural modernization and new-type urbanization continually improved, with the combination level increasing from "Low-Low" to "Medium-Medium."

Keywords: Chengdu-Chongqing, agricultural modernization, new-type urbanization, coupling and coordination

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* Wu Xiaoxuan, the Regional Economy Department, Party School of Sichuan Committee of C.P.C;
Liu Hang, the Regional Economy Department, Party School of Sichuan Committee of C.P.C.

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Correspondence concerning this article should be addressed to Wu Xiaoxuan, the Regional Economy Department, Party School of Sichuan Commitee of C.P.C, Chengdu, 610072, China. Email: 764908679@qq.com

Introduction

In March 2014, the *National New-Type Urbanization Plan (2014-2020)* was released, which proposed that China would uphold the path of new-type agricultural modernization with Chinese characteristics, and that "urbanization would serve as an important way to solve the issues relating to agriculture, rural areas, and rural residents." In *The 14th Five-Year Plan for Promoting Agricultural and Rural Modernization* issued by the State Council of the People's Republic of China, China would accelerate the construction of modern agriculture, strengthen the support of modern agricultural science and technology, optimize the modern rural industrial system, and boost the two-way flow of urban and rural elements, which would further clarify the importance of the coordinated development of agricultural modernization and new-type urbanization. On November 11, 2021, the Sixth Plenary Session of the 19th Central Committee of the Communist Party of China adopted the *Resolution of the Central Committee of the Communist Party of China on the Major Achievements and Historical Experience of the Party over the Past Century*, which emphasized promoting the construction of people-oriented new-type urbanization in economic construction and strengthening urban planning, construction, and governance. The Communist Party of China has always made issues relating to agriculture, rural areas, and rural residents a top priority. It has introduced rural revitalization strategies and accelerated the modernization of agriculture and rural areas… With all these efforts, the Chinese people can ensure the country's food security ("*Resolution of the Central Committee of the Communist Party of China on the Major Achievements and Historical Experience of the Party over the Past Century*," 2021, p 14). Therefore, to clarify the temporal and spatial characteristics and the coupling degree of agricultural modernization and new-type urbanization, as well as how to effectively coordinate their development, possesses great significance for the high-quality coordinated development of the agricultural industry and urbanization, the acceleration of the two-way flow of urban and rural elements, and the construction of new-type urban-rural relationships.

The connotation of agricultural modernization increasingly diversifies with technological, economic, and social innovation. Since the 18th National Congress of the Communist Party of China, China has vigorously integrated rural revitalization strategies with urban development to promote the construction of agricultural modernization, increase rural residents' income, and advance sustainable and high-quality agricultural development (Jiang, Lu & Zhang, 2019). Basically, the mainstream view on the definition and connotation of agricultural modernization centers on developing agriculture that accords with high-yield, high-quality, high-efficiency, ecological standards, and food security and takes into account science & technology, society, and the environment to narrow the gap between urban and rural areas and promote the all-round progress of rural areas and agriculture (Research group of "Research on the construction of agricultural modernization evaluation index system," Zhang & Xia, 2012). Relevant domestic studies discuss agricultural modernization from different aspects on the basis of measuring the level of agricultural modernization from different dimensions.

Lu Yilong (2018) explored the existing problems of agricultural modernization from the perspective of rural revitalization. Lou Yuhua (2019) confirmed the driving effect of industrialization on agricultural modernization by applying the system dynamics model. An Xiaoning (2020) constructed an index system to measure the agricultural modernization system, revealing that the development of agricultural modernization in China is making remarkable progress, yet regional imbalances seem prominent. Luo Qianfeng (2021) examined the path to achieve agricultural modernization from the perspective of three systems: element allocation, structural optimization, and functional expansion. In terms of relevant foreign studies, M. A. Altieri (1997) verified the promoting role of agricultural modernization and biological control, which demonstrated the support of modernization for sustainable development. G. Bahiigwa (2005) researched the role of agricultural modernization in poverty alleviation in Uganda. T. Garnett (2013) investigated the role of agricultural modernization in rural economic development and sustainable development. Hilde Bjørkhaug (2018) scrutinized the connection between farm modernization and rural development and resilience, as well as the path to achieve agricultural modernization.

Urbanization means a socio-economic evolution that involves various aspects (Zhang, 2013). Meanwhile, with urbanization comes the problem of urban-rural imbalance, i.e., the imbalanced development of urbanization, industry, and agriculture (Leng, 2016). In terms of urbanization, many foreign scholars concentrated on the impact of urbanization on the environment and climate (Kalnay, Cai, et al., 2003; Mckinney, 2002a, 2002b, 2006), and the optimization of spatial layouts after urbanization (Lehrer & Schooley, 2010). Domestic scholars considered new-type urbanization from multiple approaches. Wen Ting (2021) took the Yangtze River Economic Belt as a research topic and probed the impact of the agglomeration of the logistics industry on new-type urbanization. Lyu Ping (2021) emphasized the perspective of rural revitalization and analyzed the temporal and spatial evolution characteristics of the coordinated development of new-type urbanization and rural revitalization in China. Zhu Yuanyuan (2021) started from the coordinated development of food security and new-type urbanization, and quantitatively discussed the influential elements of the coordinated development of the two systems.

Agricultural modernization and new-type urbanization are practical ways to coordinate the integrated development of urban and rural areas and implement the rural revitalization strategies for people-centered urbanization development. In terms of the relationship between agricultural modernization and new-type urbanization, relevant studies have measured it from different scales. In relevant foreign studies, M. Tiffen (2003) analyzed the relationships between agriculture, urbanization, and income growth, and obtained mixed results. St. Hilaire (2016) studied the role of water quality in urbanization and agriculture. D. Elias (2014) explored the impact of agricultural science and technology and informatization on urbanization in Brazil. K. Palanisamy (2016) focused on the sustainability of urbanization and agricultural development. Drebold (2017) elaborated on the relationship between rapid urbanization and food security. Adriana Allen (2014) demonstrates that urban agriculture allows for environmental sustainability and fair urbanization in Accra. In terms of relevant research on domestic

scholars, Ma Yuan (2010) revealed that urbanization, agricultural modernization, and industrial-structure adjustments form a long-term balanced relationship and promote each other. Zhou Zhanqiang (2012) discovered that industrialization and urbanization have a significant impact on agricultural modernization. Cheng Li et al. (2013) concluded that the development of agricultural modernization, including the improvement of the level of agricultural mechanization and the optimization of agricultural structure, helps to narrow the income gap between urban and rural areas. Xin Ling (2016) proved that presently, the matching degree of agricultural modernization and urbanization remains low, and that their coordinated development centers on fostering agricultural modernization. Zhang Bosheng (2020) observed that the coupling and coordination of urban-rural coordinated development and rural poverty governance develop in a favorable and interactive way. Liu Heng (2021) expounded that the imbalance of the coupling and coordinated development of agricultural modernization and urban-rural integration slows down year by year and presents the distribution characteristics of "high-level in the east and low-level in the southwest." Jiang Zhengyun (2021) measured the central region, as well as agricultural modernization and new-type urbanization in different provinces (Wen, Li, Zhou, Lu, Zhang & Zhao, 2020), concluding that in spite of the fact that the development of agricultural modernization does not keep pace with that of new-type urbanization, the coupling degree tends to be continuously optimized. Thus, it can be safely stated that the theoretical connotation and level measurement of agricultural modernization and new-type urbanization have been studied to varying degrees, and the results indicate that agricultural modernization and new-type urbanization promote each other, yet they can be improved.

The Chengdu-Chongqing Economic Circle is a key area for China to promote the construction of new-type urbanization and an important layout for China to advance regional development. The construction of the Chengdu-Chongqing Economic Circle not only plays an irreplaceable leading role in the development of Western China and the nearby urbanization of more than 100 million people, but also provides a beneficial exploration of the model of new-type urbanization in Western China. In Western China, the Chengdu-Chongqing Economic Circle boasts the highest level of urbanization. With great development potential, the Chengdu-Chongqing Economic Circle is an integral part of the development of the Yangtze River Economic Belt and the Belt and Road Initiative. Giving consideration of the achievements and shortcomings of the existing literature, we proceeded from the perspective of new-type urbanization and agricultural modernization and took the Chengdu-Chongqing Economic Circle as the research object, measured the synergistic effect between them using the coupling and coordination model, and analyzed the mechanism between them to provide empirical support for promoting the development of agricultural modernization and the construction of new-type urbanization.

The Mechanism of the Coupling and Coordination Model

According to the existing literature and policies, the agricultural modernization index system

we used for our analysis consists of comprehensive agricultural production capacity, sustainable agricultural development capacity, and agricultural mechanization which aims to improve the quality of agricultural and rural development. New-type urbanization highlights the integrated development of population, industry, economy, society, space, and environment (Wang, Tian & Qin, 2020).

On the one hand, agricultural modernization has actively promoted the rapid development of new-type urbanization. First, the promotion of agricultural modernization will gradually enhance the mechanization and informatization of agricultural production, enormously improve the production efficiency of the primary industry, raise the living standards of rural residents, continuously provide a market for the flow of urban resources and provide a micro-economic foundation for the promotion of urbanization. Therefore, the significance of vigorously promoting agricultural modernization lies not only in rural development, but also in the cornerstone of urbanization (Shen, 2013). Second, the development of agricultural modernization provides more high-quality resources (e.g., high-quality agricultural and sideline products) and various high-quality raw materials and processed products for urban construction. Finally, agricultural modernization liberates the agricultural surplus labor force, provides rich labor resources for the development of urbanization, accelerates the flow of high-quality people to cities and towns, and creates a talent pool for the construction and development of urbanization. On the other hand, with the development of agricultural modernization, the development of new-type urbanization faces pressure to some degree. As more rural laborers flow into the cities, the speed of urban development slows. As a result, the pressure of urbanization-construction remains high (Niu and Long, 2020). Owing to the vulnerability of agriculture, the industry needs a great deal of capital investment and talent support, which depletes the funds and talents available for urbanization, yet construction of new-type urbanization also promotes the development of agricultural modernization. The advancement of urbanization provides not only financial, technological, and talent support for agricultural and rural modernization, but also the market to absorb the achievements of agricultural modernization. First, the large amount of funds that is accumulated in cities and towns will be invested into agricultural production, which quickens the operation of large-scale agricultural projects, facilitates the intensive and large-scale development of agricultural production, and expedites the reform of agricultural production models (Zhu, 2020). Second, cities provide technological and talent support for agricultural modernization. Advanced technologies and equipment in cities and towns are applied to agriculture and rural areas, which raises production efficiency and effectively boosts the development of agricultural mechanization and informatization (Ju, 2016). Third, cities provide necessary consumer markets for agricultural products, create conditions for land transfers, ameliorate rural infrastructure and life and improve the levels of rural construction. Simultaneously, in the development of urbanization, with unique advantages, cities expand into rural land and attract the rural labor force, talents, and other resources, which results in a shortage of labor available for agricultural production. Moreover, rural residents often lack the knowledge of and enthusiasm for new-type agriculture, which probably weakens the popularity of new-type agriculture and impedes the overall process of agricultural modernization (He, 2017).

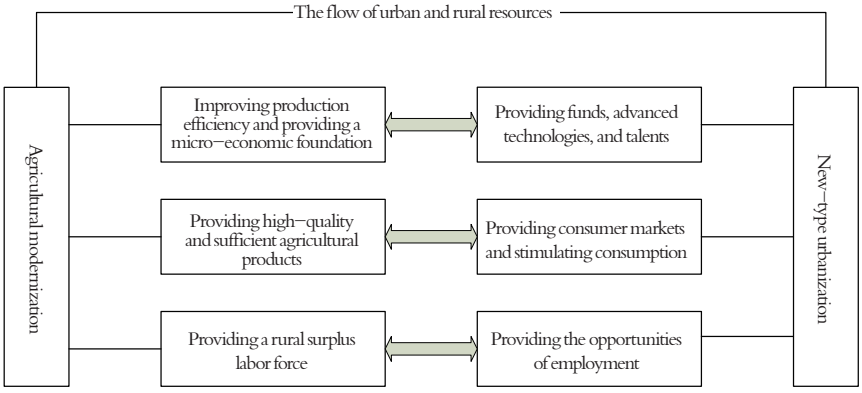

Figure 1 The mechanism of the coupling and coordination of agricultural modernization and new-type urbanization

Under the traditional dualistic structure, cities and rural areas separately take different paths of modernization, which gives rise to the gradual decline of rural areas and the rapid expansion of urbanization (Yang, 2021). The connotation of agricultural modernization in China, however, is to give consideration to efficiency and sustainable development, as the integration and optimization of rural resources are coordinated with urbanization. New-type urbanization is not meant to develop cities and towns one-sidedly, but the balanced and coordinated development of cities and rural areas (Gao, 2020). As the existing literature and data suggest, agricultural modernization and new-type urbanization are interdependent and interrelated.

Index Construction and Data Sources

Index Construction

In terms of agricultural modernization, we combined the practices of Wen Feng (2020) and Liu Heng (2021) considered the availability of various data and the representativeness of agricultural modernization, selected the following indexes for quantitative calculation, and constructed a three-layered system: agricultural comprehensive production capacity, agricultural sustainable development capacity, and agricultural mechanization. Agricultural comprehensive production capacity includes rural per capita disposable income, agricultural sustainable development capacity includes the pesticide amount per unit of cultivated land, and agricultural mechanization includes the total power of agricultural machinery per unit of cultivated land (see Table 1).

In terms of new-type urbanization, we followed the practice of Jiang Zhengyun (2021), and divided new-type urbanization into six dimensions (i.e. population urbanization, industrial urbanization, economic urbanization, social urbanization, spatial urbanization, and environmental urbanization) to construct the evaluation indexes of development. Specifically, population urbanization

includes the urbanization rate and population density of permanent residents, industrial urbanization includes the density of the secondary and tertiary industries, per capita GDP and others, economic urbanization includes the average wage of urban employees, the per capita disposable income of urban residents and others, social urbanization includes per capita education funds, hospital beds per 10,000 people and others, spatial urbanization includes the proportion of construction land, per capita urban road area and others, and environmental urbanization includes urban sewage treatment rate, urban household waste treatment rate and others (see Table 2).

Table 1 Index System of Agricultural Modernization

System layer	Index layer	Attribute	Unit	Weight
Agricultural comprehensive production capacity	Agricultural per capita productivity	+	10,000 / Person	8.89%
	Agricultural land productivity	+	100,000 Yuan / Hectare	8.92%
	Rural per capita disposable income	+	*Yuan*	8.76%
Agricultural sustainable development capacity	Average application amount of agricultural mulching film	-	10 Tons / Hectare	9.24%
	Average application amount of pesticide	-	10 Tons / Hectare	9.23%
	Average application amount of diesel	-	10 Tons / Hectare	9.36%
	Average application amount of fertilizer	-	10 Tons / Hectare	9.23%
Agricultural mechanization	Rural power consumption intensity	+	100,000 kWh / Hectare	8.94%
	The proportion of effective irrigation area	+	%	9.14%
	Tillage rate	+	%	9.16%
	The total power of average agricultural machinery	+	10kW / Hectare	9.13%

Table 2 Index System of New-Type Urbanization

System layer	Index layer	Attribute	Unit	Weight
Population urbanization	Urbanization rate of permanent residents	+	%	4.78%
	Population density	+	Person / km^2	4.67%
Industrial urbanization	The secondary industry density	+	10,000 *Yuan* / km^2	4.40%
	The tertiary industry density	+	10,000 *Yuan* / km^2	4.00%
	Unit land output value	+	100 million *Yuan* / km^2	4.72%
	Per capita GDP	+	*Yuan* / Person	4.57%
Economic urbanization	Average wage of employees in urban units	+	*Yuan* / Person	4.58%
	Per capita disposable income of urban residents	+	*Yuan* / Person	4.62%
	Urban consumer price index	-	%	4.88%
	Registered urban unemployment rate	-	%	4.79%
	Total retail sales of social consumer goods per capita	+	*Yuan* / Person	4.50%
Social urbanization	Per capita education expenditure	+	*Yuan* / Person	4.52%
	Hospital beds per 10,000 people	+	Beds/ 10,000 People	4.68%
	Mobile phone users	+	10,000 Households	3.98%
	The number of doctors per 10,000 people	+	Doctors/10,000 People	4.61%
	Buses for every 10,000 people in the urban area	+	Buses/10,000 People	4.51%

System layer	Index layer	Attribute	Unit	Weight
Spatial urbanization	The proportion of construction land	+	%	4.03%
	Urban road area per capita	+	m^2 / Person	4.52%
	urban area per capita	+	m^2 / Person	4.25%
Environmental urbanization	Urban sewage treatment rate	+	%	4.82%
	Urban house waste treatment rate	+	%	4.87%
	Urban green space area per capita	+	m^2	4.71%

Data Sources

Given the availability of data, the index data we used for our analysis came from *Sichuan Statistical Yearbook* and *Chongqing Statistical Yearbook* from 2005 to 2020. As some data were missing for several years, we used a moving weighted average to estimate the missing values to reduce the biased error of the evaluation results caused by the missing data.

Research Methods

Entropy Value Method

Data standardization.

As the units of the selected indexes vary, we nondimensionalized them rather than compare them directly. Suppose a_{ij} stands for the actual value of the j index in the year.

Positive Index: $$b_{ij} = \frac{a_{ij} - a_{j\min}}{a_{j\max} - a_{j\min}} \quad (1)$$

Negative Index: $$b_{ij} = \frac{a_{j\max} - a_{ij}}{a_{j\max} - a_{j\min}} \quad (2)$$

In particular, b_{ij} stands for the standardized value of the j index in the i year, and a_{jmax} and a_{jmin} stand for the maximum and minimum values of the index, respectively.

Determining the weights.

The entropy value method refers to the method that determines the weights in multi-objective comprehensive decision-making. Entropy determines the weight by defining entropy, which is based on the dispersion degree of an index. A greater dispersion degree denotes a greater impact on the index of comprehensive evaluation and greater weight. Accordingly, we used the entropy value method to calculate the weight of each index to provide a basis for multi-objective comprehensive evaluation.

Suppose that there are m indexes and n years to be evaluated; the specific calculation steps are as follows.

$$h_j = -k\sum_{i=1}^{n} p_{ij} \ln p_{ij} \quad (3)$$

In particular, $p_{ij} = \frac{b_{ij}}{\sum_{i=1}^{n} b_{ij}}$, $k = \frac{1}{\ln n}$,

h_j stands for the entropy of the j index, n stands for the number of states the system may be in, and p_{ij} stands for the probability of a certain state of the system.

After the entropy value of each index is obtained, the weight of each index can be calculated.

$$w_j = \frac{1 - h_j}{m - \sum_{j=1}^{m} h_j} \quad (4)$$

In particular, w_j stands for the weight of the j index.

Index calculation method.

The calculation method of the agricultural modernization index and new-type urbanization index is as follows:

$$F_i = \sum_{j=1}^{m} w_j b_{ij} \quad (5)$$

In particular, F_i stands for the comprehensive order parameter of agricultural modernization or new-type urbanization in the i year.

The Coupling and Coordination Degree Model

To quantitatively measure the relationship between agricultural modernization and new-type urbanization in a more accurate way, we followed the idea that Xue Lei et al. (2019) introduced in their coupling and coordination degree model and divided the coupling and coordination degree into ten levels. Afterwards, to present the coupling and coordination degree of agricultural modernization and new-type urbanization in a more intuitive way, we categorized them into five types in line with the kernel density distribution of agricultural modernization and new-type urbanization (Figure 1 and Figure 3). Additionally, we followed the practice of Cui Xuegang (2018) and Liu Heng (2021) and specified the combination level of agricultural modernization and new-type urbanization. There are five combination levels, i.e., high agricultural modernization & high new-type urbanization (high-high), high agricultural modernization and low new-type urbanization (high-low), medium agricultural modernization and medium new-type urbanization (medium-medium), low agricultural modernization and high new-type urbanization (low-high) and low agricultural modernization and low new-type urbanization (low-low).

The measurement methods of the coupling degree (C), the development degree (T) and the coordination degree (D) are as follows:

$$C = \frac{\sqrt{MOD_i \cdot URB_i}}{(MOD_i + URB_i)/2} \quad (6)$$

$$T = \alpha MOD_i + \beta URB_i \quad (7)$$

$$D = \sqrt{C \cdot T} \quad (8)$$

In particular, MOD_i and URB_i are the comprehensive order parameters of agricultural modernization and new-type urbanization, respectively, and α and β are undetermined parameters, both of which are taken as 0.5.

Empirical Analysis

The Temporal and Spatial Evolution of the Agricultural Modernization Index in the Chengdu-Chongqing Economic Circle

Temporally, the level of agricultural modernization in the Chengdu-Chongqing Economic Circle displayed an upward trend from 2005 to 2019. The standard deviation of each city was maintained at less than 0.1, and the range was roughly maintained between 0.20 to 0.27. From 2005 to 2014, the range demonstrated an expanding trend, increasing from 0.2019 to 0.2622. From 2014 to 2016, the range presented a downward trend, decreasing to 0.1842 in 2016. From 2016 to 2019, the range enlarged again. In terms of the comprehensive order parameter of agricultural modernization, the maximum value appeared in Chengdu and Ya'an, and the minimum value appeared in Meishan, Zigong and Chongqing. In terms of fluctuation, it mainly occurred in Sichuan province in 2010, and the agricultural modernization index of each city declined to varying degrees. Twelve cities, including Chengdu, Neijiang, and Leshan, sank to their lowest levels since 2005. The most likely reason was the severe drought in Southwest China from the autumn of 2009 to the spring of 2010. Such a drought was rarely seen in the previous 50 years either in the duration, stricken area, or the reduction of precipitation. Extreme climate has a great impact on agricultural output, and comprehensive agricultural production capacity functions as an important index to measure agricultural modernization. Therefore, the level of agricultural modernization in the Chengdu-Chongqing Economic Circle dropped sharply in 2010. Due to the vulnerability of agriculture, it rose in 2011, yet failed to reach the levels of 2009. In addition to the fluctuation in 2010, only Chengdu and Meishan maintained an upward trend in 2018, while other cities decreased to varying degrees over 2017. Particularly, in Leshan and Ziyang, the level decreased by 11.50 percent and 10.41 percent, respectively. In Ya'an, it decreased significantly by 21.42 percent in 2018, to the lowest level of 0.4731 since 2005, yet it increased remarkably by 46.52 percent, to the highest level

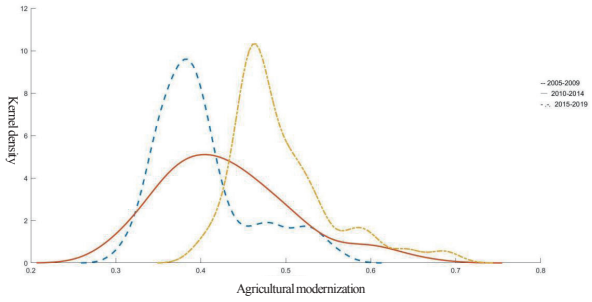

Figure 2 The kernel density of agricultural modernization

of 0.6932 in 2019. In Chongqing, the agricultural modernization index increased by an average rate of 2.04 percent over the years, except that it decreased by 1.64 percent in 2006. The main reason why the agricultural modernization index of Chongqing was lower than those of cities in Sichuan was that the cultivated land area of Chongqing was larger. The cultivated land area of Chongqing was 9.78 times that of Chengdu in 2005, and around 6.4 times that of Chengdu in 2019, while other indexes of total volume did not reach the level.

Spatially, Chengdu and Ya'an maintained high levels in the agricultural modernization index in the Chengdu-Chongqing Economic Circle. Noticeably, from 2005 to 2010, the phenomenon of polarization occurred in the Chengdu-Chongqing Economic Circle. Chengdu embodied high-level agricultural modernization. Cities (e.g., Ziyang and Leshan) that adjoined Chengdu and Chongqing developed well, whereas cities (e.g., Zigong and Meishan) that are far from Chengdu and Chongqing developed slowly. From 2010 to 2019, as China gradually entered the late stage of industrialization (Huang, 2021), the level of agricultural modernization in Western China increased year by year. The average level of the Chengdu-Chongqing Economic Circle increased from 0.3937 in 2005 to 0.5480 in

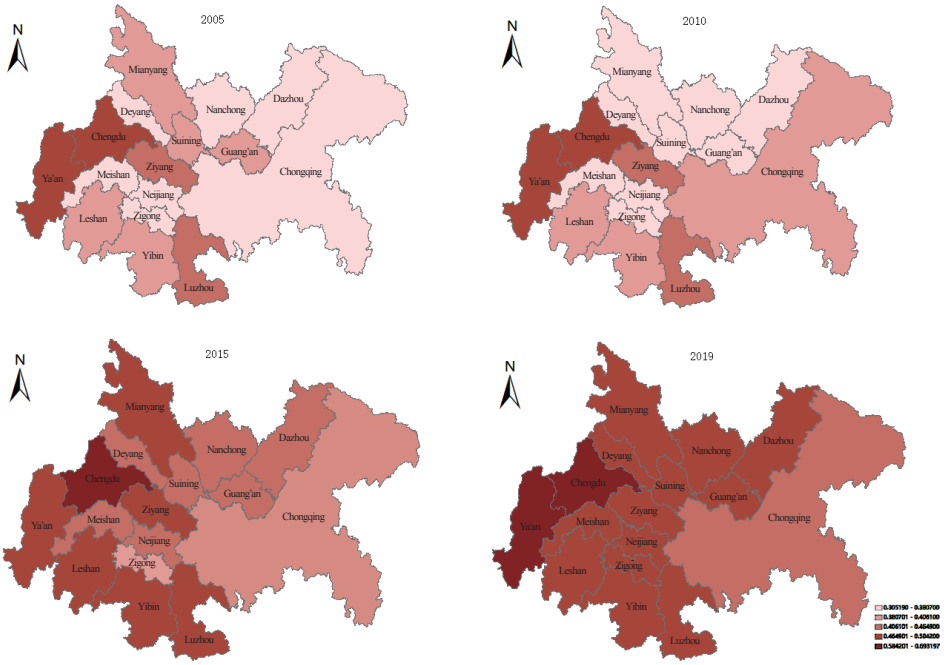

Figure 3 The spatial evolution of agricultural modernization in the Chengdu-Chongqing Economic Circle in representative years
Note: The underlying-map data come from National Catalogue Service for Geographic Information, 1:1,000,000 Public-Version Basic Geographic Information Data (2021).

2019, with the landscape of agricultural modernization developing in a balanced way.

The Temporal and Spatial Evolution of the New-Type Urbanization Index in the Chengdu-Chongqing Economic Circle

Temporally, the level of new-type urbanization in the Chengdu-Chongqing Economic Circle basically displayed a steady upward trend from 2005 to 2019, with an average annual growth rate of *c.* 6.96 percent and an average standard deviation of *c.* 0.094. The range increased from 0.2047 in 2005 to 0.3486 in 2019, demonstrating an enlarging trend and indicating the larger gaps in urbanization levels in various cities. The maximum value of the new-type urbanization index appeared in Chengdu and Chongqing. The minimum value appeared in Suining in 2005, Neijiang in 2006–2008, Nanchong in 2009–2012 (the development of the new-type urbanization there lagged behind), and Dazhou in 2014–2019. In Sichuan province, Chengdu kept far ahead of all other cities in the new-type urbanization level and achieved stable growth from 0.3520 in 2005 to 0.7880 in 2019. Chengdu also enjoyed the highest urbanization level or index in the Chengdu-Chongqing Economic Circle. Urbanization in other cities developed at the same level. In 2006, the level in Guang'an, Luzhou, and Zigong declined. In 2014, the level in Dazhou decreased by 7.44 percent. In other years, all cities basically actualized steady increases, and the average urbanization level increased from 0.2071 to 0.5101. Chongqing realized an average growth rate of 8.89 percent from 2005 to 2019, from 0.1852 to 0.6017. In 2019, Chongqing ranked second in the level of the new-type urbanization in the Chengdu-Chongqing Economic Circle.

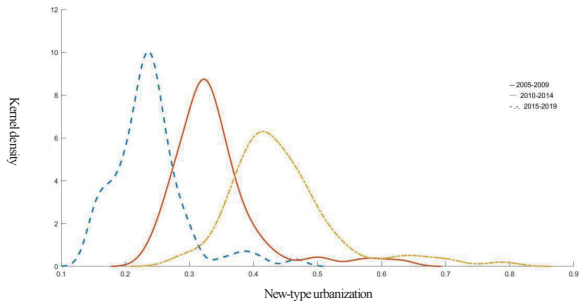

Figure 4 The kernel density of new-type urbanization

Spatially, from 2005 to 2010, the spatial distribution patterns of the new-type urbanization and agricultural modernization in the Chengdu-Chongqing Economic Circle were similar. From 2010 to 2019, compared with the pattern of agricultural modernization, the bipolar-driven trend of the new-type urbanization became more obvious, with the role of polarization and dispersion more prominent. On the one hand, owing to complete infrastructure and high-degree industrial agglomeration, Chengdu and Chongqing gradually forged economies of scale under the effect of polarization. Meanwhile, this affected the surrounding areas, Meishan and Dazhou, to some extent. On the other hand, the phenomenon of dispersion played an increasingly important role. The surrounding areas of Chengdu and Chongqing, such as Ziyang, Deyang, and Guang'an, acquired elements such as capital and talent from the central cities, which stimulated and promoted the development of urbanization. Besides, the urbanization of cities like Nanchong, which stand in between and stay far from two the poles of Chengdu and Chongqing, developed slowly.

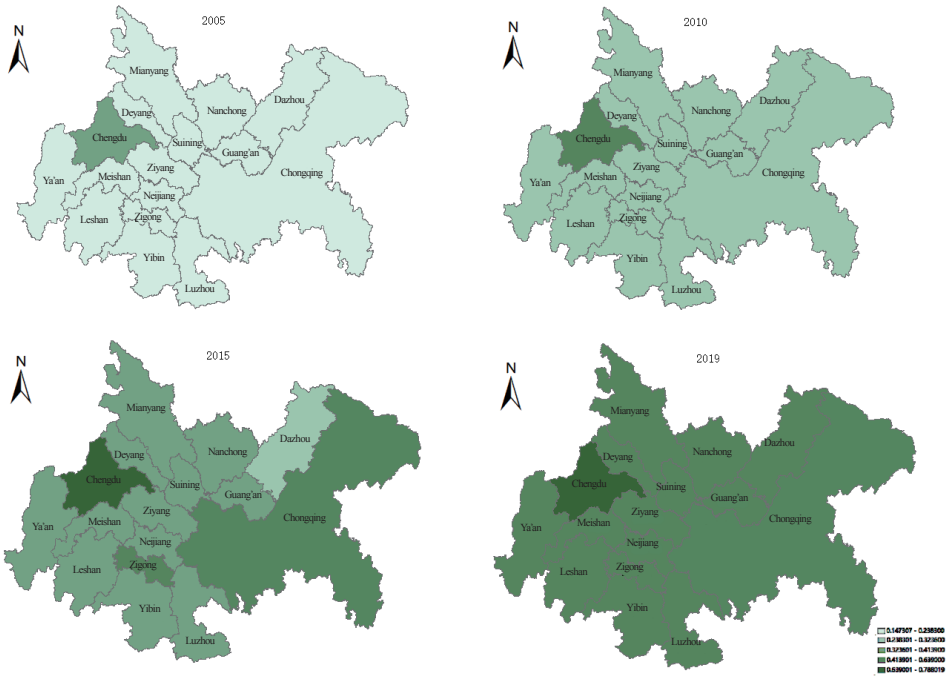

Figure 5 The spatial evolution of new-type urbanization in the Chengdu-Chongqing Economic Circle in representative years
Note: The underlying-map data come from National Catalogue Service for Geographic Information, 1:1,000,000 Public-Version Basic Geographic Information Data (2021).

The Analysis of the Coupling Degree or Level in the Chengdu-Chongqing Economic Circle

Regarding the coupling degree of agricultural modernization and the new-type urbanization, there was a high-degree of coordination in the Chengdu-Chongqing Economic Circle, with only small-scale fluctuations. From 2005 to 2019, the average value was 0.9812, the lowest value was 0.8903 (in Suining in 2005), and the value in other cities was above 0.9. The coupling degree of most cities in Sichuan province realized relatively stable growth. The coupling degrees of Suining in 2005 and 2006 were relatively lower than those in other cities. However, there was an obvious increase in 2007. The main reason was because the degree of the new-type urbanization in Suining remained low in 2005 and 2006, while the degree of agricultural modernization did not match it, resulting in a low-degree of coordination between them. Likewise, the coordination degree of Ya'an before 2016 was low, mainly because the degree of agricultural modernization remained high and the level of the early-stage new-type urbanization proved relatively slow, resulting in dissatisfactory coordination between agricultural modernization and the new-type urbanization. Chongqing maintained a high-degree of coupling, with agricultural modernization and the new-type urbanization being both complementary and coordinated.

The Analysis on the Degree or Level of Coupling and Coordination in the Chengdu-Chongqing Economic Circle

Temporally, from 2005 to 2019, the degree of coupling and coordination of agricultural modernization

and the new-type urbanization in the Chengdu-Chongqing Economic Circle presented an upward trend. Most cities progressed from undeveloped coordination to intermediate coordination, and the imbalanced development of agricultural modernization and the new-type urbanization continued to decrease (Table 3). After 2005, the evolutive process of the degree of coupling and coordination of agricultural modernization and the new-type urbanization can be roughly divided into three stages. The first stage, or the initial stage, started in 2004 and ended in 2008. In 2005, 70.5 percent of the cities had undeveloped coordination, and four cities, i.e., Neijiang, Nanchong, Yibin, and Suining remained on the verge of imbalance. With the development of agricultural modernization and the new-type urbanization, the number of areas on the verge of imbalance decreased year by year. In 2007, only Neijiang and Nanchong had a below 0.5 degree of coupling and coordination. In 2008, the degree of coupling and coordination in all cities in the Chengdu-Chongqing Economic Circle had undeveloped coordination or above. The second stage, or the coordinated-development stage, started in 2009 and ended in 2015. The degree of coupling and coordination in all cities remained undeveloped coordination or above. Chengdu achieved intermediate coordination in 2009, and Luzhou, Ziyang, Ya'an and Chongqing realized primary coordination in 2011. In 2012, the areas with primary coordination accounted for 75 percent, and the proportion increased year by year. In 2013 and 2014, it reached 75 percent and 87.5 percent, respectively. In 2015, only Dazhou stayed at undeveloped coordination in the degree of coupling and coordination. Other cities achieved primary coordination or above, and Chengdu basically realized intermediate coordination at the second stage. The third stage, or the fast-advancement stage, started in 2016 and ended in 2019. In 2016, all cities actualized primary coordination in the level of coordination. Chengdu achieved good coordination in 2017 and maintained it until 2019. Chongqing achieved intermediate coordination in 2018 and maintained it until 2019. In 2019, there were two cities with primary coordination, i.e., Nanchong and Dazhou, and there were 13 cities with intermediate coordination, accounting for 81.2 percent. Spatially, from 2005 to 2019, the degree of coupling and coordination of cities in the Chengdu-Chongqing Economic Circle was generally similar to the spatial distribution pattern of new-type urbanization, with the characteristics of the bipolar-driving of Chengdu and Chongqing and the progressive decrease in in-between cities. Chengdu and Chongqing, as important cities in Southwest China, own relatively complete and developed industrialization systems and neighbor each other. Due to the siphon effect, Chengdu and Chongqing attract various elements in the surrounding areas like two poles, and in-between cities develop slowly.

Regarding the combination levels, in 2005, the low-low combination level of agricultural modernization and the new-type urbanization in cities in the Chengdu-Chongqing Economic Circle reached 76.4 percent, and the degree of coupling and coordination in these cities stayed at undeveloped coordination or below. With the regulation and control of national regional-development strategy and the continuous advancement of industrialization and urbanization, the year 2010 saw the stage of undeveloped coordination, yet the proportion of low-low combination remained as high as 70.5 percent. In 2015, only Meishan stayed in a low-low combination, and the proportion of medium-medium combination reached 47 percent. In 2019, the proportion of medium-medium combination increased to 64.7 percent, and the low-low combination disappeared. Under the regulation and control

of regional-development policy, on the one hand, the index or level of agricultural modernization and the new-type urbanization increased year by year. The two indexes or levels in 2019 were basically higher than before, so the degree of coupling and coordination was also the highest. However, the development speed of agricultural modernization and the new-type urbanization in these cities varied. In particular, from 2015 to 2019, the crux of the agricultural-modernization index or level shifted to the west, yet the new-type-urbanization index or level remained in the bipolar-driven trend. On the other hand, before 2015, the agricultural-modernization level of most cities in the Chengdu-Chongqing Economic Circle was slightly higher than the new-type-urbanization level. After 2015, as the degree of industrialization matured, the new-type-urbanization level proved higher than the agricultural-modernization level, which led to the imbalance or low-value structure of the combination level.

In terms of the ranking of the degree of coupling and coordination, Chengdu holds a safe lead over other cities in Sichuan province. Excluding Chengdu, the top three cities in the degree of coupling and coordination are Ya'an, Deyang, and Yibin. Deyang and Ya'an are adjacent to Chengdu, while Yibin is far away from Chengdu. The last three cities are Meishan, Suining and Nanchong. Meishan is close to Chengdu, while Suining and Nanchong are far away from Chengdu. In the ranking of the degree of coupling and coordination, Chongqing comes after Chengdu, and cities near Chongqing remain slightly lower than those near Chengdu. As the above research suggests, the interaction between agricultural modernization and the new-type urbanization demonstrates itself more obviously in the central cities. Owing to the polarization effect, the areas with relatively hysteretic interactions are distributed in Dazhou and Meishan. Because of the dispersion effect, the interactions in Deyang and Ya'an (near Chengdu) are also obvious.

Table 3 The Degree of Coupling and Coordination of Agricultural Modernization and the New-Type Urbanization in the Chengdu-Chongqing Economic Circle

Cities	2005		2010		2015		2019	
	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination
Chengdu	Medium-Low	Undeveloped coordination	Medium-Medium	Primary coordination	High-High	Intermediate coordination	High-High	Good coordination
Zigong	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Low-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Luzhou	Low-Low	Undeveloped coordination	Medium-Low	Undeveloped coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Deyang	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	High-Medium	Intermediate coordination
Mianyang	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Suining	Low-Low	On the verge of imbalance	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Neijiang	Low-Low	On the verge of imbalance	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Leshan	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	High-Medium	Intermediate coordination

Cities	2005		2010		2015		2019	
	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination	Combination Level	The Degree of Coupling and Coordination
Nanchong	Low-Low	On the verge of imbalance	Low-Low	Undeveloped coordination	Medium-Low	Primary coordination	Medium-Medium	Primary coordination
Meishan	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Low-Low	Primary coordination	Medium-Medium	Intermediate coordination
Yibin	Low-Low	On the verge of imbalance	Low-Low	Undeveloped coordination	Medium-Low	Primary coordination	Medium-Medium	Intermediate coordination
Guang'an	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Dazhou	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Medium-Low	Undeveloped coordination	Medium-Medium	Primary coordination
Ya'an	Medium-Low	Undeveloped coordination	Medium-Low	Primary coordination	High-Low	Primary coordination	High-Medium	Intermediate coordination
Ziyang	Medium-Low	Undeveloped coordination	Medium-Low	Primary coordination	Medium-Medium	Primary coordination	Medium-Medium	Intermediate coordination
Chongqing	Low-Low	Undeveloped coordination	Low-Low	Undeveloped coordination	Low-Medium	Primary coordination	Medium-High	Intermediate coordination

Conclusion and Policy-Related Suggestions

We constructed an index system that can comprehensively measure agricultural modernization and the new-type urbanization. Based on the coupling degree and the coupling and coordination degree model, we calculated and analyzed the levels and coupling and coordination degrees of agricultural modernization and the new-type urbanization in the Chengdu-Chongqing Economic Circle from 2005 to 2019. The results evince that: (a) from 2005 to 2019, the comprehensive index of agricultural modernization in the Chengdu-Chongqing Economic Circle basically kept rising, and the average value increased from 0.394 in 2005 to 0.548 in 2019. In 2019, Chengdu boasted the highest development level, reaching 0.693; (b) from 2005 to 2019, the comprehensive index of the new-type urbanization in the Chengdu-Chongqing Economic Circle increased at an average rate of 6.96 percent, with faster development speed (the average value rising from 0.207 to 0.510). In 2019, Chengdu embodied the highest development level, reaching 0.788, and Dazhou owned the lowest development level, only reaching 0.439; and (c) from 2005 to 2019, the degree of coupling and coordination of agricultural modernization and the new-type urbanization in the Chengdu-Chongqing Economic Circle increased from 0.531 to 0.727 on average, with a stable growth rate and a remarkable improvement in coordinated development. In 2019, the highest and lowest levels of coordinated development were 0.855 in Chengdu and 0.687 in Dazhou, respectively. The combination level also increased from low-low to medium-medium.

In order to improve the coordinated development level of the new-type urbanization and

agricultural modernization and realize the high-quality development of the regional economy, the Chengdu-Chongqing Economic Circle should not only vigorously promote the construction of people-oriented new-type urbanization and raise the comprehensive level of urbanization, but also painstakingly develop modern agriculture with Chinese characteristics, consolidate and expand the achievements of poverty alleviation, effectively connect it with rural revitalization, comprehensively foster rural revitalization and strengthen the level of agricultural modernization. In line with the above-stated theoretical and empirical analyses, as well as the socio-economic development characteristics of the Chengdu-Chongqing Economic Circle, we propose three policy-related suggestions:

1. While consolidating their own advantages, cities with high-level agricultural modernization and the new-type urbanization should scientifically formulate regional planning, prioritize the optimization of urban spatial structure and the transformation of the urbanization model (intensive model), and fully tap and utilize resources. In metropolises with large market demands like Chengdu and Chongqing, the quality of similar domestic products, e.g., high-quality milk, vegetables and fruits, cannot meet the market demand for quality. It is an urgent task to deepen the agricultural supply-side reform and produce and provide high-quality products that people desire. Areas with higher urbanization levels can use their advantage to make the output products meet the needs of consumers in quality and quantity and reduce their dependence on foreign seeds and productive machines through the innovation of agricultural products and agricultural production models.

2. Cities with relatively backward agricultural modernization and the new-type urbanization should attach attention to accelerating the construction of rural and urban infrastructure and social security systems. They should reinforce the population absorbing and carrying capacity of cities and towns, seize the opportunity of the national strategy of the Chengdu-Chongqing Economic Circle, fulfil the task of industrial undertaking, and transfer of Chengdu and Chongqing, facilitate the development of characteristic industries (for example, characteristic agricultural products in Meishan and the wine industry in Luzhou), and forge industrial agglomerations and economies of scale. Simultaneously, they should further expand rural collective economies, effectively protect the interests of rural residents, grasp the strategic opportunity of rural revitalization, tap the potential of regional development, and invest agricultural support financial funds into key fields like small and medium-sized infrastructure that can directly benefit rural residents, and enhance the endogenous driving force of agricultural and rural modernization.

3. Cities in the Chengdu-Chongqing Economic Circle should effectively play the complementary role of the new-type urbanization and agricultural modernization and boost the efficient and coordinated development of urban and rural areas. They should strive to strengthen the communications, connections and interactions between urban and rural areas, reduce the isolation of administrative divisions, improve the free flow of the elements, narrow the gap between urban and rural areas, and realize the high-quality and balanced development of the regional economy and society.

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An Empirical Study on the Influence of Agricultural Public Infrastructure on Total Factor Productivity of China's Grain Production

Yang Yu, and Pan Yueping*

Chengdu University of Technology

Abstract: A critical method of ensuring grain production is to increase the total factor productivity (TFP), and the key measure to increase the TFP of grain production lies in the construction of agricultural public infrastructure. For this topic, existing literature lacks systematic and empirical analysis. Therefore, research on the influence of agricultural public infrastructure on the TFP of China's grain production has relatively strong policy implications and theoretical value. For this study, we collected panel data for grain inputs and outputs as well as for agricultural public infrastructure in China's provinces (autonomous regions/municipalities) from 1990 to 2017, and adopted the stochastic frontier function (SFF) approach to measure the TFP of provincial-level grain production. Through this empirical study, we analyzed the influence of agricultural public infrastructures, such as irrigation, roads, and electric power facilities on the TFP of China's agriculture. We found that such facilities have a positive influence on the TFP of grain production. Specifically, when the input for irrigation facilities is increased by 1 percent, the TFP of grain production will rise by 5.74 percent. Based on this finding, policy recommendations are proposed for enhancing grain TFP through agricultural public infrastructure construction.

Keywords: agricultural public infrastructure, grain production, total factor productivity, empirical analysis

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* Yang Yu, Business School, Chengdu University of Technology;
Pan Yueping, Business School, Chengdu University of Technology.

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Corresponding concerning this article should be addressed to Pan Yueping, Business School , Chengdu University of Technology, Chengdu. Email: pypdaytoy@163.com

Introduction

The Chinese government has achieved remarkable results by abiding by the principle of basic food self-sufficiency based on domestic grain production and attaching great importance to improving grain productivity in its economic policies. China's grain output in 2020 reached 1.339 trillion *jin* (669.5 billion kg), increasing by 11.3 billion *jin* (5.65 billion kg) from the previous year, setting a record of good harvests in grain production for 17 years in a row and ensuring a self-sufficiency rate of grain and food security. On the other hand, negative factors are accruing that may affect China's grain production, including a gradual decrease in arable area, soil degradation, severe insufficiency inland reserves, and an increasing shortage of water resources (Chen Shuai et al., 2016; Ali et al., 2017; Xie et al., 2020). Such constraints are becoming more striking in the context of rural economic transitions and the rapid development of agricultural modernization (Huang Jikun et al., 2019). Therefore, under the constraints of resources and the environment, improving grain productivity has become a key issue for the country. Improving agricultural TFP is also vital for realizing agricultural modernization and sustainable development (Cao & Birchenall, 2013).

The construction of agricultural public infrastructure is the key measure to increase the TFP of grain production. Currently, it is one of the biggest issues that need to be addressed in China's grain production (Kong Xiangzhi, 2016). Covering irrigation, road, and electric power facilities, agricultural infrastructure can be seen as fundamental investments for large-scale operations and technical progress (Chen Hongwei & Mu Yueying, 2021). The construction of agricultural public infrastructure plays a vital role in supporting the TFP of grain production to contribute to rural economic development, and the Chinese government has emphasized the importance of agricultural public infrastructure construction in its No. 1 central document (the first policy statement released each year) many times (Yang Jun et al., 2019). For instance, the No. 1 central document for 2016 pointed out that efforts should be made to develop high-standard farmland and construct farmland water conservancy facilities on a large scale, to accelerate the construction of infrastructure for rural life and production, and to constantly reinforce the foundation of modern agriculture (Cai Baozhong & Zeng Fusheng, 2017). The construction of agricultural infrastructures, such as irrigation works, mechanical and electric power facilities, roads, and logistics facilities, is of great importance to resisting natural disasters and ensuring production (Zhu Jing & Jin Yue, 2017). Increasing inputs in agricultural infrastructure is actually an effort to reserve grain production capacity (Liang Ziqian & Li Xiaojun, 2006; Teruel, 2005). As early as 1978, Theodore Schultz mentioned in his book *Transforming Traditional Agriculture* that infrastructure for transportation and irrigation facilitate agricultural production by reducing circulation and input costs (Zhu & Jin, 2017). Many scholars also found that agricultural infrastructure can enhance agricultural TFP (Deng Xiaolan & Yan Weibo, 2018; Chen & Mu, 2021; Huang Jinbo & Zhou Xianbo, 2010). The construction and maintenance of farmland irrigation facilities are also important measures to guarantee the growth effect of the TFP (Luan Jian & Han Yijun, 2020).

We focused our analysis on the influence of agricultural public infrastructure on the TFP of grain production. But considering that there are various kinds of agricultural public infrastructure that can enhance TFP in a variety of ways and to different extents, it was difficult to make an exhaustive study. Therefore, in addition to theoretical analysis, we used panel data from 25 provinces (autonomous regions/municipalities) in China to make an empirical study on the influence of three major types of agricultural public infrastructure (farmland water conservancy, roads, and electric power facilities) on the TFP of grain production to offer empirical evidence for the proposal of strengthening agricultural infrastructure construction to improve grain productivity.

Literature Review

Many scholars have conducted research on the influence of agricultural public infrastructure relative to the TFP of grain production. However, much of the research studied theories on the TFP, and only a few delved into the actual TFP and the mechanisms that directly influence the TFP of grain production. After a thorough reading of these papers, we found that they can be roughly classified into two categories.

Studies on the TFP of Grain Production

On the measurement of the TFP of grain production.

As China is faced with growing resource and environmental constraints on agricultural production, there is less and less room for improving agricultural output by increasing inputs of natural resources and the factors of production. In this case, the TFP is of more research significance for the sustainable development of China's agriculture. Robert Solow was the first scholar to define the portion that could not be accounted for by the explanatory variable in the production function as the residual of technological advanced ("the Solow residual"), which he defined as the TFP (Tian Hongyu & Zhu Zhiyong, 2018). Input indicators of grain the TFP generally covers include five aspects: sown area, agricultural machinery power, irrigation area, the input of draft animals, and consumption of chemical fertilizers (Wang Chen et al., 2017). The theory of the TFP was later introduced to China. There are generally four types of methods for TFP measurements: the production function approach, the growth accounting index, the Malmquist productivity index based on data envelopment analysis (DEA), and the stochastic frontier approach (SFA) (Yu Kang et al., 2012). Many domestic scholars thought DEA can measure the efficiency of a production system featuring many inputs and outputs and is more in line with production reality, so they used a DEA-based Malmquist approach to measure China's grain TFP (Ma Linjing et al., 2014; Li Gucheng et al., 2015; Jiang Songying et al., 2016; Xie Feng, 2016; Zhang Liguo & Bao Bingfei, 2016; Chen Qiufei and Tan Xiaodong, 2017; Zhuo Yue & Zeng Fusheng, 2018; Tian & Zhu, 2018; Deng & Yan, 2018). Other scholars used a slack-based measure (SBM) in combination with the Malmquist approach to calculate and decompose the TFP (Fan Lixia, 2017; Song Haifeng & Liu Yingzong, 2019). Still, other scholars used SFA functions to measure

the TFP of China's grain production (Huang & Zhou, 2010; Xiao Saili et al., 2015). Among them, Li Gucheng et al. (2007) used an SFA approach based on Trans-log functions to make a systematic analysis in the TFP and technological efficiency of rural family businesses through microdata from rural households in Hubei Province from 1999 to 2003. In recent years, the Torgvist-Theil index has also been widely used to measure the changes of the TFP. Chen Weiping and Ding Ying (2007) used such an index to measure the TFP of China's grain production and then calculated the contribution of the TFP to the output.

On growth sources of the TFP of grain production.

Fan (2017) holds that based on the significant differences in the growth of grain in the provinces concerned, the TFP of the provinces can be classified into three types. The first type features "continuous decline," including eight provinces, such as Anhui, whose TFP value is lower than 1. The drop in their grain TFP is due to efficiency deterioration and technology decline. The second type features "slow rise," including 11 provinces such as Guangdong, whose TFP value is between 1 and 1.01. The growth in their grain TFP is mostly due to technological progress. The third type features "continuous rise," including nine provinces such as Jilin, whose TFP value is greater than 1.01. The growth in their grain TFP is driven by both technological efficiency improvements and progress. In China, many scholars think that technological progress is the major force to promote the growth of the TFP of grain production, while technological efficiency improvement does not matter much or even impedes the growth of agricultural TFP (Min Rui, 2012; Xie Feng, 2016; Chen & Tan, 2017). Other scholars hold that technological efficiency and progress are the two factors that promote increases in the TFP (Gao Shuai & Wang Zhengbing, 2012; Xiao Hongbo & Wang Jimin, 2012; Ma Linjing et al., 2014). Ma et al. (2014) hold that the dual driving forces are vital to the sustainable development of agriculture and grain production in the future.

On influence factors of grain TFP growth.

There are still insufficient studies that have taken human capital into the framework for analyzing agricultural TFP growth and expanding production limits (Ma et al., 2014). Chen and Tan (2017) evaluated TFP growth from four input indexes: total power of agricultural machinery, effective irrigation area, consumption of chemical fertilizers, and sown area of grain crops. Tian and Zhu (2018) hold that chemical fertilizers, agricultural machinery, irrigation, and grain price are key factors to promote the increase in grain productivity and their degrees of contribution can be shown as: price > chemical fertilizers > agricultural machinery > irrigation. Ma et al. (2014) think that agricultural economic development levels, rural education levels, land quality, grain sowing proportions, level of exposure to natural disasters, per capita scale of operations, and the level of mechanization for grain growing have a positive or negative influence on grain TFP growth.

Studies on the Influence of Agricultural Public Infrastructure on the TFP of Grain Production

Infrastructure, like the factors of production such as labor and capital, influences production, and can influence economies of scale, products, and markets, promote technological progress, and enhance

agricultural productivity. Zhang Yan et al. (2011) hold that rural irrigation facilities are fundamental for guaranteeing food security and production. Many scholars analyzed the relationships between agricultural public infrastructure and grain output in a quantitative way. For instance, Cai and Zeng (2017) proved by using simultaneous equations that inputs in agricultural public infrastructure have increased grain yields in 28 provinces of China over 13 years. Xie Xiaorong et al. (2014) made an empirical study on the relationships between agricultural public infrastructure and grain output by using panel data from the regions. Ma Peiheng (2011) conducted an empirical analysis on the effect of agricultural public infrastructure inputs on increasing grain yield in Henan province using the DEA approach and making the amount of rural social fixed asset investment a substitute variable for agricultural public infrastructure input. Based on the influence of agricultural public infrastructure on grain productivity, Zhuo and Zeng (2018) found that the lagged variables of farmland water conservancy and transport facilities had a significant positive influence on grain TFP in their study. Romeo G. Teruel and Yoshimi Kuroda (2005) also hold that agricultural public infrastructure, especially water conservancy and transport infrastructure, make huge contributions to the increase in grain productivity. Liu Qiong and Xiao Haifeng (2021) found that rural transport infrastructure had a noticeable positive spatial spillover effect on agricultural productivity in their study.

Some scholars delved into the path by which agricultural public infrastructure affected the increase in grain TFP. Zhu and Jin (2017) found that agricultural infrastructure enhanced TFP by increasing returns on investments in other private factors, optimizing the input structures of the factors of production, and serving as public investments to replace private input. The research by Chen and Mu (2021) shows that water-saving irrigation facilities improved grain TFP through technological progress and efficiency improvements, and the positive influence spiraled up with the rise in rural human capital, the per capita grain-growing scale, and the per capita GDP. Onofri and Fulginiti (2008) hold that infrastructure affects agricultural production by stimulating long-term needs for private capital through increasing returns to the scale of input factors. In addition, improvements in agricultural public infrastructure are also investments made to promote scaled operations of agriculture and to save costs, thus enhancing grain productivity and competitiveness (Mamatzakis, 2003; Teruel & Kuroda, 2005; Zeng Fusheng & Li Fei, 2015; Zhu & Jin, 2017). But some scholars have different opinions. For instance, Wu Qinghua et al. (2015) put forward the possibility that infrastructure construction may indeed promote optimal configurations of the factors of agricultural production but lead to an increase in agricultural production costs.

The above literature shows that previous domestic studies mostly focus on the influence of agricultural public infrastructure on agricultural production but with less attention to the effects of infrastructure on grain production output. But since grain production constitutes a major part of all agricultural production, and because of the substitution effect, these papers shed much light on our research as well. Agricultural public infrastructure construction is conducive to improving grain productivity and reducing production costs and thus promoting output growth. Based on the above research findings, we assumed that certain correlations might exist between agricultural public

infrastructure and the TFP of grain production. Although scholars have studied the influence of agricultural public infrastructure on grain TFP, they generally chose the data of only one province for analysis. There are few papers making analysis of nationwide data in this regard. Therefore, we present a detailed study on the influence of three key facilities (farmland water conservancy, transport, and electric power) of agricultural public infrastructure in 25 provinces (autonomous regions/ municipalities) on grain TFP in China. We then analyzed our findings and offered recommendations for improving the TFP of grain production in China.

Measurement of Grain TFP

Modeling

The SFA model is used to study the maximum output achievable under established technological conditions. It can be applied to measure technological efficiency and progress of grain production. A mathematical SFA model can be expressed using the following equation:

$$y_{it} = f(x_{it}, t)\exp(v_{it} - \mu_{it})$$

Where: y_{it} stands for the output of the i^{th} unit in the t^{th} year; $f(x_{it}, t)$ stands for the maximum economic yield achievable under a perfectly efficient state; x_{it} stands for the investment amount of economic factors of the i^{th} unit in the t^{th} year; t mainly refers to the time trend variable; v_{it} refers to errors that are generated in the economic process and are not subject to human intervention, including statistical errors or errors out of market changes; μ_{it} mainly refers to a non-negative variable for technical loss of the i^{th} unit in the t^{th} year. The word "non-negative" here means that the actual output of the decision-making unit (DMU) cannot exceed the production frontier and must be above or below it. TE refers to the variable for technological efficiency. $TE_{it} = \exp(-\mu_{it})$ refers to the gap between the expected yield and the actual yield due to unordered and inefficient production. The following mathematical equation is obtained by expressing the SFA model in a logarithmic form.

$$\ln y_{it} = \ln f(x_{it}, t) + v_{it} - \mu_{it}$$

A translog function mode was selected to build the stochastic frontier production model for the grain production of 25 provinces (autonomous regions/municipalities) in China. It was also assumed that technological progress was neutral. The production function was expressed as a translog function, and factor inputs of the production function were set to consist of physical capital inputs (S for average seed input per *mu*[①], F for average chemical fertilizer input per *mu*, M for machinery input) and labor

① One mu is equal to about 667 square meters.

input (L). In this way, the SFA logarithmic production model in this article can be expressed as:

$$\ln Y_{it} = \beta_1 \ln S_{it} + \beta_2 \ln F_{it} + \beta_3 \ln M_{it} + \beta_4 \ln L_{it} + \beta_5 T + \frac{1}{2}\beta_{11}(\ln S_{it})^2 + \frac{1}{2}\beta_{22}(\ln F_{it})^2 + \frac{1}{2}\beta_{33}(\ln M_{it})^2 + \frac{1}{2}\beta_{44}(\ln L_{it})^2 + \frac{1}{2}\beta_{55}T^2 + \beta_{34}\ln M_{it}\ln L_{it} + \beta_{1t}T\ln S_{it} + \beta_{2t}T\ln F_{it} + \beta_{3t}T\ln M_{it} + \beta_{4t}T\ln L_{it} + v_{it} - u_{it} + \beta_0$$

Where: S_{it} stands for average seed input per *mu* of DMU$_i$ in the t^{th} year; F_{it} stands for fertilizer input per *mu* of DMU$_i$ in the t^{th} year; M_{it} stands for average large equipment input per *mu* of DMU$_i$ in the th year; L_{it} stands for labor input of DMU$_i$ in the t^{th} year; T stands for the time variable; β_0, β_1, β_2, and β_3 mainly refer to each predictor variable; the stochastic error term (v_{it}) presents the normal distribution of $N(0, \sigma_v^2)$; μ_{it} refers to the technical inefficiencies. Suppose $\mu_{it}=\mu_i \exp[-\eta(t-T)]$, then the influence η in this equation refers to the specific influence of the time variable on μ_{it}.

In terms of γ, one of the most important reference values for judging the suitability of the SFA model, some scholars hold that covariance parameters should be expressed by $\gamma=\sigma^2_{\mu}/\sigma^2_{\mu}+\sigma^2_{v}$, where $\gamma \in [0, 1]$ mainly refers to a situation in which there is a large gap between the actual yield and the expected yield due to low production efficiency. Where γ is approaching 0, the gap between the actual yield and the possible maximum yield is mainly due to the variable v_{it}. If γ=1, it means that the deviation of the actual yield from the production frontier is fully due to production inefficiency and irrelevant to stochastic errors. Relevant estimators can be obtained through related SFA equations. Then the TFP of each province (autonomous region/municipalities) in the years concerned can be found by using these equations.

Data Source and Variable Selection

Based on the research nature and orientation of this article as well as data availability, input and output panel data for the SFA logarithmic production model herein came from real data for the 25 provinces (autonomous regions/municipalities). As the other three municipalities (Beijing, Shanghai, and Tianjin) are not major grain-producing areas, they do not have data about costs per *mu*. Tibet autonomous region and Qinghai province have little grain cultivation due to their special natural conditions. Therefore, the above areas are not included in the analysis herein. In addition, since it was from 1997 when Chongqing became a municipality, its data before 1997 was included in Sichuan province in our research. Owing to our data statistic specifications, panel data for the 25 provinces (autonomous regions/municipalities) is available only from 1990 to 2017. Unless otherwise specified herein, all the data was taken from *China Rural Statistical Yearbook* (1991–2018), *National Agricultural Products Cost-Benefit Data Collection* (1991–2018), National Bureau of Statistics, and a few other sources.

Variables were selected appropriately as follows: (a) Output variable. In order to ensure the objectivity and authenticity of this variable, we selected the average output of three major grain crops (rice, wheat, corn) per *mu* in the 25 provinces (autonomous regions/municipalities) during 28 years (from 1990 to 2017) as the output variable in the SFA logarithmic production model. (b) Physical capital investment. To ensure the objectivity and authenticity of this variable, we selected average

seed consumption per *mu*, average chemical fertilizer consumption per *mu*, and average agricultural equipment input per *mu* to constitute the variable of physical capital investment. (c) Labor input. We took the average number of the labor force per *mu* as the variable in the model.

Measurement Results and Analysis of the TFP

Based on the SFA panel model, which centers on the Cobb-Douglas production function as designed above, efficient, reliable analyses and verification were conducted on the panel data of the 25 provinces (autonomous regions/municipalities) during the 28 year period (from 1990 to 2017) by using software Frontier 4.1 to measure actual productivity of the TFP of grain production in these areas.

The data in Table 1 shows that:

(a) The coefficients of seed, labor, and machinery inputs per unit of land area are all positive but not significant, while the estimated coefficient of chemical fertilizer input is 0.665 and statistically significant at the 0.05 level, meaning that chemical fertilizers promoted an increase in output.

(b) The coefficient of the time variable is 0.0609, proving that with continuous improvements in agricultural public infrastructure, China's grain production technologies have shown an obvious tendency for upgrading. With quantified data and symbolization, this means that the average annual technological progress is at a rate of 6.09 percent. In addition, the coefficient of the quadratic term of the time variable is −0.00169 and shows statistical significance at the 0.01 confidence level. It can thus be inferred that upgrading and transformations of grain production technologies did not have a significant positive correlation with the time variable. In other words, technological progress did not show a rapid growth tendency over time.

(c) The data also shows that there was a negative relation between the time variable and the variable of chemical fertilizer input. With technological progress, the contribution rate of chemical fertilizers dropped, and technological changes in grain production in the 25 provinces (autonomous regions/municipalities) featured excessive input of chemical fertilizers.

Table 1 Efficiencies Estimated with SFF

Variable	Coefficient	Standard Deviation
Seed input	0.0215	0.210
Chemical fertilizer input	0.665**	0.267
Machinery input	0.0473	0.118
Labor input	0.637	0.435
Quadratic term of seed input	−0.0768**	0.0371
Quadratic term of chemical fertilizer input	−0.0534	0.0608
Quadratic term of machinery input	0.0437***	0.00915
Quadratic term of labor input	0.0514	0.143
t	0.0609**	0.0290
t quadratic term	−0.00169***	0.000412

Variable	Coefficient	Standard Deviation
Chemical fertilizer input * machinery input	0.0374*	0.0224
Chemical fertilizer input * labor input	−0.0697	0.0630
Labor input * machinery input	−0.0362	0.0324
Chemical fertilizer input * seed input	0.0541	0.0458
Machinery input * seed input	0.0162	0.0168
Labor input * seed input	−0.0485	0.0471
t*seed input	−0.000404	0.00270
t*chemical fertilizer input	−0.0101**	0.00510
t*machinery input	4.58e-05	0.00152
t*labor input	0.00154	0.00634
Sample size	700	
LL	595.4	

Note: ***, **, * represent the significance levels at 1%, 5%, and 10% respectively.
Source: collection and analysis were made based on data from *National Agricultural Products Cost-Benefit Data Collection* (1991–2018) and *China Rural Statistical Yearbook* (1991–2018).

Table 2 shows annual average changes in technological efficiency (TE), technological progress (TP), and the TFP of major grain crops in the 25 provinces (autonomous regions/municipalities). The data in Table 2 shows that:

(a) The technological level of grain production did not have significant development. Although the average actual technological efficiency of grain production in the 25 provinces (autonomous regions/municipalities) reached 0.1453 percent, it should be noticed that some of these provinces (autonomous region/municipalities), such as Yunnan, Jilin, Sichuan (including Chongqing), Shandong, Guangxi, Xinjiang, Hebei, Hubei, Hunan, Guizhou, Shaanxi, and Heilongjiang, still witnessed negative growth in this aspect. Among others, Heilongjiang's annual average growth in technological efficiency of grain production was the lowest (at −1.605 percent), while Jiangxi's figure was the highest (at 2.276 percent). The growth rates of technological efficiency of Liaoning, Fujian, Gansu, Hainan, Zhejiang, Jiangxi, Anhui, and Inner Mongolia were higher than the average value, probably due to rapid economic development of these provinces (autonomous regions), which greatly promoted grain production in these areas.

(b) Grain production technologies made rapid progress. Overall, the average annual growth rate of grain production technologies in the 25 provinces (autonomous regions/municipalities) was 0.8584 percent, with Guizhou having the fastest progress (annual average rate at 1.31 percent). Twelve provinces, including Yunnan, Sichuan (plus Chongqing), Anhui, Shanxi, Jiangxi, Henan, Hainan, Hunan, Hubei, Guizhou, Shaanxi, and Heilongjiang, had growth rates above the average value in this aspect.

(3) The TFP of grain production exhibited continuous growth. Except for Heilongjiang, the 25 provinces (autonomous regions/municipalities) have all had continuous growth in the TFP since

1990. For 13 provinces (autonomous regions), including Inner Mongolia, Anhui, Shanxi, Guangdong, Jiangxi, Henan, Zhejiang, Hainan, Gansu, Fujian, Guizhou, Liaoning, and Shaanxi, their TFP growth rates were greater than the average value of the 25 provinces (autonomous regions/municipalities). Except for Heilongjiang, all the other provinces (autonomous regions/municipalities) which had negative growth in technological efficiency, witnessed the same tendency in terms of their the TFP growth and technological progress, so that the latter has become the source of their TFP growth. Such TFP growth is regarded as a growth mode driven by technological progress instead of improvement in existing technological efficiency since technological progress has made up for the slow change in technological efficiency. These provinces (autonomous regions/municipalities) did not make significant achievements in promoting the popularization of agricultural technologies, so that their efforts in this regard should be further strengthened.

(d) The improvement in technological efficiency will be a potential driving force for TFP growth. With their current technological levels, the 25 provinces (autonomous regions/municipalities) did not bring their agricultural technologies into full play so that their technological efficiency applied to grain production should be greatly improved. It is feasible to increase the TFP by enhancing technological efficiency, which will become a potential driving force for TFP growth.

Table 2 Annual Average Changes in TFP, Technological Efficiency and Progress

Province/Autonomous Region	TFP	TE	TP
Yunnan	0.929	−0.238	1.045
Inner Mongolia	1.153	0.274	0.777
Jilin	0.879	−0.0314	0.793
Sichuan and Chongqing	0.722	−0.556	1.155
Ningxia	0.823	0.130	0.581
Anhui	1.915	0.901	0.893
Shandong	0.498	−0.176	0.562
Shanxi	1.066	0.0580	0.898
Guangdong	1.029	0.140	0.766
Guangxi	0.895	−0.0315	0.808
Xinjiang	0.624	−0.0705	0.583
Jiangsu	0.758	0.0104	0.631
Jiangxi	3.341	2.276	0.950
Hebei	0.613	-0.164	0.667
Henan	1.107	0.116	0.877
Zhejiang	1.519	0.570	0.828
Hainan	1.910	0.821	0.982
Hubei	0.739	−0.316	0.933
Hunan	0.964	−0.143	0.983
Gansu	1.331	0.521	0.711
Fujian	2.075	1.093	0.855

Province/Autonomous Region	TFP	TE	TP
Guizhou	1.380	−0.164	1.310
Liaoning	1.109	0.272	0.717
Shaanxi	1.069	−0.0538	1.009
Heilongjiang	−0.368	−1.605	1.147
Average	1.0037	0.1453	0.8584

Source: collection and analysis were made based on data from *National Agricultural Products Cost-Benefit Data Collection* (1991–2018) and *China Rural Statistical Yearbook* (1991–2018).

Empirical Model, Variable Selection, and Data Processing

Modeling

Based on the research designs of Hulten et al. (2006), and Liu Shenglong and Hu Angang (2010), we developed a dynamic panel econometric model for our analyses:

$$\ln\left(TFP_{i,t}\right) = \alpha + \beta \ln\left(TFP_{i,t-1}\right) + \gamma I_{i,t} + u_i + \varepsilon_{i,t}$$

Where: i (= 1, 2,…25) stands for the 25 provinces (autonomous regions/municipalities); t stands for the year; the explained variable is the logarithm of the TFP; I is the explanatory variable, standing for the three types of agricultural public infrastructure; u_i stands for the individual effect; $\varepsilon_{i,t}$ is the typical stochastic disturbance.

Variable Selection

The explained variable referred to herein is the TFP of grain production calculated by the above equations. Each index is explained here.

Road facilities (Road).

This is represented by the density of rural roads. Subject to data availability, the density was obtained by calculating the lengths of rural roads in the 25 provinces (autonomous regions/municipalities) and dividing them by the corresponding provincial area. For the calculations of road length, we used the agricultural census data released by relevant institutions in China and found that less than half of the towns are accessible to Class II highways or above. Based on this situation, we made a prudent calculation of the lengths of rural roads by utilizing the difference value between Class III and Class IV highways and expressways, Class I and Class II highways, as well as out-of-grade roads to effectively avoid spatial influence from rural road facilities.

Irrigation facilities (Irri).

In China, irrigation facilities cover a variety of structures that are mainly used to prevent and control droughts, floods, waterlogging, and salinization that affect farmlands and to improve

agricultural production conditions. To accurately measure the overall condition of water conservancy facilities, we decided to use the ratio of effective irrigation area and sown area of crops.

Electric power facilities (Elec).

Complete electric power facilities can ensure stable power supplies, provide adequate power sources for crop production, and improve the utilization efficiency of existing factors of production. We selected per capita electricity consumption in rural areas to show the concentration and quality of rural power grids and measure the condition of rural electric power facilities.

Data Source and Descriptive Statistics

Owing to data availability, we used panel data from the 25 provinces (autonomous regions/ municipalities) from 1990 to 2017. Unless otherwise specified, all the data was taken from *China Rural Statistical Yearbook* (1991–2018), *National Agricultural Products Cost-Benefit Data Collection* (1991–2018), National Bureau of Statistics Descriptive Statistics of variables are shown here.

Table 3 Descriptive Statistics of Data

Variable (Unit)	Observed Value	Mean Value	Standard Deviation	Minimum Value	Maximum Value
Average yield per *mu* (kg)	700	404.08	68.53	201.03	574.26
Average seed consumption per *mu* (kg)	700	6.50	3.81	1.02	18.05
Average consumption per *mu* of chemical fertilizers (converted to pure quantity in kg)	700	22.70	8.08	9.14	67.10
Average machinery cost per *mu* (*yuan*)	700	54.64	55.25	0	244.06
Average manpower per *mu* (person)	700	12.09	6.54	3.74	38.60
Road (10,000 km/ 10,000 km^2)	700	0.432	0.334	0.013	1.493
Irri (%)	700	0.363	0.170	0.084	0.938
Elec (100 million kWh/ 10,000 persons)	700	0.051	0.089	0.001	0.753

Source: collection and analysis were made based on data from *National Agricultural Products Cost-Benefit Data Collection* (1991–2018) and *China Rural Statistical Yearbook* (1991–2018).

Model Verification and Result Analysis

As the sample data involved in this study has a time span of 28 years, the differentiated generalized method of moments (GMM) was used to test and analyze the model to enhance the reliability of the test results.

Table 4 shows the model assessments. Notice that the first three models have only one independent variable while the fourth model has all the independent variables. The last three lines of the table show the testing of the practicality and validity of the differentiated GMM estimation. The P value was used for substitution. For the other four models, their P values of AR1 are all less than 0.05, while those of AR2 are all above 0.05. This proves that a first-order autocorrelation is present while a second-order autocorrelation is not. Therefore, the models we use comply with the standard for correlation tests.

In addition, for the first three models, coefficients and significance levels of the model variables are consistent with those of the fourth model variables. This means that the estimates are robust. The estimates show that variables for irrigation, electric power, and road facilities all passed the significance test and corresponding coefficients are positive. This means that such facilities are all conducive to enhancing TFP. Model 4 considers the influence of the three major types of agricultural public infrastructure. The following analysis mainly focuses on the estimates of Model 4.

Table 4 Estimates of Panel Models

	TFP			
Variable	Model 1	Model 2	Model 3	Model 4
L.the TFP	−0.383**	−0.376**	−0.378**	−0.405**
	(0.0137)	(0.0179)	(0.0234)	(0.0192)
Electric power facilities	0.0152***			0.0205***
	(0.00342)			(0.00925)
Irrigation facilities		0.0515**		0.0574*
		(0.0145)		(0.0869)
Road facilities			0.0122***	0.0135***
			(0.00300)	(0.00714)
Constant	0.0722**	0.0289**	0.0297***	−0.0158
	(0.0125)	(0.0158)	(0.00417)	(0.0621)
Sample size	700	700	700	700
Number of code	25	25	25	25
AR1	0.0234	0.0247	0.0222	0.0270
AR2	0.0845	0.0810	0.106	0.0502
Sargan	0.325	0.184	0.299	0.778

Note: ***, **, * represent the significance levels at 1%, 5%, and 10% respectively.

The model data indicates that the elasticity coefficient is 0.0574, which proves that farmland irrigation facilities have a significant positive influence on the TFP of grain production. Such an influence can be revealed in many aspects. The construction of agricultural irrigation facilities can optimize the planting environment for grain production, thus laying a good foundation for upgrading and transforming agricultural planting technologies. Such facilities can improve agricultural production conditions, enabling wide planting of new crop varieties that have special irrigation requirements, expand the combination of existing technologies, and support the commercialization of agricultural, scientific, and technological achievements, and the inter-regional promotion of agricultural technologies. In the meantime, such facilities can reduce the impact of natural disasters, such as drought and flood on agricultural production, and enhance the efficiency of agricultural technologies in the application process. Both coefficients of irrigation facilities in Model 2 and Model 4 are significantly positive, demonstrating again that water conservancy facilities have a positive effect on grain TFP. This also explains that the gradual completion of China's water conservancy construction for farmland is one of the key reasons for the rise in grain TFP.

Among the models, both coefficients of road facilities in Model 3 and Model 4 are significantly positive, signifying that road facilities also have a positive effect on grain TFP. The elasticity coefficient of rural road facilities is 0.0135, meaning that road facilities have a less significant effect on grain TFP than irrigation facilities. As the coefficient is still positive, it shows that the more complete the road facilities are, the faster agriculture will develop. Complete rural road facilities can reduce agricultural production costs, such as transportation costs of seeds, chemical fertilizers, and other means of production, depending on the agricultural products. Roads can facilitate the circulation of agricultural equipment and sales of agricultural products. They can also reduce the mobility costs of the factors of agricultural production and enhance the operational efficiency of agricultural machinery and the marketization degree of agricultural products. They affect agricultural TFP by influencing production costs and facilitating production and sales activities. In addition, He Zhongwei et al. (2008) hold that road facilities also have significant positive influence on the development of food markets, and they can improve the transportation efficiency of materials, contribute to a rise in trading volumes or prices, promote technological innovations and the application of new technologies, and enhance productivity. A well-established transportation network can also help popularize new innovations and technologies. Roads can enable agricultural producers to master and apply more advanced technologies and thus entitle them to the economic benefits made possible through scientific and technological progress.

Agricultural electric power facilities ensure the normal operation of agricultural machinery that uses electric power. Some irrigation facilities also require an electric power supply. Complete rural electric power facilities can reduce loss during the operation of agricultural machinery and enhance farmers' productivity. For our models, when the coefficient of electric power facilities is 0.0205, its influence is relatively noteworthy at the significance level of 1 percent. Wang Xiaoqin et al. (2009) hold that rural irrigation and electric power facilities can overcome negative impacts from the factors of production, resources, and ecological conditions on agricultural productivity and enhance agricultural productivity and output even in the context of labor migration and the decreasing trend of cultivated land.

Conclusions and Policy Recommendations

We collected 1990–2017 data of grain production inputs and three major facilities of agricultural public infrastructure from 25 provinces (autonomous regions/municipalities) in China and measured the TFP of grain production in these areas during the period 1990 to 2017 using an SFA approach. The results indicate that during this period, China's TFP of grain production presented a constant growth rate of 1.0037 percent annually. After the TFP of grain production was measured, GMM was applied to analyze the influence of agricultural public infrastructures such as roads, irrigation, and electric power facilities on grain crops, including rice, wheat, and corn. Our conclusions are: First, the three types of agricultural public infrastructure can all enhance the TFP of grain production. Specifically, with every 1 percent increase in the expansion of irrigation facilities, China's TFP of grain production will increase by 5.74 percent. With every 1 percent increase in the construction of electric power facilities, China's TFP of grain production will increase by 2.05

percent. This shows that among the types of agricultural public infrastructure, irrigation facilities have the biggest positive influence on the TFP of grain production. Second, irrigation and electric power facilities can effectively increase the TFP of grain production through technological progress and efficiency while road facilities can enhance increases through influencing technological efficiency. Third, the measurements of the TFP of grain production show that adjustments to agricultural mechanization, inputs of various factors, and planting structures can enhance the TFP of grain production.

Based on the above conclusions, we put forward the following policy recommendations:

(a) Construction of farmland water conservancy facilities should continuously be strengthened because they can significantly enhance the TFP of grain production. In the process of grain production, such facilities are always the most important part of agricultural public infrastructure. Constant efforts should be made to construct, repair, and maintain such facilities, especially small works like canals, ditches, weirs, and ponds, to develop a well-planned irrigation infrastructure network that is rational in scale, appropriate in location and density, and can play an effective role over the long term. In this way, they are expected to exert a greater positive influence on the TFP of grain production. The government should shift its focus to the central and western regions and the construction of small and medium-sized irrigation facilities according to financial circumstances, actual agricultural development, and localized agricultural public infrastructure demands. It should make innovations in the supply system of agricultural public infrastructure, provide incentives to encourage the participation of non-governmental organizations, and promote the building of democracy and improve democratic decision-making mechanisms for infrastructure in rural areas. It should also implement government subsidy policies for the operation and maintenance of irrigation facilities and adopt diversified management and maintenance mechanisms to ensure the functions of agricultural public infrastructure.

(b) Investments in road and electric power facilities should be increased. Based on our empirical results and related theories, roads, and electric power facilities also played a significant role in China's TFP of grain production. Since 1990, China has increased its investments in agricultural public infrastructure, but in comparison with developed countries, it still has a long way to go in infrastructure construction. The government should continue to increase investments in rural road construction and explore diversified investments and financing modes with government funding as the major source to accelerate rural road construction, which will reduce farmers' burdens. It should adjust measures according to local conditions and the electric load of different rural areas and implement a variety of power supply modes to satisfy the needs for rural economic development and household electricity consumption. It should also provide more policy and funding support to rural power grid upgrading and transformation and hydropower renovation for efficiency and expansion. More investments in road and electric power facilities are favorable measures to promote agricultural economic growth, which also benefits from modernized transportation and power networks, reductions in agricultural production costs, and adjustments to investment structures of agricultural infrastructure.

Local governments at various levels should fully recognize the importance of agricultural public infrastructure construction, expand relevant investment channels, attract social capital for

infrastructure construction, enhance their management levels for agricultural public infrastructure construction, and play an active role in increasing agricultural TFP.

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The Impact of SO_2 Emission Trading Policy on Enterprise Performance

Sang Bin

Zhejiang Financial College

Zhang Xufei, Guo Lin, and Sun Shujun*

Zhejiang University

Abstract: We used the latest database of Chinese industrial enterprises to make an empirical test of the relationship between the SO_2 emissions trading pilot (ETP) policy implemented in 2007 and enterprise performance based on a difference-in-difference (DID) method since the ETP policy tends to be a "quasi-natural experiment." The empirical results show that the ETP policy has a significant promotion effect on enterprise performance, which provides evidence supporting the "Porter hypothesis" in China. Heterogeneous regression results show that ETP policies play a vital role in promoting development in heavily polluting industries, state-owned enterprises, and central regions. The test results of the mechanism demonstrate that the ETP policy has two mechanisms to affect enterprise performance: "improving the total factor productivity of the enterprise" and "increasing the extra cost of the enterprise." There are two policy implications of our research: first, government departments should strive to explore and implement relevant market-based environmental regulations and policies; second, government departments should vigorously support small and medium-sized enterprises and backward areas in the west while focusing on heavily polluting industries and making the best use of environmental regulations in pollution control, which are the key points for China to win the defense of the blue sky.

Keywords: ETP policy, enterprise performance, environmental regulation

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* Sang Bin, Zhejiang Financial College;
Zhang Xufei, School of Economics, Zhejiang University;
Guo Lin, School of Economics, Zhejiang University;
Sun Shujun, School of Economics, Zhejiang University.

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Correspondence concerning this article should be addressed to Sun Shujun, School of Economics, Zhejiang University, Hangzhou, Zhejiang, 310018, China. E-mail: shujunsun@zju.edu.cn

Introduction

Since the first Law on the Prevention and Control of Environmental Pollution by Solid Wastes of the People's Republic of China was enacted by China's central government in 1987, the Air Pollution Prevention and Control Action Plan, known as the strictest air control plan in history, was released in 2013. The Central Committee of the Communist Party of China promulgated the Law on the Prevention and Control of Environmental Pollution by Solid Wastes of the People's Republic of China (Revised Edition) again in 2018, which reflects the central government's determination to control air pollution. The 2021 Government Work Report states that we should strengthen pollution prevention and ecological construction, continue to improve environmental quality, in-depth implementation of sustainable development strategies, consolidate the results of the blue sky, blue water, clean soil defense war, and promote the green transformation of production and lifestyle. All of these exemplified the fact that China's central government has attached great importance to protecting and improving the environment, advancing the construction of an ecological civilization, and promoting sustainable economic and social development. As we all know, the development of enterprises is inseparable from the consumption of natural resources. At the same time, it is inevitable to produce pollution of "three industrial wastes," namely wastewater, waste gas, and waste residue. This naturally leads to a question: Can enterprise development coexist with environmental regulations and policies that aim to protect an ecological civilization? The answer to this question is seriously related to whether China's economy can achieve sound and rapid development.

Regarding the relationship between environmental regulation policies and enterprise performance, there are two main types of research literature in the academic field: the first type of literature supports the "inhibition hypothesis" of neoclassical economics (Gray, 1987; Barbera et al., 1990; Gray et al., 2003; Lanoie et al., 2008; Tu et al., 2015; Wang, 2017; Xie, 2017; Li et al., 2019; Zhang et al., 2019), that is, the implementation of environmental regulations adds additional cost burdens to enterprises, leading to a decline in enterprise performance. On the other hand, some literature supports Porter's "promoting hypothesis" view (Montgomery, 1972; Porter et al., 1995; Jaffe et al., 1997; Brannlund et al., 1998; Hamamoto, 2006; Testa et al., 2011; Ambec et al., 2013; Rubashkina et al., 2015; Qi et al., 2018; Ren et al., 2019; Borsatto et al., 2020; Zhang, 2020; Tao,2021). According to the "Porter hypothesis," appropriate environmental regulations can improve the efficiency of enterprise by stimulating corporate innovation to offset or even exceed the additional environmental protection costs, thereby improving enterprise performance. Based on a comprehensive review of the two types of literature, it was difficult for us to judge the relationship between environmental regulation policies and enterprise performance in theory, so we researched an answer from an empirical perspective.

In 2007, China implemented the largest SO_2 emission trading pilot (ETP), an environmental regulation policy in 11 provinces, which is equivalent to a rare "quasi-natural experiment" (Li et al., 2016), which provided a valuable opportunity for us to test the relationship between environmental

regulation and enterprise performance. The following figure shows the impact of the ETP policy on SO_2 emissions in experimental areas (11 provinces, represented by the Treated group) and non-experimental areas (other provinces, represented by the Control group). It is noticeable that the average SO_2 emission in the experimental area is significantly higher than that in the non-experimental area, which indicates the accuracy of selecting regions; secondly, after the implementation of the ETP policy in 2007, the average SO_2 emissions of both the experimental group and the non-experimental group have been in a downward trend, and this downward trend began to appear in 2006, which may reflect the expected effect of the ETP policy approaching implementation. Finally, it can be seen that the average SO_2 emissions remained stable in 2009 and 2010 and began to show an increase after 2010. One possible reason may be the side effects of the central government's response to the global economic crisis by stimulating the economy.

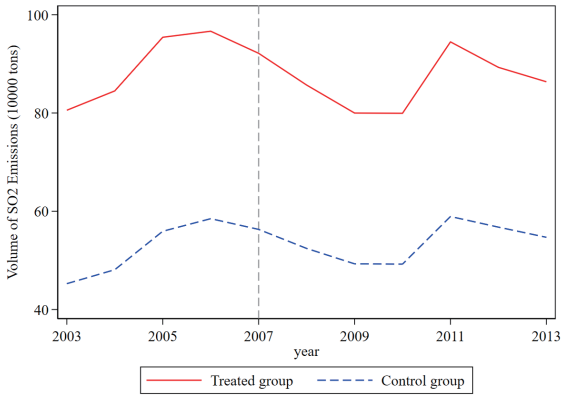

Fig.1 The time trend of SO_2 emission
Note: Data from the China Statistical Yearbook

Currently, there are three important articles closely related to the topic of ETP: the first one belongs to Tu et al. (2015), who explored whether the ETP policy stimulates the "Porter Effect" in China. Their empirical results show that although the emissions trading mechanism has alleviated the pollution to a certain extent, there is a serious shortcoming in this article that cannot be ignored. In the article, the year 2002 was used as the demarcation point of the experimental period. However, it was just in the initial exploration period of the ETP policy, and the central government did not issue a relevant standard policy system at that time, so the trading volume of emission rights in the pilot area was basically zero in 2002 (Li et al., 2016; Ren et al., 2019). Thereby, the empirical results may reflect other policy impacts (Such as the 2007 ETP policy) since its experimental period also includes 2007 to 2012; Second, Qi et al. (2018) used the 2007 ETP policy as a quasi-natural experiment and listed company data to confirm that emissions trading policies have significantly promoted corporate green innovation. The main drawback of this article is that the sample database of listed companies is imperfect because the database ignores many non-listed companies in the industry (annual observation value is 200,000 to 300,000) (Kong et al., 2013). Meanwhile, this article lacks a mechanism test for ETP policies promoting corporate green innovation. In the last one, Ren et al. (2019) also used the 2007 SO_2 emission trading policy as a quasi-natural experiment and found that the emission trading system significantly improved the total factor productivity of listed companies in the pilot area. However, this article also used an imperfect database of listed companies. In addition, it is argued that the sample period should not include 2015 because the ETP policy had by that time spread throughout the country.

Our paper fully draws on the merits of the above studies and has made some improvements.

Specifically, we make the following contributions: First, the latest industrial enterprise data from 2003 to 2013 was used for the first time. Taking 2007 as the cut-off point of the ETP policy period, we conducted a strict normative, empirical test on the ETP policy, which included not only the data of listed companies, but also a large number of non-listed companies, which makes the data more rigorous, comprehensive, and credible. Besides, we included return on assets (ROA) as an agent variable of enterprise performance since it can be divided into "profit margin on sales" and "turnover rate of total assets," which is helpful when analyzing the real source of enterprise performance improvement at a deeper level. Finally, we improved the robustness test conducted by Ren et al. (2019) by using the random sampling method. It not only carries out random sampling for the experimental group to capture the unobservable impact in different areas but also carries out random sampling for the experimental period to capture the unobservable impact at different times.

The structure of this paper is as follows: The first part is a review of the mainstream literature on the current research on environmental regulation and enterprise performance and a brief introduction to China's pilot policy on emissions trading. The second part is the research design, including sample selection, variable measurement, and econometric model setting. The empirical analysis is the third part, including basic regression analysis, robustness analysis, heterogeneity analysis, and mechanism testing. The last is our conclusions and policy recommendations.

Literature Review and Policy Background

Literature Review

On the relationship between environmental regulation and enterprise performance, there is a large debate in the academic community at present, and the views are quite the opposite. Some scholars hold the view that environmental regulation hurts enterprise performance, which is a typical view of neoclassical economics. Gray (1987), after research, believes that environmental regulation will add additional burdens on production costs to enterprises and, therefore, will pose a depressing effect on enterprise performance. Barbera et al. (1990) found that imperative environmental regulations also have a suppressive effect on manufacturing productivity. Furthermore, Gray et al. (2003) pointed out that under the requirements of environmental regulations, enterprises must conduct additional R&D and technological innovations in energy conservation and emission reduction, which in turn, have led to the "crowding-out effect" of productive investment in enterprises. Lanoie et al. (2008), though analyzing data from Quebec, Canada, found that environmental regulation makes companies' performance negative by increasing their extra costs. Tu et al. (2015) tried to explore whether the pilot policy of SO_2 emission trading in China stimulated the Porter effect. However, the empirical results show that observing from both realistic and potential perspectives. The Porter effect has not been verified in China, although to a certain extent, the problem of inefficient allocation of pollution rights has been alleviated. Wang (2017) empirically tested the relationship between environmental

regulations and the company's total factor productivity using data from China's industrial enterprises' database and city-level data. The empirical results show that for every 1 percent increase in the intensity of environmental regulation measured by the proportion of industrial pollution control investment, the productivity of enterprises in the current period decreases by about 1 percent. Li et al. (2019) studied the relationship between environmental regulation and green total factor productivity of enterprises based on the Malmquist-Luenberger productivity index method and found that environmental regulation will reduce the the green total factor productivity of enterprises in the short term. Zhang et al. (2019) explored the impact of environmental regulation on the total factor productivity of enterprises in the Yangtze River Economic Belt, and the results showed that environmental regulation induced fluctuations in the total factor productivity of enterprises.

The opposite view is that environmental regulation can promote enterprise performance. Montgomery (1972) proved theoretically that environmental regulation could effectively reduce the cost of reducing pollution. Porter et al. (1995) proposed the famous "Porter hypothesis," which predicts that under certain conditions, environmental regulation can offset the cost of production brought by environmental regulation through innovation incentives and improving the production efficiency of enterprises so as to improve the performance of enterprises. Environmental regulation and enterprise performance can coexist completely. Jaffe et al. (1997) believe that environmental regulation policy can internalize the negative environmental externalities in the process of pollution discharge into the production costs of enterprises and then force enterprises to carry out reform and technological innovation, to achieve the improvement of performance. Besides, Brannlund et al. (1998) believed that the trading mechanism of emission rights had realized the growth of corporate profits in the paper industry in Sweden. Hamamoto (2006) studied the data of the Japanese manufacturing sector and found that environmental regulations have improved the productivity of enterprises by improving their R&D and innovation. Testa et al. (2011) also supported the view with empirical research of the EU construction companies. Ambec et al. (2013) found that environmental regulation is consistent with the growing trend of enterprise innovation. Li et al. (2013) found that the air pollution control method played a significant role in promoting the total factor productivity of industrial enterprises by using the DID method. Jefferson et al. (2013) studied the related policies of acid rain and SO_2 emission in 1998 and found that environmental regulatory policies promoted profits for enterprises in heavily polluted areas of China. Qi et al. (2018) used data from listed companies with the SO_2 emission trading policy of 2007 as a quasi-natural experiment to confirm that the emission trading policy significantly promoted corporate green innovation. Ren et al. (2019) also used the 2007 SO_2 emission trading policy as a quasi-natural experiment and found that the emission trading system significantly improved the total factor productivity of listed companies in the pilot regions. Borsatto et al. (2020) combed through 96 academic papers published in databases such as Web of Science over the last ten years and found that most of the relevant literature identified environmental regulations as one of the main factors that motivate firms to engage in green innovation. Zhang (2020) found that the stronger the dynamic innovation capacity to a certain extent, the better the promotion of corporate financial

performance, and the environmental regulation policy is significantly and positively related to the firm's performance; that is, the environmental regulation can significantly improve the financial performance of the firm. Tao (2021) found that the environmental target responsibility system can lead to an increase in the number of green innovations, and the establishment of an innovation review system can maximize the quality of corporate innovation, stimulate a high level of corporate innovation, and ultimately improve corporate performance.

In addition, some scholars have found that the relationship between the two is non-linear. For example, Wang et al. (2014) empirically tested the impact of environmental regulation on the total factor productivity of enterprises using data from Chinese industrial enterprises and found that there is an inverse N-type relationship between environmental regulation and enterprise total factor productivity. Xing (2020) analyzed the relationship between environmental regulation and enterprise profitability in Guangdong province and found that the relationship between environmental regulation and enterprise profitability is complicated by the dual effect of "innovation compensation" and "compliance cost" on performance improvement, which is not a simple linear relationship, but an inverted U-shaped relationship.

Policy Background

China's extensive economic growth has created many environmental problems, so how to effectively deal with environmental issues and achieve sustainable economic development is an urgent challenge for China to tackle. The ETP policy of China was first implemented in the field of water pollution. It was not until the mid-1990s that the former Ministry of Environmental Protection decided to conduct pilots for air pollution trading in 6 cities, including Baotou and Guiyang (Li et al., 2016). In 2000, the central government began to explore market-based environmental regulations (Ren et al., 2019). In March 2002, in order to explore the trading mechanism of SO_2 pollution rights, the former Ministry of Environmental Protection took the lead in four provinces; Shandong, Shanxi, Jiangsu, and Henan, and three cities; Shanghai, Tianjin, and Liuzhou, and later joined the Huaneng Group to launch the SO_2 ETP policy, which was also called the "4 + 3 + 1" trading pilot policy. Since this policy did not have a strictly regulated trading system nor an emission trading center or trading market, the emission trading volume in many places after the implementation of the policy was zero (Li et al., 2016; Ren et al., 2019), and the "Porter effect" was not detected (Tu et al., 2015; Qi et al., 2018).

In 2007, the central government officially launched the SO_2 pollution rights trading policy. The Ministry of Finance of the People's Republic of China, the former Ministry of Environmental Protection and the National Development and Reform Commission approved eleven provincial-level regions as pilot areas: Jiangsu, Tianjin, Zhejiang, Hebei, Shanxi, Chongqing, Hubei, Shaanxi, Inner Mongolia, Hunan, and Henan, involving multiple industries such as glass, chemical, mining, and cement. The implementation of the emission trading policy was coordinated and realized under the guidance of the central top-level design, local government supervision, and market mechanism. During this period, the standardization process of emission rights was significantly accelerated

(Li et al., 2016). At the same time, various regions formulated a series of relevant implementation policies, resulting in an increase in the volume of emission trading year by year. Then in 2008, the first municipal-level emission right reserve and trading center was established and listed in Zhejiang province, and the corresponding offices and relevant supporting system measures were also introduced one by one. Until 2014, the general office of the State Council issued guidance on further promoting the pilot work of paid use and trading of emission rights, which marked the formal and comprehensive spread of the SO_2 pollution rights trading policy.

Empirical Design

Sample Selection

We selected the micro-data of manufacturing enterprises from 2003 to 2013 for our research, with data mainly coming from the database of Chinese industrial enterprises. The specific selection processes were as follows: Referring to the processing method of Cai & Liu (2009), the first step was to eliminate missing observations of key indicators (such as government subsidies, total profit, income tax expenses, number of employees, total industrial output value, sales income, etc.); the second step was to eliminate observations that did not meet the "above-scale" standard, which means the total industrial output value was less than RMB10 million. Sales were less than RMB10 million, or the number of employees was less than 30; the third step was to exclude some observations that did not meet accounting principles. In the end, we obtained sample data of manufacturing enterprises for a total of nine years, from 2003 to 2013 (data missing in 2009 and 2010), covering 31 manufacturing double-digit industries, which better reflected the overall situation of the entire manufacturing industry.

Variable Measurement

In related literature, there are many indicators for measuring enterprise performance. These indicators usually include Tobin's Q (Zhao et al., 2015), total ROA (Zhou et al., 2015), and return on net assets (ROE) (Peng et al., 2015). We believe that Tobin's Q method is only suitable for listed companies. On the other hand, the database of Chinese industrial enterprises lacks some specific data needed in this method. At the same time, considering the advantages of ROA that indicators can be further decomposed, it will help us analyze the true source of enterprise performance improvement at a deeper level. In contrast, ROE focuses more on the leverage of enterprises. To avoid a possible error in the research results caused by the different emphasis on ROE, we finally decided to use the ROA as the primary measure of enterprise performance.

$$ROA = \frac{\text{Net profit}}{\text{Total assets}} = \frac{\text{Net proft}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}$$

According to the DuPont analysis formula, an enterprise's ROA is composed of two parts, which are

the profit margin on sales and the turnover rate of total assets. The product competitiveness and operation efficiency of an enterprise can be properly displayed by the above two indicators. Meanwhile, on the premise that the total assets of an enterprise remain relatively stable, the turnover rate of total assets can also represent the expansion of the sales scale of an enterprise, which can help us to understand the Internal influence approach of the ETP policy on enterprise performance from a deeper level. Therefore, in the basic regression analysis, both indicators will be included in the measurement of enterprise performance. In addition, to control the influence of financial subsidies on the net profit of enterprises, we deducted the financial subsidies from the net profit in advance when calculating the above indicators by referring to the practice of Zhao et al. (2015). According to Aghion et al. (2015) and Wang et al. (2014), "tax benefits" is an important explanatory variable that affects enterprise performance. The tax benefits obtained by a company are equal to "total profit * corporate income tax rate-the actual enterprise payable income tax." Regarding the establishment of the corporate income tax rate, we have sorted out the Detailed Rules for Implementation of the Income Tax Law for Enterprises with Foreign Investment Enterprises and Foreign Enterprises, "Notice on Tax Preferential Policies for the Development of the Western Regions," and the "Enterprise Income Tax Law of the People's Republic of China (Amended in 2018)." Among these and other relevant tax policy documents, it was found that the setting principles are as follows: The income tax rate of western development enterprises and high-tech enterprises is set at 15 percent; the income tax rate of foreign-funded enterprises and enterprises in the special economic zone is set at 15 percent before 2008, and then gradually increased to 25 percent within five years according to the tax law setting rules. Excluding other small corporate income tax rates that cannot be judged, the remaining corporate income tax rates were uniformly set to 33 percent before 2008 and 25 percent after 2008, according to tax law requirements. Although the intensity of fiscal subsidies and income tax preferences are not the focus of this article. To control the impact of the two, we added two variables, lag periods for fiscal and tax intensity. In addition to the above variables, we also referred to the control variables commonly used in related research, such as corporate growth capacity, asset guarantee value, corporate age, main business profitability, and main business growth rate (Hong et al., 2006; Chen et al., 2012; Zhao et al., 2015; Liu, 2016), to control the regression equation. The setting method of all basic variables in this article is shown in Table 3 below:

Table 1 Main variables and measurement

Variable	Meaning	Measurements
ROA	Enterprise performance	(Total profits-income tax-subsidies)/total assets
Treat	Dummy variable	In the pilot area, make it 1, or 0
Post	Dummy variable	After 2007, make it 1, or 0
Sub	Fiscal subsidies	Measurement 1: log (1+fiscal subsidies) Measurement 2: fiscal subsidies/total assets
Comp	Competition	Measurement 1: 1- Herfindahl index of sales Measurement 2: 1- Average industry profit margin
Tax	Income tax preferences	log (1+ Nominal tax-Actual tax)
NPR	Corporate growth capacity	(Net profit t-Net profit t-1)/Net profit t-1

Variable	Meaning	Measurements
Tar	Asset guarantee value	(Stock+fixed assets)/total assets
Age	Corporate age	ln (2013-Establishment year +1)
Prof	Main business profitability	(Main business income-Main business cost)/Main business income
Growth	Main business growth rate	Main business income t-Main business income t-1)/Main business income t-1

Model Setting

To examine the impact of the ETP policy on enterprise performance, we refer to the practices of Zhou et al. (2018), Zheng et al. (2018) and Ren et al. (2019) to construct the following two-way fixed effect model:

$$ROA_{it} = \beta_0 + \beta_1 Post_t * Treat_i + \beta_2 Post_t + \beta_3 Treat_i + \beta_4 Z_{it} + u_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In the equation above, the subscript t represents time, and i represents the enterprise. This regression adopts clustering robust standard error, clustering to industry level. The coefficient of the core explanatory variable *Post* * *Treat* in the equation was the focus of our attention, and Z was the control variable, including the strength of financial subsidy (Sub), the strength of tax benefits (Tax), the growth ability of the company (NPR), the asset guarantee value (Tar), the age of the company (Age), the main business profit margin (Prof) and main business growth rate (Growth), The calculation of specific variables is shown in table 1. In addition, u_i represents the individual effect of the enterprise, λ_t represents the fixed effect of time, and ε_{it} is the error term.

Empirical Analysis

Basic Regression Analysis

The results of basic regression analysis show that the ETP policy has a significant promotion effect on enterprise performance, providing evidence for the "Porter hypothesis," which means that the promotion effect of the ETP policy on enterprise performance is greater than the inhibitory effect. The following are the specific analysis: Column (1) is the regression result of ordinary ordinary least square(OLS) without any control variables. We found that the emission trading policy Treat # Post has no significant impact on enterprise performance after the reform, maybe because we did not control the impact of other variables, leading to an inaccurate estimation; Then, in column (2), when we introduce all the control variables without controlling overtime fixed effects and individual fixed effects to capture the uncertain impact of a specific year and a specific individual, a significant negative impact of Treat # Post on enterprise performance shows up; while in column (3), the time-fixed and individual fixed effect are added to the control variables on the basis of column (2), that

is, a two-way fixed-effect model is used to capture the uncertain impact of a specific year and the individual enterprise's heterogeneity difference respectively, then the result of Treat # Post is significantly positive; Column (4) is based on the two-way fixed model with the robust standard error clustering to the industry to capture the correlation and heteroscedasticity of individual error terms in the industry. As a result, the coefficient of Treat # Post is 0.00666, and it is significantly positive at the level of 5 percent, which fully indicates that emissions trading policies have a significant promotion effect on enterprise performance. To further investigate the internal source of enterprise performance change, we decomposed enterprise performance into sales profit rate and total asset turnover rate, and then regress them respectively. The results are shown in columns (5) and (6). It is obvious that Treat # Post has a significant promoting effect on sales profit rate with a coefficient of 0.00304, which is significant at the level of 1 percent, but has no significant effect on the total asset turnover rate. This shows that the improvement of enterprise performance is more from the growth of the sales profit rate.

Table 2 Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ROA	ROA	ROA	ROA	Sales profit rate	Total asset turnover rate
Treat#Post	0.113	-0.0118***	0.00666***	0.00666**	0.00304***	-0.705
	(0.108)	(0.00193)	(0.00192)	(0.00317)	(0.000570)	(0.685)
Treat	-0.126	0.0202***	0.000936	0.000936	-0.00421***	0.674
	(0.0810)	(0.00150)	(0.00387)	(0.00678)	(0.000796)	(0.594)
Post	-0.0757	0.0395***	0.0795***	0.0668***	-0.00490***	1.347***
	(0.0651)	(0.00134)	(0.00244)	(0.00688)	(0.00129)	(0.363)
Constant	0.254***	0.138***	0.0449***	0.0449***	0.0285***	3.536***
	(0.0512)	(0.00961)	(0.0171)	(0.0118)	(0.00431)	(1.133)
Controls	N	Y	Y	Y	Y	Y
Year FE	N	N	Y	Y	Y	Y
Firm FE	N	N	Y	Y	Y	Y
Clustered	N	N	N	Y	Y	Y
Observations	959,677	440,675	440,675	440,675	440,675	440,675
R-squared	0.000	0.119	0.077	0.077	0.235	0.000

Note: *, ** and *** represents the significance level at 10%, 5% and 1% respectively. The standard errors are reported in parentheses and clustered at the industry level.

Parallel Trend and Dynamic Effect Test

Consistency of double-difference or multiple-difference estimators requires the assumption of parallel trends (Fu et al., 2015). As we all know, the premise of using the DID method is that the experimental group and the non-experimental group must meet the parallel trend hypothesis. On the assumption of a parallel trend, many scholars use the drawing observation method to identify it, which is intuitive but not rigorous. In this part, with reference to the practices of Kong et al. (2015), Zheng et al. (2018), Ren et al. (2019), the "event study approach" was used to test the balance trend.

This method is different from the DID method, which can only identify the average effect before and after the ETP policy period and can also observe the dynamic effect brought by the ETP policy in each year. Assuming the ETP policy reform takes place in each year of the sample period, the following measurement equation was constructed:

$$ROA_{it} = \beta_0 + \beta_t \sum_{t=2003}^{2013} Post_t * Treat_i + \beta_2 Z_{it} + u_i + \lambda_t + \varepsilon_{it} \quad (2)$$

The meaning here is different from equation (1). Specifically, when t = 2003, *Post*2003 = 1, and other years are replaced by 0, then every year, the situation is analogous in this way. Representing the effect of the ETP policy every year is the coefficient we care about, with the explanation of other variables unchanged. The regression results are shown in Table 3 below. No significant differences in enterprise performance are shown in 2004, 2005, and 2006. This means that there was no significant difference between the experimental group and the non-experimental group before the ETP policy reform, which indicates that this empirical analysis meets the assumption of parallel trends. Meanwhile, the ETP policy has significantly promoted enterprise performance since 2007. Then the promotion effect weakened in 2008 and disappeared in 2011, indicating that although the emission trading policy has a significant impact on enterprise performance, the impact decreases with time.

Table 3 Dynamic results

	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2013
Coefficient	0.00173	-0.000191	0.00176	0.00741**	0.00947***	0.00602**
Standard error	(0.00334)	(0.00347)	(0.00349)	(0.00324)	(0.00314)	(0.00218)

Note: *, ** and *** represents the significance level at 10%, 5% and 1% respectively. The standard errors are reported in parentheses and clustered at the industry level. Because of collinearity and missing values, the coefficients of the year 2003, 2011, and 2012 are missing. The database of manufacturing enterprises does not include the year 2008 and 2009, then we also do not report the results.

Figure 2 shows the dynamic change of β_t and its 90 percent confidence interval. From the figure, it is noticeable that the dynamic regression coefficient was not significantly different from 0 in 2006 and before at 90 percent confidence interval, while the data were significantly different from zero in 2007 and 2008 until the policy effect disappeared in 2013.

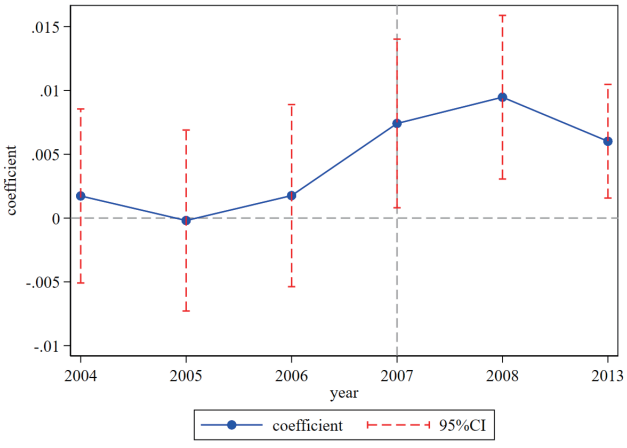

Fig.2 The dynamic effect of the ETP policy on enterprise performance

Robustness Analysis

Placebo Test (a): Referring to the random sampling method used by Zhou

et al. (2018) and Ren et al. (2019), our procedure further improves this method and then uses it for a placebo test. Specifically, to start with, 200 random samples were taken from 31 provincial-level administrative units in China. 11 provinces were randomly selected as the experimental group and the remaining 20 provinces as the non-experimental group. The biggest advantage of this is that it cannot only control the observable influencing factors but also capture some influencing factors that are difficult to observe with the change of the region, "such as other industrial policy adjustments of local governments in different regions"(Zhou et al., 2018). Second, the reference method only randomly samples the experimental group, and based on this, 200 random samplings were simultaneously performed for the policy period in this article. Specifically, the first and last two years of the sample period were eliminated, and then a year was randomly selected from 2004 to 2012 as the implementation year of the policy. This year and the following years were designated as the experimental period, and the former as the non-experimental period. The main advantage of this method is that it can eliminate the unobservable shocks that occur in the period, such as the "4 + 3 + 1" ETP policy started from 2002 while superimposed in the same period, and the pollution charge collection policy issued by the State Council in 2003. Third, after 200 random samplings, we could get 200 experimental periods and experimental groups, and then substitute them into equation (1) for regression, respectively, getting 200 regression coefficients and T values of Treat#Post. The last step was to draw the kernel density plots of coefficients and *t* values, as shown in Figures 3 and 4.

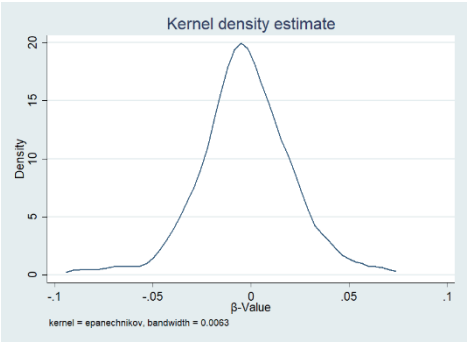

Fig.3 the density of coefficients

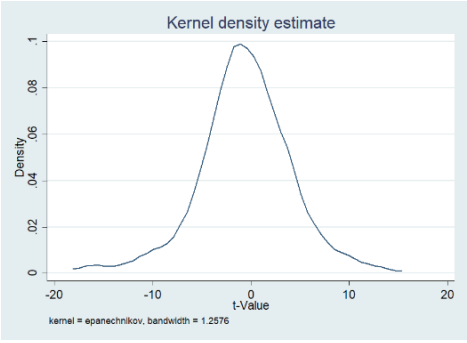

Fig.4 the density of *t* values

It is obvious from Figure 4 that most of the coefficients are distributed around the value of 0, which indicates that the impact of the ETP policy is small. Similarly, in Figure 5 the t value is also mainly distributed around the value of 0, which indicates that the impact of the ETP policy is basically not significant. Combining the results of the two graphs, the impact of ETP policies on enterprise performance is unlikely to be driven by the impact of unobservable shocks in different regions and years.

Placebo Test (b): Referring to the practice of Lu & Yu (2015), we took the sample period from 2003 to 2006 before the ETP policy actually occurred, and assumed that the ETP policy occurred in 2004 and 2005, respectively. Then in 2004 (2005) and after, the *POST* value is 1, otherwise it is 0. The target coefficients we expected were not significant. Otherwise, there may have been other unobservable factors affecting the previous results. The test results are shown in Table 4. Column (1) is the regression result of assuming policy reform occurred in 2004.

Obviously, the coefficient of the interaction term is not significant, indicating that the ETP policy had no impact on enterprise performance. Meanwhile, column (2) assumes that the policy reform that occurred in 2005 shows the same result. Taking the two results together, it is confirmed there was no significant difference between the treatment group and the experimental group before the ETP policy reform was actually implemented, which also supports the parallel trend assumption of the two from another aspect.

Replace Explanatory Variables: For "industry competition variable," "industry average profit rate" takes the place as a different measurement method; the results are shown in column (3) of Table 4. The average impact of the ETP policy on corporate performance is 0.00665, significant at the level of 5 percent, indicating that the ETP policy still has a significant impact on enterprise performance, and the results remain robust. Similarly, using the second algorithm of "financial subsidy intensity" by "subsidy amount / total assets," we found the coefficient was 0.0067, significant at 5 percent. Consistent results suggest that the conclusions are robust. Limited by the length of this article, results are not reported here.

Using D-K Standard Error: Clustering standard error is used in the article, only considering heteroscedasticity and autocorrelation problems of the error term. The error term of the measurement equation may have three major problems of autocorrelation, heteroscedasticity, and cross-section correlation, leading to invalid results. To solve this problem, we used the Driscoll-Kraay (DK) standard error to test, since the DK standard error can deal with the three major problems described above at the same time. The regression results are shown in column (4). With significant results at the level of 1 percent, the ETP policy still has a significant and robust effect on promoting corporate performance.

Using Instrumental Variables: Considering that industry competition Comp1 and corporate performance ROA may have a two-way causal relationship because high-performance companies have stronger market competitiveness, which in turn can further intensify market competition, which could lead to the invalidation of the estimation results of our analysis, we dealt with possible endogenous problems in Comp1 by using the lagging phase 1 and lagging phase 2 of Comp1 as the instrumental variables for regression. Meanwhile, considering the possible heteroscedasticity and autocorrelation of the error term, we further used the Gaussian Mixed Model (GMM) instrumental variable method for regression. The β_1 is 0.0104, shown in column (5), significantly positive at the level of 5 percent, which indicates that the results remain robust after considering endogenous issues. In addition, three major tests on the validity of the instrumental variables were performed: the test results rejected the unidentifiable test null hypothesis (KP statistic is 1795.264), indicating that the instrumental variables meet the rank condition; the test results rejected the weakly recognized test null hypothesis (F statistics is 2411.412), indicating that the instrumental variables have a strong correlation; the test results were also subjected to an over-identification test (Hasen's statistic is 0.164), indicating that the instrumental variables are all exogenous. The above three tests fully show that the instrumental variables selected for our analysis were effective.

Time Trend Effect: Under normal circumstances, there is a tendency for enterprise performance to change over time, which could easily confuse our estimates. To capture the possible trend effect of time, based on the measurement equation (1), we introduced the time trend term to capture the time effect, with results shown in column (6). The β_1 is 0.00666, significantly positive at the level of 5 percent, indicating that the ETP policy still has a significant and robust impact on enterprise performance. In addition, we also introduced the "Provincial Time Trend" and "Industry Time Trend" to capture the province fixed effects and industry fixed effects that change with time trends. The results remained stable but are not reported here because of the limited length of the article.

Table 4 Robustness results

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ROA	ROA	ROA	ROA	ROA	ROA
Treat#Post2004	0.0727					
	(0.0460)					
Treat#Post2005		0.000299				
		(0.00216)				
Treat#Post			0.00665**	0.00666***	0.0104**	0.00666**
			(0.00317)	(0.00232)	(0.00455)	(0.00317)
Constant	-0.0215	-0.0214	0.0390	0	0	0.0272**
	(0.0576)	(0.0578)	(0.0582)	(0)	(0)	(0.0121)
Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Clustered	Y	Y	Y	Y	Y	Y
Observations	168,877	168,877	440,675	440,675	102467	440,675
R-squared	0.062	0.062	0.076	0.077	0.0729	211,854

Note: *, ** and *** represents the significance level at 10%, 5% and 1% respectively. The standard errors are reported in parentheses and clustered at the industry level.

Heterogeneity Analysis

The heterogeneity of the impact from three different perspectives: industry pollution attributes, ownership attributes, and regional attributes are discussed in this section. Referring to the practice of Fan et al. (2019), the measurement equation was set as follows:

$$ROA_{it} = \beta_0 + \beta_1 Post_t * Treat_i * M + \beta_2 Post_t * M + \beta_3 Treat_i * M + \beta_4 Treat_i * Post_t + \beta_5 Z_{it} + u_i + \lambda_t + \varepsilon_{it} \quad (3)$$

When the industry belongs to a heavy pollution industry, it was assigned as 1, otherwise 0; when the ownership is a state-owned enterprise, it was assigned as 1, otherwise 0; when the region is in the East, it was assigned as 3; when the region is in the middle, it was assigned as 2; when the region is in the west, it is assigned as 1. Among them, the interaction term $Post_t$ * $Treat_i$ * M is the core variable

we care about. The essence of this method is the Chow test, which is more standard and accurate than group regression. The specific regression results are shown in Table 5 below:

Column (1) is the regression result of the pollution heterogeneity of the industry. It is not difficult to find that the coefficient of the interaction term is 0.0108, significant at the level of 10 percent, which shows that compared with the industries with light pollution, the ETP policy has a stronger effect on promoting corporate performance in heavily polluting industries. The regression results are also consistent with our intuition since additional environmental costs force highly polluting enterprises to carry out green innovation, which has improved production efficiency and performance. Therefore, we can also conclude that the significant promotion effect of ETP policies on enterprise performance mainly come from heavily polluting industries.

Column (2) is the regression result of enterprise ownership heterogeneity. The interaction term coefficient is 0.00902, significant at the level of 5 percent, which shows that compared to non-state-owned enterprises, the emission trading policy has a greater effect on the performance of enterprises directly controlled by the state. One of the possible explanations is that these enterprises will respond more actively to the ETP policy reforms. At the same time, due to the strong financial resources of state-owned enterprises, they can invest a large number of funds for R&D and innovation in a short period of time, so the effect of policies on state-owned enterprises is more significant.

Column (3) shows the result of regression by different regions. It is not difficult to find that as the region advances from the west to the east, the inhibitory effect of the ETP policy on enterprise performance becomes stronger. The analysis was based on the assumption that there is a linear relationship between the ETP policy and regional heterogeneity, which may be unreasonable. Therefore, to further test the average impact of policy reforms on each region, we also conducted a sub-sample regression of the eastern, central, and western regions. The results show that emissions trading policies have a significant promotion effect on the central region and a significant inhibitory effect on the western and eastern regions. This result is considered to be in line with reality because the pilot areas of the ETP policy reform are mainly concentrated in the central and eastern regions, while the eastern region is located in a coastal zone with a relatively developed economy and relatively intensive production. Because polluting companies have gradually migrated to the central and western regions, the ETP policy has limited incentives in the eastern region, and additional environmental protection costs may not be conducive to the performance improvement of the enterprises in the eastern region. On the other hand, the western region is lacking in funds and technology, which leads to difficulty in offsetting the environmental protection costs created by the ETP policy through technological innovation, resulting in easily causing a decline in performance. In contrast, the central region has more technological and financial advantages. By increasing the investment in research and development of new technology, these enterprises can effectively improve the production mode and enhance the efficiency of enterprises to offset the additional environmental costs, and then promote the improvement of enterprise performance. At last, we can conclude that from the perspective of regional heterogeneity, enterprises in the central regions play a leading role in promoting the

performance of enterprises.

Table 5 Heterogeneous results

	(1)	(2)	(3)
	Pollution	Ownership	Region
VARIABLES	ROA	ROA	ROA
Treat#Post#pollution	0.0108* (0.00575)		
Treat#Post#soe		0.00902** (0.00372)	
Treat#Post#region			-0.0242*** (0.00566)
Constant	0.0436*** (0.0122)	0.0454*** (0.0125)	0.0375** (0.0175)
Controls	Y	Y	Y
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Clustered	Y	Y	Y
Observations	440,675	440,675	403,905
R-squared	0.077	0.077	0.079

Note: *, ** and *** represents the significance level at 10%, 5% and 1% respectively. The standard errors are reported in parentheses and clustered at the industry level.

Mechanism Analysis

According to the previous review, there are two main internal mechanisms of the effect of ETP policies on corporate performance: the first is the productivity mechanism. The ETP policy urged companies to increase research and development efforts to improve corporate productivity, thereby making up for the additional environmental protection costs that the companies have added. Eventually, these actions led to the promotion of corporate performance. The second is the pollution cost mechanism. The implementation of the ETP policy has caused enterprises to increase their pollution costs, forcing them to transfer some resources to pollution control, which in turn has reduced their performance. Regarding the second mechanism, there is no relevant pollution data in the database of Chinese industrial enterprises, and the existing data cannot be used for measurement. So, referring to the practice of Fang et al. (2013), we only tested the first mechanism to disprove the second mechanism.

For the measurement of corporate productivity, mainstream literature tends to use TFP (Wang et al., 2014; Ren et al., 2019). However, TFP has two algorithms: the OP method and the LP method. The OP method can better deal with the problem of simultaneity deviation and selectivity deviation by using the current investment of the company as the proxy variable of unobservable productivity, but it can also cause the loss of many samples, while the LP method can better solve the problem of missing samples by using intermediate input instead of investment. To ensure robust results, we used

both the OP and LP methods to measure corporate productivity. For the selection of the mechanism test method, we used the "sequential test method" or "casual steps" proposed by Baron & Kenny (1986) in three steps.

The specific results are shown in Table 6: Column (1) is the basic regression result with a significant promotion effect on enterprise performance, same as above. Column (2) is the regression result of the TFP calculated by the OP method as the explanatory variable. It can be seen that the coefficient of the ETP policy is 0.0155, significant at the level of 10 percent, which indicates that the ETP policy has a significant promotion effect on the enterprise's total factor productivity. Column (3) is the regression result of the TFP calculated by the OP method, in which the coefficient is 0.0554, significant at the level of 1 percent. Combined with the results of column (2), the productivity mechanism is fully confirmed. Further observe that the coefficient of Treat # Post is 0.0095, significant at the level of 5 percent, which is only slightly improved compared to column (1), indicating that the productivity mechanism is a mechanism of the ETP policy affecting corporate performance, rather than the main mechanism, which means that there are other mechanism effects, so the second pollution cost mechanism mentioned above is confirmed. The regression results obtained by calculating the TFP using the LP method shown in columns (4) and (5) are very robust.

Table 6 Mechanism results

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ROA	OP_TFP	ROA	LP_TFP	ROA
Treat#Post	0.00666**	0.0155*	0.00950**	0.0167*	0.00959**
	(0.00317)	(0.00830)	(0.00381)	(0.00887)	(0.00383)
OP_TFP			0.0554*** (0.00312)		
LP_TFP					0.0468*** (0.00266)
Constant	0.0449*** (0.0118)	2.176*** (0.130)	-0.168*** (0.0439)	2.315*** (0.141)	-0.159*** (0.0435)
Controls	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Clustered	Y	Y	Y	Y	Y
Observations	440,675	261,671	255,987	261,671	255,987
R-squared	0.077	0.109	0.083	0.145	0.078

Note: *, ** and *** represents the significance level at 10%, 5% and 1% respectively. The standard errors are reported in parentheses and clustered at the industry level.

Conclusions and Policy Implication

Based on the existing related literature research, we used the latest database of Chinese industrial enterprises from 2003 to 2013 and the two-way fixed-effect regression model based on the DID

method to conduct a strict and standardized empirical test on the relationship between the SO_2 ETP policy and corporate performance with the help of the "quasi-natural experiment" in 2007. The results of the basic regression and robustness tests show that the ETP policy has a significant promotion effect on corporate performance, providing Chinese evidence for the "Porter hypothesis." Heterogeneous regression results show that the SO_2 ETP policy has a more significant promotion effect in heavily polluting industries, state-owned enterprises, and central regions, while in lightly polluting industries, non-state-owned enterprises, and eastern and western regions, there is no significant or even negative impact. The results of the mechanism test show that the ETP policy promotes the improvement of corporate performance through the mechanism of "increasing the total factor productivity of the enterprise," and also implies the existence of a reverse mechanism of "increasing the additional environmental protection costs of the enterprise."

The policy implications of this article focus on two points. First, given that the SO_2 ETP policy conforms with the "Porter hypothesis," central and local government departments of China should strive to explore and implement relevant market-based environmental regulatory policies, so that the market can give full play to the role of resource allocation, promoting corporate R&D innovation capabilities and awareness of energy conservation and emission reduction, to achieve better, faster, and higher-quality economic development. Second, government departments should improve relevant policy supporting measures and market supervision to support enterprises at different levels. For small and medium-sized enterprises and backward areas in the west, we must vigorously support them to promote their R&D and innovation to improve production efficiency. For heavily polluting industries, which are in the worst-hit areas of sewage, we must focus on strengthening supervision and ensuring strict implementation of environmental regulations and policies. At the same time, we can also make use of incentives to achieve a reborn industry as soon as possible, which is the key point to China's victory in defense of the blue sky.

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Chengdu's Smart Manufacturing in the New Era: Achievements and Optimization

Sun Genjin, Gao Rui, and Liu Ying*

Sichuan Agricultural University

Abstract: The promotion of smart manufacturing is a crucial move that will enable Chengdu to build a major growth pole for high-quality national development and shape a new growth powerhouse. In recent years, Chengdu's capability has made marked progress in smart manufacturing, significantly enhancing the capability for independent innovation, gradually optimizing development factor allocations, relentlessly strengthening pilot and demonstration effects, and constantly emerging collaborative service platforms. The development of Chengdu's smart manufacturing can be summarized in four points: taking a holistic approach to top-down design, raising policy incentives for innovative talents, creating a favorable environment for industrial innovation, and building service platforms to promote innovation. In the new era, Chengdu should continue to explore the best possible path to smart manufacturing and target high-quality development of local manufacturing industries by making the following efforts: a) optimizing top-down design for better policy guidance; b) focusing on technological innovation to improve corresponding innovation capability; c) forging service platforms to break barriers to development; d) strengthening lateral communications to promote collaborative transformation; and e) building leading enterprises and brands native to Chengdu.

Keywords: smart manufacturing, achievements, experience, optimization, Chengdu

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* Sun Genjin, Business and Tourism School, Sichuan Agricultural University;
Gao Rui, Business and Tourism School, Sichuan Agricultural University;
Liu Ying, Business and Tourism School, Sichuan Agricultural University.

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Correspondence concerning this article should be addressed to Sun Genjin, Business and Tourism School, Sichuan Agricultural University, Ya'an, 625014, China. Email: 1026740247@qq.com

Introduction

The world is now at a historic intersection of a new technological revolution and a rapid industrial transformation. Against such a backdrop, humanity keeps making technological breakthroughs in areas such as information and communications technology (ICT), biomedicine, new materials, and new energy. Their accelerated integration with advanced manufacturing creates a wonderful opportunity for high-end manufacturing that is smart and eco-friendly. Manufacturing is the mainstay of the real economy, and its strength determines the position of the economy it belongs to in the regional economic landscape. In the context of global changes unseen in a century and an increasingly complex international environment, international competition is becoming more intense in science, technology, and industries. Accordingly, the world's major economies have successively updated their development strategies, giving priority to a manufacturing revival. Among the development strategies, of which smart manufacturing is invariably a critical part.

At present, the Chinese economy is shifting from a stage of rapid development to a stage of high-quality development. To accomplish such a shift, the high-quality development of the manufacturing industries is the key. As China aims to grow from a manufacturer of quantity to one of quality, it is imperative to further transform and upgrade its manufacturing industries to enable the country to climb the global value chain. Smart manufacturing plays a significant role in consolidating the foundation of the real economy, building a modern industrial system, and completing new industrialization. Also, smart manufacturing is a top priority of China as it transforms into a manufacturer of quality, and the progress in smart manufacturing directly concerns the quality of the entire manufacturing industry. To grow from a manufacturer of quantity to one of quality, it will be necessary for China to quickly make its manufacturing industries more digital, better connected, and smarter through technological and industrial innovation. In the era of the Fourth Industrial Revolution, the only strategic path to high-quality manufacturing is to go smart (Li, 2020). Under such circumstances, it is China's responsibility to pursue high-quality development of its manufacturing industries by accelerating its integration with the next-generation information technology, taking supply-side structural reform as the main task and smart manufacturing as the focus, bringing fundamental changes to manufacturing methods and business forms, and making the manufacturing industries more digital, better connected, and smarter. Alongside the rising tide of the Fourth Industrial Revolution, smart manufacturing has become particularly topical in academia. The available literature on smart manufacturing generally falls into four areas. The first area is smart manufacturing's intrinsic mechanism. In this regard, Chen Jin and Li Ruohui (2019) examined three links of the industry chain, namely, smart product research and development, smart production, and smart marketing and management, to explore the intrinsic mechanism under which various innovative forms act on the three links. The second area is smart manufacturing's measurement. In this regard, Ji Liangyu (2021) designed an index measurement system for smart manufacturing in China and measured the levels of smart manufacturing in

30 provincial-level administrative regions from 2003 to 2017 by applying the vertical-horizontal wide range method and the entropy weight method (EWM). The third area is smart manufacturing's impact, which is reflected by fluctuations in the income gap (Liu, et al., 2021), the upgrading of industrial structures (Ji, et al., 2021), the increase in factor productivity (Wen & Zhong, 2021), and the high-quality development of the manufacturing industries (Tang & Chi, 2021). The fourth area is smart manufacturing's path. In this regard, Guo Jin (2021) constructed the "three chains' interaction-enabled industrial upgrade" model to envisage enterprises' main scope of, and possible paths to, smart manufacturing in three dimensions (i.e., technology chain, industries chain, and value chain). The available literature offers insight into this study. Yet, when it comes to smart manufacturing in Chengdu, only one essay by Zhang Meng (2020) focuses on a technological innovation path and an industrial development model. Little research touches upon the smart transformation and upgrading of Chengdu's manufacturing industries in the new era, summarizes its experience in smart manufacturing, or explores an optimal path to smart manufacturing for Chengdu.

As a leading "new first-tier" city, Chengdu has made remarkable achievements in promoting national economic and social development, particularly in building an innovative city over the past years. As for the development of its manufacturing industries, Chengdu focuses on the construction of industrial ecosystems and functional zones to develop five advanced manufacturing segments (i.e., electronic information, equipment manufacturing, health and medicine, new materials, and organic food) and to accelerate the building of a modern and open industrial system for the high-quality development of manufacturing. At the historic intersection of new technological revolution and industrial transformation, Chengdu shoulders a new historical mission and encounters emerging opportunities and challenges on the way to smart manufacturing. Given that, it is time to systematically discuss Chengdu's historical mission and development effectiveness in smart manufacturing in the new era, sum up its development experience, and predict future trends. Chengdu's experience in smart manufacturing, which is instructive to the high-quality development of advanced manufacturing in local practice, can also shed light on the smart transformation of manufacturing industries in other regions and even contribute to the high-quality development of manufacturing industries as a whole in China.

Smart Manufacturing as a Catalyst in Chengdu's Building of a Major Growth Pole for National High-Quality Development

Promotion of Smart Manufacturing: An Inevitable Choice for Chengdu to Achieve the Goal of High-Quality Development of Its Local Manufacturing Industries

To implement the "14th Five-Year Plan" and to promote smart manufacturing in China, eight ministries and commissions, including the Ministry of Industry and Information Technology of the People's Republic of China, jointly issued the "Smart Manufacturing Development Plan for the '14th Five-Year Plan (2021–2025)' Period." The development plan is expected to significantly help China

promote smart manufacturing, complete new industrialization, and build a modern industrial system to consolidate the foundation of China's real economy for sustainable development. In the new round of the fast-moving technological revolution and industrial transformation worldwide, Chengdu, which aspires to become an innovative city, has seized the historical opportunity for high-end manufacturing that is smart and eco-friendly by issuing the "Three-Year Action Plan for Smart Manufacturing in Chengdu (2021–2023)." The action plan aims to lay a solid foundation for smart manufacturing, promote the high-quality development of advanced manufacturing, and optimize and upgrade the whole industrial chain. Based on the new development philosophy of innovative, coordinated, green, open and shared development, the action plan involves furthering the supply-side structural reform. Its significance lies in that the action plan offers policy support to Chengdu's manufacturing industries for innovation and leapfrog development. The action plan can help Chengdu build a demonstration city that takes the lead in smart manufacturing in the Chengdu Plain Economic Zone, the Chengdu-Chongqing city cluster, the urban network of central and western China, and beyond.

Promotion of Smart Manufacturing: An Important Measure for Chengdu to Build a Pilot Zone for Innovation-Driven High-Quality Development

Innovation is the primary driving force of development. In the new development stage, the goal of high-quality development can only be achieved through innovation-driven intensive growth. Smart manufacturing is a systematic innovation that covers the whole industrial chain (Chen & Li, 2019). The promotion of smart manufacturing helps enhance the manufacturing industries' capability to innovate, generate new drivers through new industries, and boost the new economy through new drivers. Of all the elements of urban innovation, industrial innovation plays a critical role in integrating innovation projects, innovative talents, and advantageous capital to produce an agglomeration effect. In recent years, Chengdu has made relentless efforts in industrial innovation, building a new system of modern manufacturing with "a clear architecture, outstanding advantages, and an efficient ecosystem" and significantly improving the capability of industrial innovation. It has made breakthroughs in the development of general-purpose, high-end chips, flexible displays, and liquid-crystal displays (LCDs), meeting advanced international standards, and it is now among the best cities in China, as rated by the advanced manufacturing city development index. Compared with other elements of urban innovation, industrial innovation is closer to the application layer, and can therefore gather related projects, talents, and capital on a larger scale. Chengdu promotes industrial innovation through smart manufacturing and stimulates high-quality economic growth by shaping a new growth powerhouse in China. Such a strategy makes it easier for Chengdu to accelerate the building of a pilot zone for innovation-driven high-quality development.

Promotion of Smart Manufacturing: A Main Path to Chengdu's Integration into the New "Dual Circulation" Development Pattern for the Mutual Reinforcement of Domestic and Overseas Markets

Manufacturing is the engine of sustained economic growth (Yao, 2019), and smart manufacturing

is crucial to the "dual circulation" development pattern for the mutual reinforcement of domestic and overseas markets (Huang, 2020). General Secretary Xi Jinping stressed that this new economic development pattern should take domestic development as the mainstay, with domestic and international development reinforcing each other. It is important that this new development pattern should give full play to China's super large-scale market and well-developed manufacturing system to contribute to international cooperation and help sharpen China's competitive edge. By promoting smart manufacturing, Chengdu can increase the production efficiency of local enterprises and the internal flow of resources. When the deep integration of smart technology and manufacturing becomes a reality, manpower and machine will be fully connected, and all aspects of the product life cycle will be driven by smart means. This deep integration will facilitate customized manufacturing at lower costs with higher efficiency and enrich the entire value chain from research and development to marketing. Through smart transformation, enterprises can improve their global competitiveness and engage in international competition so that domestic and international development can reinforce each other. The promotion of smart manufacturing in Chengdu will help form the new "dual circulation" development pattern for the mutual reinforcement of domestic and overseas markets, upgrade its demand structure and supply capacity to reach a dynamic equilibrium at a higher level between supply and demand, and increase the endogenous power of high-quality development.

Promotion of Smart Manufacturing: A Main Focus for Chengdu to Achieve the Goal of High-Quality Economic Growth Through Supply-Side Structural Reform

Manufacturing is at the core of supply-side structural reform, while smart manufacturing has become the new trend in the manufacturing industries (Song & Xiao, 2019). The supply-side structural reform aims to address the structural contradiction in economic development, optimize factor allocations, and improve the quality and quantity of economic growth. For high-quality economic growth, Chengdu primarily focuses on the smart transformation and upgrading of its local manufacturing industries. Smart manufacturing, with high flexibility and self-organization, enables smart analysis and decision-making in the process of production. Therefore, smart manufacturing helps improve production capacity and efficiency, save factors of production, and respond quickly to changes in market demands (Liu, 2015). The fact that smart manufacturing increases productivity means it can contribute to offsetting the rise in labor costs and the maintenance and improvement of the overall competitiveness of enterprises. Also, smart manufacturing is sure to generate huge demands for related industries and services and thus shape new industrial growth points. In addition, through a new structure of production organization and a new business model, smart manufacturing can dynamically match production with market demand, which is conducive to the reduction of overcapacity, the prevention of excess inventory, and the conservation of resources and energy. Such results are highly consistent with the objectives of supply-side structural reform. The promotion of smart manufacturing in Chengdu, in combination with supply-side structural reform, will enable automatic optimization of resource allocations, reduce operating costs, and achieve high-quality economic growth.

Promotion of Smart Manufacturing: A Major Means for Chengdu to Transform and Upgrade Its Manufacturing Industries to Secure a Competitive Position on the Global Value Chain

Globally, the production model of manufacturing industries is rapidly changing into smart manufacturing, which will reshape the global value chain (Han, et al., 2020). Currently, the COVID-19 pandemic remains rampant worldwide, bringing a serious challenge to the Chinese economy, particularly the ongoing transformation and the upgrading of its manufacturing industries. The view that China's manufacturing industries must climb the global value chain has become a focus of attention in Chinese society (Li, 2018). According to the proposals for formulating the "14th Five-Year Plan," China continues to maintain a stable share of manufacturing in the economy, consolidate and enlarge the foundation of the real economy, promote the deep integration of the Internet, big data, and AI, and develop strategic clusters for advanced manufacturing. Seizing the strategic opportunity brought by the Fourth Industrial Revolution, Chengdu is transforming and upgrading local manufacturing industries by smart means. This effort is expected to help local manufacturers climb the global value chain to a competitive position. On the one hand, during the smart transformation of local manufacturing industries, Chengdu will increase the control of the core links of the value chain through the independent development of key equipment and core software. On the other hand, smart manufacturing will stimulate enterprises to move from a closed-loop value chain to an open network good for creating new added value. The reason is that smart manufacturing facilitates innovative business models. Manufacturing-specific production and business models (e.g., the "new demand orders + big data marketing + participation in production" model and the "products + services" model) will forge a new path to higher value-added areas for manufacturers in Chengdu. Moreover, smart manufacturing has a highly flexible production model, which requires more complex management. Enterprises need to establish an efficient and smart system of operations management to meet customers' whole-process application requirements, from smart production to user-friendly after-sales service. As a major manufacturing hub in China, Chengdu should seize the opportunity of smart manufacturing to continuously improve its manufacturing competitiveness to secure a competitive position on the global value chain.

Achievements of Chengdu's Smart Manufacturing

Thanks to the joint efforts of local enterprises, government authorities, as well as various associations and institutions over the past years, Chengdu has made substantial achievements in smart manufacturing.

Continuous Improvement of the Smart Manufacturing Level

In the "13th Five-Year Plan (2016–2020)" period, Chengdu relied on industrial cloud platforms to develop key industries, such as electronic information, automotive, metallurgy, building materials, food, and light industries. The local government kept strengthening the role of big data and cloud

computing in enabling smart manufacturing, comprehensively popularized the smart production model, and further applied digital, smart, and network technologies to the integrated innovation and application of the entire business process and industrial chains.

Significant Enhancement of Independent Innovation Capability

Revolving around five key areas (electronic information, equipment manufacturing, medicine and health, new materials, and organic food), Chengdu has accelerated the building of a modern open industrial system that consists of industrial ecosystems and functional zones. Special importance has been attached to the high-quality development of advanced manufacturing. Particularly in the "13th Five-Year Plan (2016–2020)" period, Chengdu's electronic information industry grew into a regional giant, whose total output was the highest at the municipal level in central and western China. A sound and complete industrial chain covering components, modules, software, and systems was created. Currently, Chengdu is focusing on industrial innovation, and corresponding innovation capabilities have significantly improved. Breakthroughs have been made in the innovation-driven development of general-purpose high-end chips, flexible displays, and liquid-crystal displays (LCDs), which feature advanced technologies and a high market share.

Steady Rise of Smart Innovations

Chengdu has optimized the innovation ecosystem to promote innovation and resource sharing. It has built resource-sharing platforms to boost technological innovation, accelerated the construction of research infrastructure, and made large research tools and technological data more accessible to the public. It has hosted consecutive sessions of several innovation and entrepreneurship events to better support local entrepreneurs and innovators. Among these events are Chengdu Global Innovation and Entrepreneurship Fair, Venture Tianfu-Jingronghui, and Action Plan of Venture Tianfu Trips. In such a favorable innovation environment, research institutes and their personnel in Chengdu enjoy a greater say in their research. Also, Chengdu has been advancing the pilot reforms for making innovations, with a focus on key technological endeavors, such as technological commercialization, intellectual property rights (IPR) protection, technology-enabled finance (tech-fin) development, and tech-talent attraction.

Gradual Optimization of Development Factor Allocations

Chengdu has kept on the path of parallel advancement of the "Industries 2.0" catch-up, the "Industries 3.0" popularization, and the "Industries 4.0" demonstration. In terms of basic support, Chengdu is building a number of basic supporting platforms for smart manufacturing and forming a smart manufacturing collaborative alliance to facilitate the orderly flow of various innovation factors and convenient interactions of various innovators. Chengdu has already shaped an integrated development pattern, which is driven by demonstration applications, based on smart software and hardware, and supported by a coordinated network of functional zones. This local alliance divides labor

based on the industrial chains, and each member park/zone has a special function (intellectual support, product manufacturing, etc.). In particular, the function of the intellectual support can effectively promote the research and development of key and core technologies in local manufacturing industries, as well as the introduction, cultivation, stimulation, and exchange of top innovators and entrepreneurs.

Relentless Strengthening of Pilot and Demonstration Effects

To ensure a steady increase in the supply of high-quality products and services, Chengdu has continued its investments in technology development, tackling major technical difficulties and enabling product innovations. For example, Tongwei Solar, a leading player in the global crystalline silicon photovoltaic (PV) cell market, has become a model project of smart manufacturing in Chengdu. Its newly launched crystalline silicon PV cell workshop also sets a good example for global PV plants and workshops to go digital and smart, and also for local manufacturers in Chengdu to upgrade to smarter, more digital, and better-connected resources. Another example is Siemens Industrial Automation Products (Chengdu), which was identified as one of the top nine most advanced factories in the world by the World Economic Forum on September 4, 2018. As a model plant, Siemens Industrial Automation Products (Chengdu) applies 3D simulation to product design and development and smart technologies to production, service delivery, and management, attracting professionals from other companies to come and learn its cutting-edge system and apply it to their plant construction.

Constant Emergence of Collaborative Service Platforms

Chengdu has already launched several service platforms for collaborative innovation in the smart economy, thus significantly increasing the efficiency of smart innovation factor allocations and pushing forward local smart manufacturing. These Chengdu-based centers mainly fall into two categories, a collaborative innovation platform or an application platform as a service (aPaaS). Collaborative innovation platforms include the Siemens Industrial Software Global R&D Center, and the Siemens Smart Manufacturing Innovation Center (Chengdu).

Development Experience of Chengdu's Smart Manufacturing

Based on the progress and achievements made by Chengdu in smart manufacturing, four points essential to the accomplishment of smart manufacturing are summarized as follows: raising policy incentives for innovative talents, creating a favorable environment for industrial innovation, and building service platforms to promote innovation.

Raising Policy Incentives for Innovative Talents

Chengdu has implemented the "dream pursuit" project to boost innovation, entrepreneurship, and employment, and optimized the residence registration system to attract young talents. The government issued some policies which made it much easier for various talents to work and settle

down in Chengdu by streamlining household registration procedures for graduates with a bachelor's degree or higher, building high-standard apartments for senior talents, and funding and supporting innovations and startups via multiple channels. Accordingly, a series of talent attraction events have been launched, including the Chengdu Tour for Students from Top Universities, the Tianfu Lab Global Top Talents Recruitment Program, and the Chengdu Talents' Day. Such events serve as platforms to attract all types of talents to Chengdu. Meanwhile, a number of talent attraction and recruitment plans have been implemented, including the "Chengdu Talent Plan," the "Industrial Ecosystem-Specific Talent Plan," and the "Chengdu Action Plan for City Talent Hunting," to speed up the gathering of world-class strategic tech-talents, tech-leaders, top innovation teams, as well as creative and innovative entrepreneurs. In terms of innovations in the tech-fin system, Chengdu has continued to improve the service system of innovation and entrepreneurship for young talents. The above talent policy measures ensure a sufficient supply of human resources for smart manufacturing in Chengdu.

Creating a Favorable Environment for Industrial Innovation

The sustainable development of manufacturing industries in Chengdu requires effective protection of intellectual property rights (IPR). On this basis, Chengdu strives to bring technological innovation closer to the commercialization and application of research findings and mobilize social resources for this cause. Chengdu accelerates the building of local industrial ecosystems and innovation value chains. Revolving around leading enterprises, Chengdu has connected "the dots" to form an innovation value chain. Chengdu has relied on its leading enterprises and their core products to strengthen connections, improve coordination, cultivate local suppliers, and accelerate the building, completion, and enhancement of its industrial chains. It has made a city opportunity list based on application scenarios to create a good environment for international business and speed up industrial agglomeration. Also, Chengdu has increased collaboration in manufacturing development with other cities in the Chengdu-Chongqing economic circle and the Chengdu-Deyang-Meishan-Ziyang region. It has practiced two-way expansion of the application market, facilitated regional collaborative innovation, and introduced supporting industries to create a cross-regional industrial ecosystem for smart manufacturing.

Building Service Platforms to Promote Innovation

For the successful transformation and upgrading of local manufacturing industries, Chengdu has created service platforms to promote innovation. This move helps tackle major technical difficulties and develop a sound and complete service ecosystem for smart manufacturing. Chengdu has relied primarily on platforms to aggregate the industrial chain, the innovation chain, the talent chain, the capital chain, and the data chain to explore the value of new production factors. This move helps improve the integrated management of the supply chains for enterprises and strengthen smart manufacturing's capacity for basic support and empowerment. Focusing on smart informatics, big data, and brain informatics, this platform is supposed to improve corresponding institutional mechanisms into industrial advantages and then into economic benefits.

An Optimal Path to Chengdu's Smart Manufacturing in the New Era

During the "14th Five-Year Plan (2021–2025)" period, Chengdu will be following the trend of the industrial evolution and the new "dual circulation" development pattern for the mutual reinforcement of domestic and overseas markets, vigorously developing a digital economy and giving play to its functions of guidance, leverage, and empowerment. The purpose is to facilitate deep integration of the real economy and the development of digital technologies, such as big data plus, cloud computing plus, the Internet of things (IoT) plus, artificial intelligence (AI) plus, and 5G plus. In the new era, Chengdu should continue to explore an optimal path to smart manufacturing by making the following efforts: a) optimizing top-down design for better policy guidance; b) focusing on technological innovation to improve corresponding innovation capability; c) forging service platforms to break barriers to development; d) strengthening lateral communications to promote collaborative transformations; and e) building leading enterprises and brands native to Chengdu.

Optimizing the Top-Down Design for Better Policy Guidance

The "Smart Manufacturing Development Plan for the '14th Five-Year Plan (2021–2025)' Period," which was issued by the Chinese government in 2021, builds a strong support network for China to seek sustainable, high-quality development of manufacturing industries, achieve the goal of becoming a manufacturer of quality, develop a digital economy, and sharpen its competitive edge in the global markets. In this development context, Chengdu should continue to increase policy support for local manufacturing industries and implement development strategies for Sichuan province and the country to create a favorable environment for manufacturers to develop and go smart.

Chengdu should further advance the factor supply-side structural reform to ensure the orderly flow of factors and the efficient matching of resources to create new competitive advantages of strategic importance for local manufacturing industries. As part of a larger picture, Chengdu should improve its manufacturing industries-related policy support system and align it with development plans for smart manufacturing in Sichuan province and the country. From a local perspective, it should also give ample consideration to local realities and actual needs, build a targeted and innovative local policy system, and regularly refine strategies and plans for the development of smart manufacturing.

Focusing on Technological Innovation to Improve Corresponding Innovation Capability

Against the backdrop of the fast-moving technological revolution and industrial transformation, key and core technologies such as AI and 5G are advancing by leaps and bounds, with new technologies, formats, and models emerging in spurts. Technological innovation has gradually grown into a major driving force for the high-quality development of Chengdu, creating an opportunity for local manufacturing industries to seek innovation-driven development. Chengdu should adapt to the new requirements of the times as quickly as possible and strive for technological breakthroughs in its manufacturing industries to realize smart manufacturing.

There should be a constant pursuit of top teams specializing in the research and development of manufacturing-related technologies. Chengdu should make the most of the nationwide smart transformations of manufacturing industries and integrate human resources by creating talent pools for smart manufacturing. Research and application of big industrial data, smart industries, and innovation ecosystem should be promoted among manufacturing alliances, such as the Tianfu Smart Manufacturing Park, the Chengdu Functional Zone for Smart Application Development, and the China-Germany (Chengdu) International Functional Zone for Precision Manufacturing. Through further cultivation of the existing industrial ecosystem, Chengdu can boost innovation in smart manufacturing and make its manufacturing industries go smart comprehensively.

Measures should be taken to motivate enterprises to enhance technological research and development and highlight the dominant role of enterprises in innovation. By regularly engaging enterprises in manufacturing exhibitions, Chengdu can further publicize and popularize emerging technologies, formats, and smart models in manufacturing industries, and help enterprises understand the necessity to go digital, connected, and smart. It should also launch special promotions for smart transformations of local manufacturing industries to facilitate the exchange and application of successful experiences in smart manufacturing, bring relevant upstream and downstream players together for communication and cooperation, and introduce the concept of smart transformation in multiple directions and through various channels. Moreover, Chengdu can document the development of leading enterprises with a proven record of smart transformations and summarize their successful experiences as examples for others to follow.

Forging Service Platforms to Break Barriers to Development

There is a need to build public service platforms for smart manufacturing to further integrate various resources. Such service platforms can help commercialize the core and generic technologies of smart manufacturing and form a multi-field, cross-regional service center for manufacturing innovation. Chengdu should speed up the construction of public service platforms, where manufacturers can share the massive resources of AI and the IoT more extensively to break barriers to corporate development and solve practical problems for manufacturers.

More efforts should be made to build big data sharing platforms and network security-focused operating systems, and to explore possible approaches to the construction of digital trading platforms. Chengdu should orderly enable data-sharing and access across divisions, fields, and regions while inducing leading big data operators both in China and abroad to make local manufacturing data more accessible. It should increase technical support for big data, smart voice assistants, and other aspects of smart manufacturing and strive to introduce functional centers, application platforms, and collaborative innovation platforms.

Strengthening Lateral Communications to Promote Collaborative Transformations

Collaborative transformations towards smart manufacturing require continuous communications

and sharing of development information among enterprises. Only by doing so can manufacturing industries be improved. Chengdu can bring about more extensive exchanges and cooperation between competitive smart manufacturers both in China and abroad, continue expanding the scope of enterprise cooperation, and empower SMEs through such exchanges and cooperation so that local manufacturing industries can go smart and digital.

Collaborative transformations involve offsetting vulnerabilities by improving supporting facilities and optimizing the industrial chains. To strengthen vulnerable areas, Chengdu should drive technological innovation among local enterprises by introducing advanced technologies from outside (Li, 2020). Also, Chengdu should closely follow the latest development and technological evolution of global manufacturing industries, compare the existing performance of local manufacturers against leading players both in China and abroad, and develop an accurate understanding of its own advantages and disadvantages. On this basis, Chengdu can practice targeted investment attraction to bring in global capital, advanced technologies, and management expertise. Step by step, it can gather related players for cluster development and integrated chain development, and make local manufacturing industries an indispensable part of the global value chain.

More guidance should be given to help proven SMEs with a fine potential in local manufacturing industries to go smart. Chengdu can develop pilot projects featuring smart production and digital processing to offer guidance and inspiration to SMEs about starting a transformation. By further integrating and utilizing available manufacturing resources, Chengdu can build online service platforms for manufacturing industries to share manufacturing data concerning key software and various product models and better help SMEs to go smart. It should take the initiative to guide system integrators, material suppliers, and software developers so that they can develop convenient and feasible solutions for smart transformations according to the actual needs of the SMEs. In addition, Chengdu should encourage "the Internet plus" related enterprises to develop and promote products and services capable of meeting the development needs of the SMEs in local manufacturing industries and of facilitating the deep integration of the next-generation information technologies and smart manufacturing.

Building Leading Enterprises and Brands Native to Chengdu

To realize the potential of advanced manufacturing, Chengdu needs to continuously stimulate local manufacturers, accelerate the cultivation of many more leading enterprises with international competitiveness, regional influence, and industrial leadership, and allow key enterprises to play a leading role in making local manufacturing industries smarter, more digital, and better connected to.

Quick steps should be taken to build brands with international competitiveness. Chengdu should encourage leading manufacturers to further improve their corporate structures through integration and upgrading. Feasible means such as capital increases, mergers and reorganizations, and equity transfers can help attract strategic investors, expand businesses, make the most of integrated resources, and cultivate valuable global brands. Chengdu should continue to build a smart manufacturing cluster and create a favorable industrial ecosystem to enable the incubation and growth of SMEs and the

emergence of local brands. In short, Chengdu should advance the brand-building projects of leading manufacturers so that these leading players can win more honors, improve their brand reputations, and create positive corporate images through media promotions and word-of-mouth marketing.

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The Construction of Value Identity Through Ritual Education: Its Internal Logic and Practice Approach Based on a Case Study of Ritual Education in Jiangsu

Li Xin*

Jiangsu Provincial Academy of Social Sciences

Abstract: Ritual education has become an important social approach to disciplining individuals and constructing value identity because of its unique attributes and its capacity to reshape individual behaviors and values through ritual practice. Only by properly grasping the internal logic of the construction of value identity through ritual education can we accurately identify problems arising from ritual education and put forward practical countermeasures and suggestions accordingly. Through the "eight etiquette rules and four ceremonies" campaign and the national memorial ceremony for the Nanjing Massacre victims, Jiangsu has accumulated rich experience in ritual education. Still, in theory, there remain misconceptions; in practice, old problems persist, such as the preference of form to content and lack of refinement and effective use of ritual symbols. The solution to these problems must be based on a thorough understanding of the internal logic of the construction of value identity through ritual education. It is also necessary to further improve ritual space, ritual practices, ritual symbols, and ritual themes to develop an exemplary Jiangsu approach to ritual education in China.

Keywords: ritual education, value identity, ritual practice, practice approach

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* Li Xin, Institute of Philosophy and Culture, Jiangsu Provincial Academy of Social Sciences.

Correspondence concerning this article should be addressed to Li Xin, Institute of Philosophy and Culture, Jiangsu Provincial Academy of Social Sciences, Nanjing, Jiangsu. Email: lixin7626@163.com

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Discipline and value identity are crucial to both a particular group and society as a whole. The formation of group consciousness and the maximization of group interests are only possible when everyone consciously abides by social norms and shares a value identity.

Ritual refers to a collection of symbols with expressive functions, and it is a symbolic and repetitive behavioral system that is highly pervasive and subject to specific social norms. Ritual education, with the aid of ritual practice and in the light of behavioral norms, is an important social means to discipline individuals and construct a value identity. Ritual education in China now falls into two categories: school-led ritual education (for students) and government/social organization-led ritual education (for all citizens).

School-led ritual education, which is characterized by patriotism, also involves rites of passage targeting different age groups. For example, there is a coming-of-age ritual education program① designed to prepare high-school students for adulthood. Social organization-led ritual education covers a wide range of rituals and activities related to traditional Chinese culture and folkways, aiming to inspire a feeling of citizenship, promote traditional culture, and build cultural confidence. Some examples of such culture-themed rituals and activities include the New Year bell ringing and blessing ceremony and the dragon boat racing during the Dragon Boat Festival. Government-led ritual education is primarily patriotism-themed, consisting of commemorations and ceremonies to mark major historical events. Among them are the anniversary of the founding of the Communist Party of China, the National Day celebration, and the national memorial ceremony for the Nanjing Massacre victims. It is fair to say that ritual education is an important way to improve the citizenship of a country and a key part of social life.

Jiangsu is among the best provinces in China for economic growth and cultural development. It is a major province with abundant educational resources and a clear competitive edge in education. There is a well-known saying that "education in Jiangsu is among the top in China." Jiangsu has attached great importance to ritual education for a long time and has accumulated valuable experience in this regard. Still, its ritual education is not without problems, and some

① The coming-of-age ritual education (to prepare adolescents for turning 18) involves three steps: civic awareness education for the 16-year-olds about to receive the Resident Identity Card; volunteer service during the preparation for adulthood (i.e., transition from 16 to 18); and the coming-of-age oath ceremony in front of the national flag at the age of 18. The coming-of-age ritual education came out of the first session of the Huangdu Township Group Celebration of the 18th Birthday held by the Communist Youth League Committee of Huangdu Township, Jiading County, Shanghai Municipality, on April 29, 1990. With endorsements from the Central Committee of the Communist Party of China (the CPC Central Committee) and the State Council, the celebration was successively included in several outlines and policies such as the "Outline on Conducting Patriotic Education in the New Era," the "Program for Improving Civic Morality," and in "Several Opinions of the CPC Central Committee on Further Strengthening and Improving the Ideological and Moral Construction of Minors." The Central Committee of the Communist Youth League of China has also been attaching great importance to this campaign and has issued multiple documents to regulate the coming-of-age ritual education (to prepare adolescents for turning 18) so that this campaign can be promoted smoothly by local Communist youth leagues. Among those documents are the "Interim Opinions of the Central Committee of the Communist Youth League on Regulating the Coming-of-Age Ritual Education to Prepare Adolescents for Turning 18" (1996), the "Notice on Deepening the 1999 Coming-of-Age Ritual Education to Prepare High School Students for Turning 18" (1999), the "Notice on Continuing to Vigorously Promote the Coming-of-Age Ritual Education to Prepare Adolescents for Turning 18" (2000), the "Decision of the Central Committee of the Communist Youth League on Commending the 1999 Excellent National Organizers of Coming-of-Age Ritual Education to Prepare Adolescents for Turning 18" (2000), the "Decision of the Central Committee of the Communist Youth League on Commending the 2000 Excellent National Organizers of Coming-of-Age Ritual Education to Prepare Adolescents for Turning 18" (2001), as well as the "Notice on Deepening the 2002 Coming-of-Age Ritual Education to Prepare High School Students for Turning 18" (2002). The documents are combined to give a strong impetus to the development and popularization of coming-of-age ritual education (to prepare adolescents for turning 18) nationwide.

problems are, in fact, typical of ritual education in China. A review of the development of ritual education in Jiangsu can help identify such problems and put forward practical countermeasures and suggestions. This move is of great relevance to the further promotion of ritual education and the building of a broader value identity across China at a time when "the world is undergoing profound changes unseen in a century."

The Internal Logic of the Construction of Value Identity Through Ritual Education

Ritual education has become an important social approach to disciplining individuals and constructing value identity because of its unique properties and its capacity to reshape individual behavior and values through ritual practice. Only by properly grasping the internal logic of the construction of value identity through ritual education can we accurately identify problems arising from ritual education and put forward practical countermeasures and suggestions accordingly. Thus, to explore ritual education, we should begin with the internal logic of the construction of value identity through ritual education.

The healthy and orderly development of human society depends on the degree of socialization of the individuals within the society. The socialization of individuals is mainly manifested in two basic forms, namely, passive socialization and active socialization. Passive socialization is a process in which society regulates individual behaviors in various ways to conform them to social norms. Active socialization is a process through which individuals become motivated to shape themselves into what others want them to be and act on it. Didactic teaching as a passive tradition may reflect the passive socialization of individuals, while ritual education, by virtue of its strong physical participation, acts as a catalyst for transforming individuals from passive to active players in socialization.

One key feature of ritual practice is "physical presence." When a ritual is in progress, its discourse is artificially encoded into a highly stylized series of postures, gestures, and other body movements. Such highly stylized movements shape human memories and expressions and define in an abstract way individual existence and self-presentation in reality. Through such a series of postures, gestures, and other body movements, "physical presence" makes specific behavioral norms and value identity visible and palpable.

In ritual education, "physical presence" first concerns certain ritual space, which is a specific form of spatial taming by society. Ritual is an important sequence of social interactions. Its practice reflects the relational being of individuals in the social order and the social discipline for individuals through spatial order. Ritual space is an epitome of social order on which a ritual is based and a carrier of social discipline.

According to Karl Marx (1845), "The human essence is no abstraction inherent in each single individual. In its reality it is the ensemble of the social relations." The relational being of

individuals is reflected by both social order and spatial form to which social order is attached. This spatial form can either refer to the entire social form on the macro level or to the living or activity space on the micro level. Space defines the objects therein, the relationship between/among the objects, as well as the value judgments and behavioral norms of the people therein. As there is a variety of intertwined spatial forms, individuals need to have a clear idea of the spatial forms they are in and their spatial rules and adjust their behaviors accordingly.

The establishment and evolution of social order depend on its corresponding spatial order. A society is a group of people who share a common culture, religious belief, value identity, or spatial territory. Ties within or between those groups can be strong or loose. Such different affinities manipulate people's spatial preferences, which in turn shape the social functions and spatial composition of buildings and thereby form a definite and recognizable spatial order.

> Societies change and grow, they are transformed from within and adapt to pressures and influences from without. Objective conceptions of space and time must change to accommodate new material practices of social reproduction. (Harvey, 2015, p. 253)

Due to the continuous expansion of human living space, new spatial forms keep emerging, and they overlap and interact with each other to form an increasingly complex socio-spatial order.

In ritual education, role-playing is an important result of "physical presence," and it is key to the transformation of individuals from passive to active players in socialization through social discipline.

In social life, everyone is given a specific social role, and each role has its own specific code of conduct. By accepting and playing the predefined roles, participants actively embark on a process of self-discipline and self-categorization. As ritual practice is highly stylized and symbolic, its nature of "performance" is self-explanatory. Ritual space is a relatively closed stage where each participant is assigned a role to play according to established fixed procedures. The smooth progress of ritual practice relies on the joint effort of all participants to play their roles according to the established "script." The relatively closed space and fixed roles, along with spatial regeneration, make ritual practice a crucial way to cultivate discipline. In ritual practice, spatial taming belongs to passive socialization, in which external forces discipline individuals and reshape their relational being through the construction of ritual space, whereas role-playing belongs to active socialization, in which individuals take the initiative to be disciplined and socialized.

In *The Presentation of Self in Everyday Life*, Erving Goffman argued:

> When an individual plays a part he implicitly requests his observers to take seriously the impression that is fostered before them. They are asked to believe that the character they see actually possesses the attributes he appears to possess, that the task he performs will have the consequences that are implicitly claimed for it, and that, in general, matters are what they appear to be. (Goffman, 2008, p. 15)

The key to role-playing lies in the delivery of impressive performance capable of convincing

others. To this end, one must act in accordance with character design and make sure that one's words, gestures, and moves all conform to social norms.

Social discipline for individuals is not just about introducing and teaching a series of special languages and gestures but also about constructing a close and stable one-to-one match between these special languages/gestures and human bodies so that these details form an important basis of embodied cognition. Through repeated "acting training" day after day, individuals gradually have various details internalized, thus acquiring body memory and muscle memory and making the role a "perfect fit" for corresponding social norms.

Apart from role-playing, "physical presence" in ritual education also offers the possibility of building an emotional connection.

Ritual practices in the social dimension are highly stylized group behaviors.

> (It) is an important mechanism, for it automatizes and dis−individualizes power. Power has its principle not so much in a person as in a certain concerted distribution of bodies, surfaces, lights, and gazes; in an arrangement whose internal mechanisms produce the relation in which individuals are caught up. (Foucault, 2019, p. 217)

Under the guidance of specific ritual procedures and the pressure of self-evaluation for self-identity, individuals are subject to strict behavioral constraints and show a high degree of consistency in emotional changes or fluctuations, making it possible to build an emotional connection on the broadest possible basis.

In ritual practice, participants' emotional connections, which are built on "empathy" arising from ritual interactions, are also a critical driving force behind individuals' active internalizations of social discipline. There is a neuron called a mirror neuron that is directly observed in humans. This neuron "mirrors" the behavior of the other, as though the observer were itself acting. Empathy is a driving force that enables us to adapt and change based on our own experiences. "Without empathy, we would not be able to connect to each other in any meaningful way, nor would we have the desire or inclination to care for each other" (Ciaramicoli & Ketcham, 2019, p. 26). Humans have a genetic predisposition or inherent desire to seek empathy and friendship with other persons or species. It is this desire that makes humans open their hearts to those with similar feelings, become dependent on them, and act in concert with them. In short, empathy is the emotional basis of role-playing in ritual practice.

During ritual practice, for external spatial taming and individual role-playing alike, collective attention-generated emotional connections impel individuals to behave in accordance with social norms. Mutual imitation of actions, emotional connections, and self-categorizations for social identity are all unique attributes that determine ritual education as an important approach to the construction of value identity and form the internal logic of ritual education as a catalyst for developing values.

Ritual Education in Jiangsu: Development Status and Practical Difficulties

Ritual education in Jiangsu, which is similar to that in other provinces of China, falls into two categories by organizer: school-led ritual education (for students) and government/social organization-led ritual education (for all citizens). School-led ritual education in Jiangsu mainly involves a variety of patriotism-themed activities, such as the national flag-raising ceremony, the initiation ceremony for new Young Pioneers of China, the initiation ceremony for new members of the Chinese Communist Youth League, and the memorial ceremony for the martyrs.

In 2014, the office of the Steering Committee for Ethical and Cultural Progress of Jiangsu province strengthened the promotion of civility among minors. To this end, they formulated and issued the "Opinions on Introducing Civility Education for Minors in Jiangsu Province" and the "Basic Etiquette Rules for Minors in Jiangsu Province" and launched the "eight etiquette rules and four ceremonies"① campaign. The steering committee also introduced corresponding implementation rules and performance indicators for schools. This initiative has become a highlight of ritual education in Jiangsu over the past years.

After several years of promotion, the "eight etiquette rules and four ceremonies" campaign is now an important part of ritual education in primary and secondary schools of Jiangsu. This campaign pays great attention to details of life and is easy to perform and evaluate. Also, it allows minors to appreciate the beauty of etiquette through daily bits and pieces and to develop civilized habits by osmosis. Having contributed significantly to the improvement of ritual education and cultural ethos of Jiangsu, this campaign is critically acclaimed in society.

Government/social organization-led ritual education (for all citizens) in Jiangsu aims to promote traditional culture and build cultural confidence and covers a wide range of rituals and activities related to traditional Chinese culture and folkways. Every year when the Laba Festival② comes, the Laba congee-giving ceremony is staged in major temples (the Jiming Temple, the Xuanzang Temple, the Pilu Temple, etc.) in Nanjing. Also, on New Year's Eve and during the Spring Festival, there is usually a bellringing and blessing ceremony held at famous cultural

① The "eight etiquette rules" include: a) appearance etiquette (clean face, proper dressing, neat hairstyle, and graceful manner); b) ceremonial etiquette (salute by the rules, standing in awe, preservation of grave and dignified bearing, and observance of customs and conventions), c) speech etiquette (use of polite language, keeping calm, listening with patience, and interaction with sincerity and friendliness), d) social etiquette (respect of teachers and seniors, maintenance of good partnerships, exercise of tolerance and comity, and treatment of others in good faith), e) road etiquette (compliance with traffic rules, avoidance of traffic conflicts by "yielding, slowing down, and stopping," helping the old and the weak, and seat offer to those in need), f) sightseeing etiquette (cherishing of landscape and cultural relics, respect of folkways, and abidance by social ethics), g) travel etiquette (observance of public order, protection of environment, attentive appreciation, and polite applause), and h) table etiquette (attention to hygiene, cherishing of food, reduction of food waste, and elegant eating). The "four ceremonies" include the matriculation ceremony (for seven-year-olds), growth ceremony (for 10-year-olds), adolescence ceremony (for 14-year-olds), and coming-of-age ceremony (for 18-year-olds).

② The most important day of the twelfth month of the Chinese lunar year is the eighth day, which was known as "*la-ri*" in ancient China and has been popularly referred to as the Laba Festival. Before the Qin dynasty, the Laba Festival was mainly about the worship of ancestors and gods, as well as the celebration of the new harvest and prosperity. After Buddhism spread to China during the first century, the festival on the eighth day of the twelfth month was used as a commemoration of Gautama Buddha's enlightenment at the age of 35. Since then, the Laba Festival has also been celebrated by Buddhists as the Buddha's Enlightenment Day.

attractions (the Xuanzang Temple, the Qixia Temple, the Jiming Temple, the Pilu Temple, the Tianfei Palace, etc.) in Nanjing. These ceremonial activities have increased cultural diversity for local people and promoted traditional culture, playing an important role in building a sense of cultural identity and cultural confidence.

Moreover, Nanjing, the capital of Jiangsu province, regularly holds the annual national memorial ceremony for the Nanjing Massacre victims as an important part of ritual education in Jiangsu. This annual memorial ceremony, in the strict sense, came out of a memorial service for the Nanjing Massacre victims held in Nanjing, Jiangsu province, on December 13, 1994. Its ritual procedures include speeches by relevant officials, air defense warnings, wreath-laying, and peace bell striking. On February 27, 2014, the seventh Meeting of the Standing Committee of the 12th National People's Congress adopted a resolution to proclaim December 13 as the day of the national memorial ceremony for the Nanjing Massacre victims. Following that, the first national memorial ceremony was held at the Memorial Hall of the Victims in Nanjing Massacre by Japanese Invaders in Nanjing on December 13, 2014. The national memorial ceremony for the Nanjing Massacre victims has since been held annually in accordance with highly standardized ritual procedures at the same memorial hall on December 13.

Take the first national memorial ceremony (in 2014) as an example. Its ritual procedures in sequence are as follows: a) a military band began their performance, and the whole audience sang the national anthem in unison; b) an air defense warning went off at the ceremony, and all stood in silent tribute; c) soldiers laid wreaths in memory of the victims of the Nanjing Massacre to requiem music; d) teenagers read out a declaration of peace; e) President Xi Jinping, together with the representatives of the Nanjing Massacre survivors and the representatives of the Young Pioneers, unveiled the Public Memorial Tripod[①]; f) the CPC and state leaders on scene delivered speeches; and g) (six) representatives from Nanjing rang the peace bell while (3,000) doves were released into the air.

In general, Jiangsu has been advancing ritual education in three dimensions: a minors-oriented dimension, a citizens-oriented dimension, and a social dimension. Minors-oriented ritual education relies primarily on the "eight etiquette rules and four ceremonies" campaign. Citizens-oriented ritual education is facilitated by public cultural services. Society-oriented ritual education is based on the annual national memorial ceremony for the Nanjing Massacre victims to advocate patriotism and peace. Through unremitting effort, Jiangsu has made substantial achievements and accumulated valuable experience in ritual education, but problems remain.

First, there are misconceptions of the rituals themselves, resulting in a superficial knowledge of the internal logic of ritual education.

Although ritual education is widely accepted as an important approach to the construction

① Note: This procedure (i.e., procedure "e") only existed in the first national memorial ceremony, which Xi Jinping attended as General Secretary of the CPC Central Committee, President of the People's Republic of China, and Chairman of the CPC Central Military Commission.

of value identity, little is known about how ritual education enables individuals to change their attitudes and develop their values in both mind and practice. Some even believe that value identity comes into being naturally as ritual practice occurs more frequently.

In fact, individuals may conduct a self-evaluation to gain social recognition, or they may act in accordance with social norms due to social pressure, or out of an emotional connection in a particular context. Such actions are only prompt responses made by individuals to a particular social context for public self-image purposes and shall not be deemed their heartfelt identification with important social norms or value judgments based on their private self-concepts. Given that, ritual practice enables individuals to share values while receiving social discipline only through a change of individual attitudes. Any change of attitude, however, is a rather complicated process, which involves the inheritance and continuation of ritual symbols, the shaping of individual behaviors in accordance with social norms, and the exertion of influence on individual attitudes through individual behaviors to build a value identity compliant with social norms. We must have a thorough understanding of the internal logic of the construction of value identity through ritual education if we want to make the most of ritual practice to nurture core socialist values.

Second, ritual participants are less motivated, preferring form to content.

Misconceptions about the intrinsic mechanisms of rituals often lead to ritual organizers' placement of too much emphasis on their own dominance while ignoring the part of participants in ritual practices. As a result, participants become less motivated, preferring form to content, and ritual education faces the risk of being reduced to a mere formality full of sanctimonious clichés.

The ultimate goal of ritual education is to build an emotional connection among participants on the broadest possible basis and transform this emotional connection into a value identity. Emotional connections depend on emotional interactions, and the ritual itself is an interactive process. Interactions allow us to feel each other's emotional changes and develop empathy, for which reason it is a prerequisite for constructing a value identity.

Third, there is a lack of refinement and effective use of ritual symbols.

According to Randall Collins:

> High levels of emotional entrainment—collective effervescence—are ephemeral. How long will the solidarity and the emotional mood last? This depends on the transformation of short-term emotions into long-term emotions, which is to say, the extent to which they are stored in symbols that re-invoke them. Symbols, in turn, differ as to what kind of group solidarity they invoke, and thus what symbolic/emotional memories or meanings will do in affecting group interactions, and personal identities in future situations. (Collins, 2012, p. 125)

Thus, ritual symbols are key to invoking group solidarity and transforming short-term emotions into long-term emotions. Ritual symbols are created as a special bond to help pass down memories and maintain solidarity and emotional moods. But, at least for now, ritual education in Jiangsu and even the whole country is compromised by a lack of refinement and effective use

of ritual symbols. Even for such an important ceremony as the national memorial ceremony for the Nanjing Massacre victims, there is still much room for improvement in the creation of ritual symbols.

The Jiangsu Approach to the Construction of Value Identity Through Ritual Education

To promote the development of ritual education and improve its effectiveness, we must first have a good understanding of the basic characteristics of rituals and the internal logic of the construction of a value identity through ritual education. In view of the problems arising from ritual education in Jiangsu and the characteristics of ritual education itself, more efforts should be made in four main aspects to advance ritual education in Jiangsu.

Further Strengthening the Building of Ritual Space to Create a Space System for Ritual Education with Characteristics Unique to Jiangsu

As aforementioned, ritual space is an epitome of social order on which a ritual is based and a carrier of social discipline. The establishment and evolution of social order depend on its corresponding spatial order. Throughout human history, almost all important rituals and ceremonies have been held in their own separate special spaces. For example, a church, which is a building used for Christian worship services and other Christian religious activities, is one of the most ceremonial spaces. The whole church space, including all details from the exterior to the interior, is designed to manifest the Christian social order, define the relationship between the congregation and God, and regulate the congregation's behavior.

Regions with favorable conditions in Jiangsu should be encouraged to create special spaces for ritual education in accordance with corresponding value orientations and educational objectives. Through spatial details, a ritual space conveys various symbols and metaphors as psychological cues to participants to achieve the goal of value transmission.

Improving the Role-Playing of Ritual Practice to Develop an Immersive Model of Ritual Education in Jiangsu

The degree of individual participation in a ritual practice determines how a person recognizes and feels about the value conveyed by a ritual. Thus, role-playing is key to the transformation of individuals from passive to active players in socialization. For this reason, in a campaign on CPC history learning and education, participants are required to embark on a new Long March, eating what the Red Army soldiers used to eat and wearing what they wore. Through these stylized actions, they play the role of the Red Army soldiers. Such role-playing, which is detail-oriented, can help people today to appreciate the valuable spirit of the Red Army, that is, "fearlessness, sacrifice, perseverance, bravery, toughness, and enterprise."

The greatest strength of role-playing is that it can break the limits of time and space in both mind and behavior to the maximum extent and facilitate heart-felt communications and understanding. Role-playing is vital to the effectiveness of ritual education. Therefore, Jiangsu should take the initiative to improve the role-playing of ritual practice and the presentation of ritual education to develop an immersive model.

Advancing the Creation of Ritual Symbols to Prepare Jiangsu for Building an Emotional Connection in Ritual Education

Ritual practice is an emotionally interactive process. "At the center of an interaction ritual is the process in which participants develop a mutual focus of attention and become entrained in each other's bodily micro-rhythms and emotions" (Collins, 2012, p. 47). The concrete expression of this "mutual focus of attention" is a ritual symbol. Most ritual symbols "consist of 'condensation' symbols, which Sapir defines as 'highly condensed forms of substitutive behavior for direct expression, allowing for the ready release of emotional tension in the conscious or unconscious form'" (Turner, 2012, p. 36). Ritual symbols are important ritual outcomes that serve to invoke memories and emotional connections in ritual practice.

The creation of ritual symbols has remained a weak spot in ritual education in China. To some extent, this weakness affects the effectiveness of ritual education, particularly memorial ceremonies like the national memorial ceremony for the Nanjing Massacre victims. The primary function of commemorative ceremonies is to pass down memories and construct value. Ritual symbols, which are important parts of commemorative ceremonies, are highly condensed forms of substitutive behavior for direct expression. Rich in symbolic meanings, ritual symbols are created as a special bond to help pass down memories and maintain solidarity and emotional moods. It is only through ritual symbols that rituals are long preserved in the cultural structure of human beings and become an important way to pass down memories.

A review of memorial ceremonies with international influence testifies to the irreplaceable role of unique ritual symbols in raising the profile of those ceremonies.

One example is the Red Poppy (AKA remembrance poppy)[①], an artificial flower often worn on clothing leading up to Remembrance Day (on November 11th) in Commonwealth member states to commemorate their military personnel who died in the war. The origin of the Red Poppy as a national symbol of remembrance can be traced back to the World War I poem "In Flanders Fields," written by Canadian physician John McCrae on May 3, 1915 and later published on December 8, 1915. This poem is one of the most quoted literary works from the war and is frequently used at memorial ceremonies. Because of its references to the red poppies growing over the graves of fallen soldiers, the Red Poppy became a widely recognized memorial symbol in many countries for soldiers killed in the conflict. The Red Poppy symbol has helped build an emotional connection on the broadest possible basis.

These special ritual symbols are of great significance to the construction of value identity

through ritual education. At present, there are only a few ritual symbols (e.g., the date "12.13") for the national memorial ceremony for the Nanjing Massacre victims. These ritual symbols have not yet been widely recognized by the public or generated any far-reaching impact. To date, they have failed to raise the international profile of this national memorial ceremony. There is a need to further study the Nanjing Massacre to help solidify the ritual symbols of its memorial ceremony at the state level. Also, we should improve its design and standardize its application scope, methods, and approaches according to actual needs.

Striving to Institutionalize Ritual Themes to Highlight the Value Development of Ritual Education in Jiangsu

The annual national memorial ceremony for the Nanjing Massacre victims is by far the highest-profile and most influential form of ritual education in Jiangsu. Now that this national memorial ceremony has become a major commemoration with international influence, it is important for the organizers to follow the international practice and create an annual theme for this commemorative series.

As aforementioned, it is an international practice to create a theme for a major commemorative series. Take the International Holocaust Remembrance Day [On January 27, 1945, the Soviet Red Army entered Auschwitz, Poland, and liberated the survivors of that network of concentration camps], January 27th, as an example. There is a specific theme for the event each year. For example, the theme of the 2018 Holocaust memorial ceremony was "Holocaust Remembrance and Education: Our Shared Responsibility." "The theme highlights the universal dimension of the Holocaust and encourages education on this tragedy so that future generations will firmly reject all forms of racism, violence, and anti-Semitism" (UN, 2018).

For a major commemorative series, its theme is designed to help develop a "mutual focus of attention" and build an emotional connection effectively. So far, no definite theme has been identified for the national memorial ceremony for the Nanjing Massacre victims and related commemorative activities. The lack of a theme makes it difficult to highlight this commemorative series. If this commemorative series continues to be themeless, its contribution to patriotic and peace education will be compromised, and attention fatigue will occur among the public, which will be detrimental to its continuation and promotion. It is thus necessary to institutionalize the creation of themes for this commemorative series. The creation of themes should be carefully considered and developed so they can maximize both the significance of the Nanjing Massacre and its cultural implications.

① At its conference in 1920, the (National) American Legion adopted the red poppy as their official symbol of remembrance.

Conclusion

The healthy and orderly development of society requires the harmonious unity of value rationality and instrumental rationality. In today's world of pervasive instrumental rationality, the feasibility of almost any action can be determined through the calculation of benefits. The abuse of instrumental rationality has plunged humans into a quagmire of self-interest, which inevitably leads to a decline in social morality. The regression to value rationality can help restore people's faith, which is expected to rekindle their common hopes and dreams for a better world and impel them to fight for it. As ritual practice is a major approach to the construction of value identities in human societies, how to give play to ritual education in shaping dominant value identities in line with the common interests of mankind in today's complex and globalized world has become a critical issue that every region, nation, and neighborhood must face.

The emergence and continuation of rituals are driven by the common human quest for intrinsic identity and the predictability of self-development, as well as by biological and natural phenomena. Rituals can connect the past, present, and future to achieve continuity. A continuity that supports a common belief that certain ideas and thoughts can be passed on from generation to generation through rituals. All rituals (including the national memorial ceremony for the Nanjing Massacre victims, the "eight etiquette rules and four ceremonies," festivals, and traditional rites) reflect people's aspirations for a better life, greater morality, and a brighter future. There is no denying that rituals and ritual education will continue to change with the times in terms of notion and approach. Only by thoroughly grasping the internal logic of the construction of value identity through ritual education can we find the essential patterns of ritual evolution and ritual education in the future.

Rituals originated in primitive man's worship of nature and have evolved with human societies ever since. Humans have gone through the initial worship of nature to the worship of totems, and then to totemism before eventually shaping their values and beliefs. This long process is not only about the symbolization of things, but also about the solidification of value identities and behavioral norms. Ritual education involves external spatial taming, spontaneous individual role-playing, and ultimately the formation of common value identities. In ritual education, individuals who are driven by a desire for social identity and self-realization transform from passive to active players in socialization, becoming strong advocates of core social values and staunch defenders of group interests. "The rite [ritual] serves and can serve only to sustain the vitality of these beliefs, to keep them from being effaced from memory and, in sum, to revivify the most essential elements of the collective consciousness" (Durkheim, 2018, p. 518).

Value rationality goes for beliefs, which, however, does not mean absolute anti-utilitarianism, but emphasizes the balance of short-term and long-term interests and the harmony of the part (individuals) and the whole for win-win results. Currently, mankind is tested by the COVID-19

pandemic, which is still running rampant worldwide. At this critical stage, we must adhere to the right values, make every effort to safeguard the common interests of mankind, and consciously regulate individual behaviors. By doing so, we can expect to build a harmonious international community and achieve win-win results.

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On Rhyme and Symmetry in the Translation of Tang Poetry: A Case Study of Xu Yuanchong's English Translation of 300 Tang Poems

Tian Yuman*

Sichuan Normal University

Abstract: Ancient poetry represents historical and cultural legacies accumulated by the Chinese nation for thousands of years and underpins the strong cultural confidence of the Chinese people. Tang poetry distinguishes itself from other literary works with its beautiful rhyme and symmetry. Previous studies of English translations of Tang poetry mostly focused on appreciation, analysis, and critics of different translation versions. Few researchers have delved into the specific translation methods for achieving the rhyming and symmetrical effects of Tang poetry in the target text. This paper examined Professor Xu Yuanchong's English translation of *300 Tang Poems* as the research object, and elaborated on how to retain the rhyming and symmetrical effects of Tang poems. This paper also summarized some practical methods that can be applied to translating Tang poems. Rhyming can be realized by the addition of end rhyme words and changes in word or line order. Symmetry can be achieved by the omission of a modifier or predicate, the addition of function words, changes in word order, or parallelism with the original sentence structure.

Keywords: Tang poetry, rhyme, symmetry, Xu Yuanchong, *300 Tang Poems*

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* Tian Yuman, School of Foreign Languages, Sichuan Normal University.

Correspondence concerning this article should be addressed to Tian Yuman, School of Foreign Languages, Sichuan Normal University, Chengdu, 610101, China. E-mail: 1349585316@qq.com

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Introduction

With thousands of years of history, the Chinese nation boasts a rich and profound traditional culture, which is the cornerstone of our strong cultural confidence. As one of the most significant treasures in Chinese literature, the poetry of the Tang Dynasty ("Tang poetry") has played a vital role at home and abroad. With unique literary features, their beauty and influence have never faded with the passage of time. Tang poetry features many allusions that have profound and lasting connotations, reflecting China's deep cultural heritage. The rhyme schemes made up of level and oblique tones make Tang poems catchy and brilliant. Moreover, the concision and implicitness of Tang poems arouse abundant emotions, imaginations, and thoughts in readers. With such unique literary charm, they have attracted numerous scholars to annotate them. In the meantime, they have been translated into English by a number of famous translators and spread to Western countries, so that their charm can reach a wider audience.

In Chinese academia, studies on poem translations mainly focus on the application of the "Three-Beauty Principle" to poem translations and appreciation. Some studies have analyzed the translation of Chinese poems from a specific cultural perspective, such as costumes or wine culture, traditional festivals, or culture-loaded words. Other studies have explored the translations of rhetoric in Chinese poems or introduced a new theoretical perspective to guide and evaluate poem translations. Poetry uses a flexible and rhythmical language to intertwine rich imagination with sober reasoning and instinctive sensibility with explicit concepts (Lin, 2006). I hold that rhyming and structural symmetry constitute the two most prominent features of Tang poetry. Existing studies of these two features mainly analyze from a linguistic perspective, and few of them explore specific translation methods for realizing the two features. Centering on rhyming and symmetry, I examined *300 Tang Poems*, translated by Professor Xu Yuanchong, as the research object, and summarized some translation methods that can be applied to achieving the rhyming and symmetrical effects of Tang poems.

Rhyme

Tang poetry is generally classified into *guti shi* poems before Tang Dynasty and *jinti shi* poems after Tang Dynasty by genre. *Jinti shi*, also called *jinti* poems after Tang Dynasty, is the genre of poetry that is studied the most. It took shape in the early Tang, mainly including *jueju* [quatrain] and regulated verses. Among them, five-character quatrains and seven-character-regulated verses were extremely popular. The greatest feature of *jinti shi* lies in its strict rule on rhyme. That is to say, the same rhyme must be followed throughout the lines, and rhyme words are of level tones generally (Jiang, 2008). In addition, ancient poets must create poems according to the strict rhyming standard set by the imperial court.

Rhyme schemes of English poetry are different from those of Tang poetry. Comparatively

speaking, English schemes are simpler and less strict. English poetry also rhymes with the repetition of the same or similar syllables at the end of verse lines. Due to the different number of lines, a quatrain, a cinquain, and even a sonnet vary in the placement of end rhymes within the lines or stanzas. Poems with four lines as a stanza usually follow the rhyme scheme of aabb\abab. Those with eight lines as a stanza adopt the pattern of aabbccdd\ababccdd (Li, 1985). Compared to Chinese poetry, English poetry adopts freer and more diversified rhyme schemes. It is possible that an English poem has different end rhymes while Tang poems must strictly follow the rhyme scheme and use the same end rhyme throughout the lines. The freer English rhyme scheme offers poets more room for creation in that they are not bound by a strict rhyming pattern. Therefore, in the translation of Tang poems, we can use such freer rhyme schemes to achieve the sound and rhythmical effects of poetry with several end rhymes in a stanza or a change of end rhymes. Then how can we achieve these effects with end rhymes in our translation practice? Our study of *300 Tang Poems*, translated by Professor Xu Yuanchong, summarizes his translation methods for rhyming into three types: addition of end rhyme words, change of word order, and change of line order.

Addition of End Rhyme Words

End rhymes refer to a verse line's last word, which contains a syllable whose sound is identical or similar to that of the last word in the line above or below. If, after initial translation, the lines do not end in syllables that are rhymes, then some words may be added to obtain the rhyming effect. The addition does not affect the main idea of the source text (ST) since it is inferred from the context or used as a complement for what is omitted.

Example 1

ST: 羌笛何须怨杨柳，春风不度玉门关。(Wang Zhihuan, *Out of the Great Wall*)

TT: Why should the Mongol flute complain no willows grow?
Beyond the Gate of Jade no vernal wind will blow.

Example 2

ST: 滟滟长江水，悠悠远客情。(Wei Chengqing, *Parting with My Younger Brother*)

TT: The long, long river coolly flows;
My parting sorrow endless grows.

Example 3

ST: 自君之出矣，不复理残机；
思君如满月，夜夜减清辉。(Zhang Jiuling, *Since My Lord from Me Parted*)

TT: Since my lord from me parted;
I've left unused my loom.
The moon wanes, broken-hearted;
To see my growing gloom.

Example 4

ST: 生女犹得嫁比邻，生男埋没随百草。(Du Fu, *Song of the Conscripts*)

TT: A daughter can be wed to a neighbor, alas!
A son can only be buried under the grass!

In Example 1, there is no mention of the "growth" of willows in the first line of the ST, but Professor Xu (hereinafter referred to as "the translator") added a verb "grow" after "杨柳" [willows] to rhyme with and match the verb "度" [blow] in the subsequent line. The original poem depicts the scene when the general and soldiers heard the song titled *Willows*, a song of grievance, played by someone with a Mongol flute, and felt that their mood was fully expressed (Zhuge, 2010). The ST states that a spring wind was blowing, but it does not mention willows' growing. Moreover, willows in the ST refer to the name of a song, but the translator creatively described them as real objects. In Example 2, with each line made up of nouns only, the two lines feature the nominal structure, which is commonly used in Tang poetry. Or we may take them as elliptical sentences, i.e., sentences without predicates. Obviously, when they are translated into English, we must add predicates. The translator selected "flow" and "grow" to collocate with "长江水" [the Yangtze River water] and "远客情" [emotion for a departing friend]. This choice complies with the context and logic of the ST, and provides the unrhymed two ST lines with a rhyming effect, reflecting the translator's great originality. In Example 3, the translator intensified the heroine's emotion of missing her husband into "broken-hearted" and translated the "减" [decreasing] into "增" [growing], further escalating the emotion to "gloom" and showing her anguish over the fact that the moon she saw was a full moon, but she still cannot reunite with her husband. The use of "broken-hearted" and "gloom" not only reflect the heroine's sentiment of missing, but also rhyme with "parted" and "loom" in the first two lines, creating a beautiful sound effect. In Example 4, the translator added a modal particle "alas" at the end of the translated line of "生女犹得嫁比邻," which rhymes with "grass" in the following line. Du Fu wrote the *Song of the Conscripts* to reflect the severe influence of the imperial court's wantonly engagement in wars, so that families suffered from losing their sons in battles while their daughters could at least survive by marrying neighbors. The lines imply Du Fu's deep sympathy for the miserable lives of the people. The addition of "alas" is therefore reasonable from an emotional perspective.

Change of Word Order

This is mainly achieved by the change of word order in a verse line, or the change of the normal sequence of a modifier and the modified word, usually by inversion, for instance, putting the adverbial at the front or the adjective after the noun. Rhyming is thus realized by changing the word order. After the new arrangement, the sentence pattern differs from the conventional usage, but moderate inversion can highlight displacement—an original feature of Tang poetry. Displacement, or inversion, is common in Tang poetry. The frequent practice is to place a predicate before a subject, preposition an adverbial, or put an adjective after a noun. Sometimes a word needs to be placed at the end of a line for the purpose of rhyming.

Example 1
ST: 纵使晴明无雨色，入云深处亦沾衣。(Zhang Xu, *To a Guest in the Hills*)

TT: Even on a fine day when the sun's shining bright;
Your gown will moisten still in the thick of clouds white.

Example 2

ST: 自君之出矣，不复理残机。
思君如满月，夜夜减清辉。(Zhang Jiuling, *Since My Lord from Me Parted*)

TT: Since my lord from me parted;
I've left unused my loom.
The moon wanes, broken-hearted;
To see my growing gloom.

Example 3

ST: 即此羡闲逸，怅然吟式微。(Wang Wei, *Rural Scene by River Wei*)

TT: For this unhurried life I long,
Lost in singing "Home-going song."

In Example 1, the translator reversed the phrase "白云" [white clouds] and put "white" after "clouds" to echo "bright" in the "shining bright" of the previous line through reasonable deliberation. As the word "cloud" actually implies "being white," the addition of "white" here seems redundant, but it is for the purpose of making the couplet rhyme to create the beautiful sound effect of poetry. From this perspective, we may think that the translator added an end rhyme. But from another perspective, we see that it makes sense for him to translate "白云" into "white clouds" for emphasis and the post-position of the adjective shows his effort for rhyming. Example 2 was mentioned in the analysis of the first method, but here what is involved is the first two lines, which relate to the change of end rhymes. By normal word order, "自君之出矣" should be translated as "since my lord parted from me" literally. But the translator put the preposition at the front and formed an inversion. Such a sentence pattern is rarely used conventionally since the predicate is put at the end of the sentence. Generally speaking, predicates are placed at the front in inverted sentences. Although such a rendition does not comply with the general practice of inversion, it is not frequently used by the translator and shows his effort for the rhyming effect. In this way, the word "parted" in the first line becomes a rhyme for the word "broken-hearted" in the third line. Example 3 and Example 2 are similar. Both feature the preposition of the prepositional phrases, so that the rhyme words can be placed at the end of the lines. For the English translation of Tang poems, we often see translators put prepositional, participial, or adjective phrases at the front of lines. Sometimes, a single adjective may be placed after a noun for the rhyming effect. This changing of word order approach, however, does not apply to all kinds of words. Translators should still adjust the order by English grammatical rules and the actual context. Otherwise, the English translation would be grammatically wrong.

Change of Line Order

This is done by changing the sequence of the adjacent two lines or part of the words in the lines

for rhyming with a previous line without changing the original meaning of the verse. The premise is that the described thing is complete and retains its wholeness even after the change of the sequence.

Example 1

ST: 山光忽西落，池月渐东上；
散发乘夕凉，开轩卧闲敞。(Meng Haoran, *Longing for Xin the Elder*)

TT: Suddenly daylight fades o'er western hill;
Gradually climbs the moon o'er eastern pool.
With window open, at ease I lie still;
With hair unloosed, I enjoy evening cool.

Example 2

ST: 独在异乡为异客，每逢佳节倍思亲；
遥知兄弟登高处，遍插茱萸少一人。(Wang Wei, *Thinking of My Brothers on Mountain-Climbing Day*)

TT: Alone, a lonely stranger in a foreign land,
I doubly pine for my kinsfolk on holiday.
I know my brothers would, with dogwood spray in hand,
Climb up the mountain and miss me so far away.

In Example 1, the sequence of the original lines "开轩卧闲敞" and "散发乘夕凉" were switched to make "hill" and "still," "pool," and "cool" rhyme in the pattern of "abab," which is very common in English poetry. Through the two lines, the poet described the scene in his house. The change of the sequence does not affect the atmosphere of a relaxed lifestyle that the poem was intended to express. Therefore, it is feasible to switch the sequence of certain lines for rhyming. In Example 2, the English translation of the words "登高" [climb up the mountain] and "遍插茱萸" [with dogwood spray in hand] switched places in the original verse. The poem describes that the poet, who lived somewhere far away from his home, recalled the days when he and his kinsfolk climbed up a hill with dogwood worn on their heads to have fun together. It goes on to show that on that special day, the locals still went climbing, but the poet could not join them (Zhuge, 2010). The last two lines depict his sadness as a man wandering about, far from his family. Though the English translation splits them into two sections, what is rendered has the same meaning. In this way, "land" and "hand," "holiday" and "away" rhyme with each other. Compared with Example 1, the translator only switched the positions of a few words instead of two whole lines. But the underlying approach is the same. It is to switch two sentences or parts of the sentences for the rhyming effect without affecting the conveyance of the original meaning.

For the English translation of Tang poems, rhyme schemes such as aabb or abab are often followed deliberately to match the tradition of English poetry and retain the rhyming feature of Tang poetry. Methods such as the addition of end rhyme words, and change of word or line order, are applied for rhyming. Rhyming must be taken into consideration when translating such poems into English to keep the beauty of the sound effects of Tang poems.

Symmetry

Antithesis or antithetical parallelism is a common rhetoric method in Chinese and an important feature of poems after Tang Dynasty, which, however, does not require that each couplet be antithetic. Generally speaking, the two middle couplets in a regulated verse should be antithetic. For instance, four-couplet regulated verses, a common form in Tang poetry, generally have antithetic lines in the second and third couplets. There are a variety of antithetical forms and criteria for classification. Take the accuracy of antithesis as an example. There are antithetic forms requiring exact pairs of words, opposite words of the same category, words of a different category, and extraordinary antithesis. Classified by position, antithetical forms include same-line antithesis, antithesis one line apart, antithesis in the following line, antithesis in different places in two lines, corresponding repetition of the same word in the same place in two lines, and a run-on couplet (Jiang, 2008). Antithesis in Tang poems features symmetry in meaning and form, like a noun corresponding to a noun, a verb to a verb, words with similar or opposite meanings in the same number of words and with an identical structure. The antithetical form in Tang poems should be maintained as much as possible during translation to realize the poetic beauty of the form. Professor Xu held that translators must think hard about the way to translate antithesis in Tang poems to convey their beauty. If the translation is merely equivalent to the original poem in meaning without rhyme and symmetry, it cannot retain the style and charm of the original poem (Xu, 1983). Therefore, the beauty in rhyme and symmetry in Tang poems should also be rendered as much as possible in English. Symmetry in form is mainly reflected in the exact number and order of words. Attention should be paid to the adjustments of word number and order. In the following text, examples were taken from *300 Tang Poems*, translated by Professor Xu, to elaborate on the methods for realizing symmetry in translation, which include: the omission of a modifier or predicate, the addition of function words, change of word order, and parallelism with the original sentence structure.

Omission of a Modifier or Predicate

In certain cases, the modifier before a noun in the ST can be omitted, so that the English couplet can achieve equivalence in the number of words and structure. It is well-known that Tang poetry features concise language expression. Sometimes, if modifiers in the ST are completely retained, the translation would be redundant, undermining the succinctness of the ST. Therefore, on the premise that the holistic meaning of the ST is unaffected, some modifiers can be omitted for concision.

Example 1

ST: 山花如绣颊，江火似流萤。 (Li Bai, *Passing by the Triumphal Tower at Night*)

TT: The flowers blow like cheeks aglow,
And lanterns beam as fireflies gleam.

Example 2

ST: 空外一鹗鸟，河间双白鸥。(Du Fu, *Alone I Stand*)

TT: A falcon hovers in the sky;
A pair of gulls on water glide.

In Example 1, "山花" refers to wildflowers in a mountain forest. In the ST, "山花" corresponds to "江火," [literally, flame on the river], which actually means lanterns at the riverside. The ST states that the glimmering light in the lanterns was just like light produced by fireflies. If the word "江火" is translated into lanterns at the riverside, then the TT would be too long, losing the concise linguistic feature of a five-character quatrain, a typical form of Tang poems. Likewise, in order to match the single word "lantern," the best way is to delete the modifier "山" from "山花." The translation without such modifiers looks more symmetrical and concise, meeting readers' expectations for Tang poems—a terse and indirect language style. Example 2 is also an antithesis with "鹞鸟" corresponding to "白鸥." Originally, "鹞鸟" refers to a kind of fierce bird while "白鸥" means white gulls. Here the translator omitted both modifiers for the terseness of the sentence pattern. "一" [one] and "双" [two] are both numerals, but the translator changed them into "a" for the effect of an equivalent structure. In addition, the translator omitted the predicate which is the same as that in the first line when he translated the second line "河间双白鸥." This choice is in line with English grammar and syntax, which do not favor repetition. In English, if the predicates in a compound sentence are the same, the second predicate is often omitted in the subsequent part of the sentence. If nouns are to be repeated, pronouns are often used to refer to a word mentioned above. Therefore, "glide" was used in the second line to avoid repeating the word "hovers," and the English rendition can also rhyme.

Addition of Function Words

This means adding the same kind of words to antithetical lines for unity in form. Such function words are generally placed at the beginning of the lines, including articles, pronouns, or conjunctions. The addition of the same type of words highlights the beauty through the form of couplets. In addition to this method, the same sentence structure or tense can also be used to achieve formal equivalence in an obvious way.

Example 1
ST: 来如春梦几多时，去似朝云无觅处。(Bai Juyi, *A Flower in the Haze*)
TT: She comes like vernal dreams that cannot stay;
She goes like morning clouds that melt away.
Example 2
ST: 草露亦多湿，蛛丝仍未收。(Du Fu, *Alone I Stand*)
TT: The dewy grass may wet the wing,
The spider's nest may trap the weak.
Example 3
ST: 抽刀断水水更流，举杯消愁愁更愁。(Li Bai, *Farewell to Uncle Yun, Imperial Librarian, at Xie Tiao's Pavilion in Xuancheng*)
TT: But when we cut water with sword, still it will flow;

When we drink to lighten grief, heavier it will grow.

Example 4

ST: 魂来枫叶青，魂去关塞黑。(Du Fu, *Dreaming of Li Bai*)

TT: When it came, green would maple forests loom;

When it went, dark mountains were left in gloom.

Subjectless sentences are typical in Chinese, especially in Tang poems. In Example 1, the subject "she" was added by the translator to the couplet, so that the structure of the two lines looks symmetrical and unified. If "comes" or "goes" had been used to start the sentence, the couplet would not have been so symmetrical. In addition, the translator restored predicates that seemed to be missing in the ST intentionally and used attributive clauses to justify them. In this way, the couplet looks symmetrical both in structure and meaning. In Example 2, the definite article "the" was used to lead the couplet and makes readers feel that the sentence patterns are quite orderly. In fact, "dewy grass" and "spiders' nest" differ in forms because the former is an adjective-plus-noun phrase while the latter is the possessive case of a noun. Using "the" to create a unified sense of structure is a smart and effortless way to achieve the beauty of symmetry, which is essential to Tang poems. Moreover, in the following lines, the same modal verb and sentence structure were used so that two symmetrical couplets were created for readers. In Example 3, the conjunction "when" was used to connect the main clause and the subordinate clause so that even at first glance, the couplet looks unified in form. For the main clauses in the following lines, a sentence pattern of "it will..." was used. The touching couplet "抽刀断水水更流，举杯消愁愁更愁" strikes a sympathetic chord in audiences so that it has been recited and eulogized for thousands of years. The reiterative locution in "水水" [water] and "愁愁" [grief] touches readers' hearts and souls, showing the self-evident benefit of repetition in Tang poetry. The translator kept this style of narration and used "when" and "it will" twice to echo the strengthening effect of the ST. Therefore, the translation of the two lines makes the grade that the translator has always pursued—beauty in a form which brings poetic beauty to readers. In Example 4, conjunctions were also used to unify the entire sentence pattern of the poem. The consistent use of "it" as the subject and the match between the adjectives "green" and "dark" make the sentence pattern look more symmetrical. In the ST, both "青" and "黑" are placed at the end of the sentences, but it is grammatically unusual to put them this way in English. Therefore, the translator changed the sequence of "green" to make it correspond to the position of "dark." It is also worth noting that although English does not favor repetition, this preference is often shown in the omission of a repeated noun or verb. For other parts of speech, such as conjunctions, articles, and pronouns, repetition is quite common in English. Such words are thus often repeated in the translation of Tang poems to achieve beauty through the form of the poetry.

Change of Word Order

This means adjusting the order of certain ST words in the TT for formal equivalence. Generally speaking, the sentence structure of an antithesis and the parts of speech should be consistent. Partial

adjustments may be made, especially at the beginning or the end of lines, for symmetry. Adjustments at the beginning of lines give readers a sense of visual symmetry, while those at the end of lines are usually for rhyming.

Example 1

ST: 上有青冥之长天，下有绿水之波澜。(Li Bai, *Endless Longing*)

TT: Above, the boundless heaven spreads its canopy screen;
Below, the endless river rolls its billow green.

Example 2

ST: 草枯鹰眼疾，雪尽马蹄轻。(Wang Wei, *Hunting*)

TT: Keener o'er withered grass his falcon's eye,
Lighter on melted snow his steed trots by.

Example 3

ST: 分野中峰变，阴晴众壑殊。(Wang Wei, *Mount Eternal South*)

TT: Peaks vary in north and south side;
Vales differ in sunshine or shade.

In Example 1, "青冥" means blue sky. According to the rule for symmetry in Tang poetry, "青冥" should correspond to "波澜" [waves] while "长天" [long sky] should echo "绿水" [green water]. In English, "long sky" and "blue sky," "green water" and "waves," have an overlapping or inclusive relation. In the ST, the order of "绿水" and "波澜" was deliberately switched, so that "天" (*tian*) and "澜" (*lan*) could rhyme. The translator restored the proper order, so that the translation presents a consistent sentence pattern and an exact symmetry, in which "the boundless heaven" corresponds to "the endless river" and "canopy screen" echoes "billow." As for the translation of the couplet in Example 2, "疾" [keen] and "轻" [light] were placed at the beginning of the lines and changed to a comparative form. In this way, the two adjectives look more coherent in form, and the sentence structure is more symmetrical. A method can be drawn from Example 2 that when we translate Tang poems, we can preposition words of a similar form (such as participle, comparative, or superlative adjectives) to create the beauty of symmetry, a unique aesthetic effect of Tang poetry. In Example 3, the couplet actually has displaced parts which are mainly for an aesthetic effect or sometimes for rhyming. Likewise, the translator switched the original order of words and restored the normal order for symmetry as the ST has, and made "side" and "shade" rhyme. Therefore, proper adjustments to sentence structure can make the sentence look balanced and symmetrical. This is a method adopted by the translator consciously to enhance playfulness and the symmetry of the lines.

Parallelism with the Original Sentence Structure

This refers to completely literal translation according to the structure of the original poem, just like copying the structure and sequence of the ST. This method is simple and direct. It can be done just by matching the symmetrical structure and conveying the basic meaning of the ST lines. It can retain the meaning and structural form of the ST to the greatest extent. Since the lines of a Tang poem

are quite symmetrical, a translator does not need much effort to adjust the structure and only needs to imitate it.

Example 1

ST: 大漠孤烟直，长河落日圆。(Wang Wei, *On Mission to the Frontier*)

TT: In boundless desert lonely smokes rise straight;
Over endless river the sun sinks round.

Example 2

ST: 无边落木萧萧下，不尽长江滚滚来。(Du Fu, *On the Height*)

TT: The boundless forest sheds its leaves shower by shower;
The endless river rolls its waves hour after hour.

Example 3

ST: 在天愿做比翼鸟，在地愿为连理枝。(Bai Juyi, *The Everlasting Regret*)

TT: On high, we'd be two birds flying wing to wing;
On earth, two trees with branches twined from spring to spring.

In Example 1, both the ST and the TT adopt a sentence structure featuring the preposition of an adverbial modifier, then followed by a subject and a predicate. Such a sentence structure complies with both Chinese and English grammar. In comparison with other sentence patterns in Chinese, this sentence structure does not require many conversions in the TT and can be rendered with a linear translation. The sentence pattern in Example 2 resembles that in Example 1. In Example 2, the couplet adopts a subject-predicate-object-adverbial modifier pattern, which is quite common in both Chinese and English. Therefore, a literal translation can be applied with general consistency in the parts of speech and the number of words. Example 3 is of a similar structure as Example 1, i.e., adverbial modifier-subject-predicate-object, except that the translator highlighted the adverbial modifiers by isolating them from the main clauses with commas. This generates formal beauty in symmetry, making the two opposite words "在天" [on high] and "在地" [on earth] rejuvenate the ST effect. Therefore, if the TT can be made by corresponding directly to the ST, it is the best way to retain the beauty in both the meaning and the form of the original poem.

Antitheses play an important role in the longstanding popularity of Tang poetry. Although Chinese and English poetry differ dramatically in their forms, it is a critical issue in translation to retain symmetry. I selected a number of examples from *300 Tang Poems*, translated by Professor Xu, to summarize four methods for realizing the symmetry of Tang poetry, including omission of a modifier or predicate, the addition of function words, change of word order, and parallelism with the original sentence structure.

Conclusion

Rhyming and symmetry are two key features of the everlasting popularity of poetry. Poetic Chinese language developed from the condensation of writings in classical Chinese. Poem

translation is, therefore, never a simple task. Instead, it features creative subversion. Among literary translation, creative subversion in poem translation is prominent. The concise language yet unlimited connotations of poems often put translators in a dilemma. If they put their emphasis on retaining the meaning, then the form may be ruined, and vice versa (Xie, 2014). There are some opinions in academia criticizing the translation of *300 Tang Poems* by Professor Xu, claiming he focused too much on rhymes and failed to reproduce the soul of Tang poetry, so his translations can hardly be regarded as Tang poems in the true sense (Liu & Yang, 2014). But I think that considering the unique linguistic features of poetry, we obviously need to lay more emphasis on its form, even at a certain cost to the meanings. Moreover, poem translation is by no means a simple project and cannot be easily accomplished. It requires translators to hone their translation skills, so they can convey not only the emotions of the original poems, but also the beauty of the poetry in tones and forms. Based on the above analysis of the translation of *300 Tang Poems* by Professor Xu, I conclude that the following practical methods can be applied to reflect the features of Tang poetry. The rhyming effect can be realized by the addition of end rhyme words and changes in the word or line order. Symmetry can be achieved by the omission of a modifier or predicate, the addition of function words, changes in word order, and parallelism with the original sentence structure. It is hoped that more translations of Tang poems can be spread globally, and that more Western readers can have access to the charm of Tang poems.

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Study on the Application of the Restrictive Admission in the Newly-Revised Provisions of the Supreme People's Court on Evidence in Civil Procedures

Zheng Ni

Party School of Sichuan Committee C.P.C.

Yang Yang*

Sichuan University

Abstract: The Supreme People's Court classifies admission into two types—complete admission and restrictive admission—according to the degree and scope of admission. Article 7 of the newly-revised *Provisions of the Supreme People's Court on Evidence in Civil Procedures* provides clear rules for restrictive admission, which is divided into partial admission and conditional admission. In judicial practice, it is relatively easier to identify partial admission. However, the determination of conditional admission entails further considerations regarding whether there is a legal nexus between the attached condition and the admitted fact. Therefore, this study argues that there is a lack of unified rules regarding the applicability of restrictive admission in practice. Starting from the examples from the Supreme People's Court, this study analyzed the application of conditional admission in judicial practice, as well as the problems and causes in the application of restrictive admission in practice. This article also explores the route to perfecting the rules of restrictive admission from the perspectives of its definition, classification, the *onus probandi* (burden of proof) and supporting mechanisms.

Keywords: evidence in civil procedures, admission, discretion, determination of evidence

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* Zheng Ni, the Teaching and Research Department of Law, Party School of Sichuan Committee C.P.C;
Yang Yang, College of Marxism, Sichuan University.
Correspondence concerning this article should be addressed to Yang Yang, College of Marxism, Sichuan University, Chengdu, 610065, China. Email: 1065559176@qq.com

Statement of the Problem

In 2019, the Supreme People's Court of the People's Republic of China promulgated the *Decision of the Supreme People's Court to Amend the Provisions of the Supreme People's Court on Evidence in Civil Procedures*, which was the most comprehensive and systematic amendment to the *Provisions of the Supreme People's Court on Evidence in Civil Procedures* (hereinafter the Provisions) since its implementation in 2002. During the process of soliciting opinions around on the Provisions, there were debates on whether the clause of restrictive admission should be added in terms. Some argued that this clause would be unnecessary given that the facts and evidence of any cases are contingent on the determination of the People's Court in accordance with the circumstances of the case. Also, the statement of this clause, "determine whether it constitutes admission," is not in the affirmative, and its meaning is ambiguous. Thus, it is unnecessary to stipulate it. However, most believed that stipulating restrictive admission is necessary. For example, some pointed out that "restrictive admission is common in the judicial practice of civil cases, especially in contract and tort procedures" (Ruan, 2018).

In the past few years, the academia has continued the discussion about whether restrictive admission should be established in civil procedures. Whether a system should be explicitly stipulated in laws, regulations, and judicial interpretations is consequent on whether it addresses urgent practical problems in judicial practice. In China, one of the media that best reflects the urgent problems in judicial practice is the website "China Judgments Online." Therefore, we searched for relevant judgments to obtain more objective data. As of December 30, 2021, we had retrieved 370 judgments in China Judgments Online; 49 by searching "restrictive admission"; 32 by searching "conditional admission"; 94 by searching "admission with conditions"; 195 by searching "partial admission." Among them, most were civil disputes over contracts, and many cases entailed the court of the second instance or further. Clearly, the provision of restrictive admission have a wide application in judicial practices and should be stipulated in relevant clauses.

Restrictive admission is an important form of admission. Refining the rules of restrictive admission is conducive to promoting a more comprehensive system of rules of admission. Most parties and their attorneys, when stating or admitting a fact adverse to them, do not speak without reservation. Even when stating a fact adverse to themselves, they tend to relate this fact to other facts favorable to them. Namely, even when a party gives a relatively complete statement in formulating all the facts, adverse facts cannot be completely dissociated from favorable facts. Therefore, it is imperative to taxonomically classify them to specifically regulate this scenario to build a comprehensive system of rules on restrictive admission. Studying restrictive admission rules is helpful for judges' determinations based on lawfully recognized evidence in specific trials. In judicial practices, the parties, and their agents often cannot fully prove the facts that they state and do not identify the facts of restrictive admission. The lack of clear judicial stipulation on the rules

of admission may easily lead to an unfavorable judgment against the party or judicial injustices. Therefore, as a suggestive clause with no direct legal consequences, restrictive admission has great significance in judicial practice.

Definition of Concepts Relevant to the Rules of Admission

The rules of admission in civil procedures can be classified into complete admission and restrictive admission. Restrictive admission is a concept derived by virtue of extension of the concept of complete admission. In the broader sense, restrictive admission means adding a set of limitations to admission, while whether the facts given through restrictive admission can be established is determined by the judge.

The Concept of Complete Admission

Complete admission means a party admits the fact claimed by the adverse party in the procedure, also called unconditional admission, it produces the effect of exempting the adverse party from discharging the burden of proof . Article 3 of the Provisions clearly stipulates that admission entails "a party stating any fact adverse to itself, or explicitly expresses its admission of the fact during the procedures." Scholars commonly summarize the definition of admission as "a statement of fact adverse to a party made by itself during the oral arguments or preparatory procedures in a lawsuit that is consistent with the allegations of the adverse party"(Zhang, 2017). Admission is the establishment of a fact that is averse to the party by itself, either through making a statement or through admitting to the adverse party's statement.

Admission occurs during the lawsuit, and its forms include the presentation of oral arguments or briefs. Section 2 of Article 3 of the Provisions stipulates that "if a party explicitly admits any fact adverse to itself in the course of exchange of evidence, questioning, or investigation, or in briefs such as complaints, replies, and attorney's statements, the provisions of the preceding paragraph shall apply." However, beyond the litigation process, a party's admission of a fact adverse to itself does not count as admission in Procedure Law. It can only serve as evidence materials for the judge in the determination of facts. However, the laws of China do not stipulate that admission has the effect of restricting the judges. Therefore, in judicial practice, admission during and beyond the procedure is an auxiliary tool for the judge can use to identify the facts of a case and basically produces a similar effect.

The Concept of Restrictive Admission

Restrictive admission is a conditional and incomplete admission, meaning a party has a set of attached restrictions when making an admission. Namely, it sets attached conditions or restrictions to the admitted fact with the intention of counteracting the legal validity of admission (Xi, 2004). According to Article 7 of the Provisions, restrictive admission entails that "when a party admits the

fact adverse to them claimed by the other party with restrictions, or conditionally, the People's Court shall determine whether this counts as admission in the specific case ." In other words, admission here is not complete and unconditional but restricted with certain conditions attached (Luo, 2002). In the situation of restrictive admission, the court takes into consideration the circumstances of the case to determine whether it constitutes admission and produces the effect of admission in accordance with the intentions of the party that admits. For example, A sues B and demands that B to pay back a loan of RMB100 thousand, but A has no evidence of lending money in cash in the first place. B states to the judge that he/she will admit the debt of RMB100 thousand to A only if A admits that B has already paid back RMB50 thousand. In this scenario, the statement of B constitutes restrictive admission. In judicial practice, to identify the facts in a case, the judge usually does not allow parties to make a restrictive admission, but in cases with inadequate evidence, the strategies of offense and counterplea of the parties should be respected to determine the effectiveness of restrictive admission not from the perspective of "what things should be" but from the perspective of "what things are."

In judicial practice, the determination of restrictive admission is contingent on the effective and professional analysis of the judge after comprehensively accounting for the facts of the case, and concepts of similar categories need to be differentiated. With regards to a party's admission and its attached condition, comprehensive judgment is essential to avoid simply and mechanically separating the admitted fact from its attached conditions. If the fact admitted by a party and the attached conditions belong to the same legal relationship, then in the determination of whether it constitutes admission, the two facts should be considered together. If the fact admitted by a party and its attached condition do not belong to the same legal relationship, i.e., they belong to two different legal relationships, then they can be determined separately. Thus, the admitted fact can be deemed an admission, while the attached condition can be identified as an additional independent claim of the party. So, restrictive admission and the defense of a party need to be differentiated in practice. In the procedure, counterplea is a means of protection from a claim, where a party asserts a fact that is different from the allegation claimed by the opposing party in order to exclude the fact claimed by the adverse party and to dismiss the adverse party's claim. Therefore, when a party raises a counterplea, they shall bear the burden of proof for the counterplea raised. In conditional admission, if a party makes an independent attack or defense with another fact and this fact has no legal relationship with the fact alleged by the other party, then the party making an admission should bear the burden of proof for the attached condition. If a party makes an independent offense or defense with another fact and this fact has a legal relationship with the fact alleged by the opposing party, then, as attached condition is already part of the burden proof of the adverse party, the judge should comprehensively consider the circumstances of the case and distribute the burden of proof (Wang, 2003).

Categorization of the Provisions of Restrictive Admission

In the previous version of the evidence in civil procedures, although no distinction is made

between complete admission and restrictive admission, it is highly important to distinguish the two in judicial practice, especially in contract disputes where cases involving restrictive admission are very common. According to the interpretations of the Supreme People's Court, restrictive admission can be classified into two types: partial admission and conditional admission.

Partial Admission

In a situation where one party admits a part of the fact claimed by the adverse party while not admitting the rest. It is easy to determine that the part of the fact admitted by the party constitutes admission, for which the adverse party bears no burden of proof. For example, the plaintiff claims that the defendant borrowed RMB100 thousand, but the defendant only admits a loan of RMB80 thousand. The loan of RMB80 thousand constitutes partial admission, for which the plaintiff bears no burden of proof, but the plaintiff still needs to produce evidence for the rest of the RMB20 thousand. In another example, in the case No. 2 [2018], Civil Petition, the People's Court of Huaiyin Area, Huai'an, Jiangsu Province, the applicant for retrial (plantiff of the trial at first instance) Wu claims that the respondent (the defendant of the trial at first instance) Sun borrowed a total of RMB18.2 thousand in two installments in 2013, out of which RMB2.5 thousand were paid in two installments, but the remaining RMB15.7 thousand have not been paid. The respondent did not sign a promissory note at that time, but both parties described the fact, and the exact amount of the loan in the subsequent WeChat chat record, and the respondent did not deny the above facts. In the court of first instance, the respondent admitted the fact of borrowing money but only admitted an amount of RMB14 thousand. The respondent also claimed that RMB10 thousand had been returned with RMB4 thousand remaining. Throughout, however, the respondent did not provide any evidence of repayment to support this claim. In this case, Sun's statement constitutes partial admission. After investigations, the judge of the retrial asserted that "the applicant claims creditor's rights of RMB18.2 thousand against the respondent but only provides WeChat chat history as proof. The amount of loan in the chat history was unilaterally stated by the applicant, and the respondent did not make any response, so this evidence cannot prove the applicant's claim, nor does the applicant provide other relevant evidence to support the claim. Therefore, it is consistent with current laws and regulations that the judge of the trial at first instance did not approve this claim. The statement of repayment of RMB10 thousand with a debt of RMB4 thousand remaining by the respondent during the court of first instance constitutes conditional admission, and the pre-condition of this admission is that he/she only admits a debt of RMB14 thousand to the applicant, instead of RMB18.2 thousand claimed by the applicant because the applicant failed to discharge the burden of proof with regards to the loan of RMB18.2 thousand (*Wu v. Sun*, 2018)."

Conditional Admission

The attached condition can be separated from the admitted fact, i.e., the attached condition has no legal nexus with the admitted fact. It is an additional independent means of attack or defense when a party admits a fact alleged by the adverse party. In this situation, it should be determined that

restrictive admission produces the legal consequence of admission. The independent claim added by the party making admissions does not affect the actual existence of the part of the fact in that admission, and the party bearing the burden of proof should provide further evidence in accordance with the principle of distribution of the burden of proof in civil procedures. For example, the plaintiff sues the defendant for borrowing RMB100 thousand. The defendant admits the fact of a loan of RMB100 thousand but claims that the loan of 100,000 RMB has already been repaid. This constitutes conditional admission, where the condition and the admitted fact can be separated. The admission of a loan of RMB100 thousand by the defendant constitutes complete admission. The claim that the loan of RMB100 thousand has already been repaid constitutes a new allegation of fact, an independent means of opposition or defense, and the defendant should provide evidence to prove its allegation of a new fact. In another example, in the case No. 2866 [2016], Civil Petition, the Higher People's Court of Jiangsu Province, Wu claims that there were counterfeit banknotes of RMB900 in the wages distributed by Fangxing Company and sues Fangxing Company, requesting compensation for the loss of RMB900. In the court of first instance, Wu did not provide evidence for this fact. Fangxing Company made an admission that Wu had raised the problem of counterfeit banknotes, and the company had accepted the responsibility of compensation for RMB500. Based on the admission of Fangxing Company, the court of first instance determined the loss to be RMB500 without supporting the remaining RMB400. In this case, the fact that Fangxing Company accepted responsibility for Wu's loss due to counterfeit banknotes constitutes the situation of conditional admission in restrictive admission. Namely, the legal representative stated that "Wu raised the problem of 9 counterfeit banknotes. I did not ask further and said that wherever the banknotes came from, I will compensate for half of them. I gave Wu RMB500." In terms of whether the wages distributed by the company contained counterfeit banknotes, Fangxing Company claims that accepting responsibility for the loss due to counterfeit banknotes does not indicate that they admit the fact that the counterfeit banknotes came from the company in the first place. Rather, they agree that wherever the counterfeit banknotes came from, they will compensate for part of the loss. Therefore, the judge of the retrial determines after investigations that the admission of Fangxing Company does not constitute the admission of Fangxing Company being the origin of the counterfeit banknotes. Rather, it is a conditional admission, namely, the attached condition and the fact admitted are separate (*Wu v. Kunshan Fangxing Technology LLC*, 2016).

The attached condition cannot be separated from the admitted fact, i.e., the attached condition has a legal nexus with the admitted fact. When a party admits a fact alleged by the adverse party with certain conditions or limitations, on the ground of the inseparability of admission, the court should not quote out of context or separate the attached condition from the fact admitted to the point of making determinations adverse to the party that admitted. The court should take into consideration the whole picture and determine the fact based on the investigation of evidence and the overall circumstances of the oral arguments. For example, the plaintiff sues the defendant and demands the repayment of a loan. The defendant states that if the plaintiff can provide the original copy of

the promissory note, he/she shall admit the fact of the loan. This constitutes conditional admission where the attached condition and the fact admitted cannot be separated. The People's Court should determine whether it constitutes admission after comprehensively considering the circumstances of the case. For the defendant, there is a risk that it constitutes admission (Lv, 2006). In another example, in the case No. 556 [2015], Civil Petition, the Intermediate People's Courts of Taizhou, Zhejiang Province, the appellant Pei voluntarily signed a promissory note to the appellee Xi and the two parties had no objection as to the determination of the court of first instance that this case entails private lending. It should be determined that the appellant admits a private lending relationship involving RMB100 thousand between his/her father and Xi and voluntarily undertakes this debt. Therefore, the appellant Pei should repay the principal and interest of the loan as agreed in the promissory note. As for the question of whether the fact holds that Zheng, the mother of Pei, had repaid RMB90 thousand to the respondent, the court determines that the RMB90 thousand was voluntarily admitted by the respondent in the procedures concerning the dispute over the private lending of RMB250 thousand, and that the admission was conditional. Namely, the respondent admitted having received repayment of RMB90 thousand but claimed that this RMB90 thousand was for the repayment of another loan. Therefore, the admission with a certain pre-condition stated by the respondent has the characteristic of inseparability. In other words, the conditional admission should be taken as one statement in its entirety. The conditional admission made by the respondent cannot be taken independently as the evidence to support the appellant's claim (*Pei v. Xi*, 2015).

The Application of the Provisions of Restrictive Admission in Judicial Practice and Analysis of Related Problems

There are still some controversies and obstacles in the application of the rules of restrictive admission in practice. In particular, the determination of facts in a restrictive admission gives the judge considerable discretion. A different understanding of the nexus between the attached condition and the admitted fact in conditional admission may lead to problems regarding the burden of proof and may even affect the judgment of the entire case. Therefore, it is necessary to study the application of the rules of restrictive admission in practice. We have drawn on typical cases issued by the Supreme People's Court in the *Interpretation and Application of the Newly-Revised Provisions on Evidence in Civil Procedures* (henceforth abbreviated as *Interpretation and Application*) as examples for elaboration and interpretation.

Analysis of Typical Cases of Restrictive Admission

The Supreme People's Court provides the following example of a dispute over private lending relevant to restrictive admission in *Interpretation and Application*: A sues B and claims that he/she lent RMB100 thousand in cash to B without signing any written contract or issuing any written proof such as a promissory note, and that B has not repaid the money. B admits having borrowed RMB100 thousand

in cash from A but claims that the amount has been repaid in cash. Since A did not ask B to sign a promissory note in lending, B did not request any receipt from A when repaying the money. The question is: can the court determine that B owes RMB100 thousand to A according to the rules of admission and, in the meantime, order B to bear the burden of proof and prove the repayment of the loan?

Opinions of the Supreme People's Court relevant to treating the case.

B admits having borrowed RMB100 thousand in cash from A. According to the provisions of admission, it can be determined that there is a lending relationship between A and B. In the meantime, however, B admits the fact, although they could have denied the fact of the loan, which indicates that B's claim that the repayment has been made in cash is highly plausible. Therefore, A must produce evidence that B has not yet made the repayment. This case is the Supreme People's Court's attempt to interpret in depth how to contend with the inseparability of the attached condition and the admission. Article 7 of the Provisions does not specify how to delineate the demarcation line between the two, nor does *Interpretation and Application* expound on that issue in detail. The latter only lists a few examples and gives simple interpretations. There is still much ambiguity about this issue both in theory and practice, which awaits scholars and other law professionals to further ameliorate.

Analysis of the application of the provisions of conditional admission.

Whether there is a legal nexus between the attached condition and the admitted fact in conditional admission is contingent on the existence of "objective nexus" rather than "subjective nexus." With regards to the above case discussed by the Supreme People's Court, in terms of the means of denial, A does not have any written proof of the payment of money, and B could have totally denied the fact of the loan. In this way, A still has to accept the legal consequences of the impossibility of proof, i.e., the risk of losing the case, but B voluntarily admits to the fact of the loan. Analyzed from the perspective of the rules of admission and the principle of high probability, the fact of the loan could be determined. In the meantime, B claims to have made repayment in cash. Under the superficial analysis of "the burden of proof rests on who asserts it," B should bear the burden of proof to prove that the repayment has been made. However, given the two "basic facts" that A lent money to B in cash without requesting B to sign any written documents and B voluntarily admits the fact of the loan, a comprehensive analysis leads to the conclusion that B's claim of the fact that the repayment has been made is highly probable, and subsequently, based on the rule of thumb, it can be presumed that B has made the repayment. In this scenario, the burden of proof still rests on the plaintiff A, and A is responsible for adducing evidence that B has not yet paid back the money. In this example, the loan in cash is an admission, and the repayment in cash is an attached condition. There is an objective nexus between the two. This objective nexus is only possible if the judge has sufficient conviction, i.e., it can only be ascertained when the plausibility that the admission and the attached condition mutually constitute the fact reaches the standard of a high degree of probability (Guo, 2012).

The Nexus Between the Attached Condition and the Admitted Fact in Conditional Admission

The nexus between the attached condition and the admitted fact should be an objective nexus.

If the sentence "A sues B and demands repayment of RMB100 thousand from B with a promissory note" is added to the above case provided by the Supreme People's Court, in this scenario, the court should directly resort to Section 1, Article 16 of the *Provisions of the Supreme People's Court on Several Issues Concerning the Application of Law in the Trial of Private Lending Cases* and place the burden of proof of having made the repayment on B. In this situation, B's admission to the fact of the loan constitutes admission and can be directly ascertained according to the rules of admission. The attached condition of having paid back the money in cash that B claims in the meantime does not have a strong objective nexus with the admission. Namely, the loan in cash and repayment in cash fail to reach a high degree of plausibility of being reciprocally factual. After the existence of a promissory note was added, this lawsuit differs from the example provided by the Supreme People's Court in terms of the determination of admission. In the model case provided by the Supreme People's Court, A lends money to B in cash without written proof. Then, there is a high likelihood that B made a repayment in cash without retaining written proof (such as a receipt) under the condition of B's admission of the loan, but in this latter case, A lends money to B with written proof. According to the rule of thumb, it is reasonable for B to reclaim the promissory note or request a receipt from A when paying back the money. Here, B, however, does not have any written proof for repayment. Then, B has to bear the burden of proof for having made the repayment. Although B claims orally that the repayment has been made, its real meaning is that "the pre-condition of admitting the loan is that the money has been paid back," but due to the lack of objective nexus, the subjective nexus that B believes to exist between the attached condition and the admission cannot be ascertained.

"Proving the existence of a fact" is relatively easier than "proving the non-existence of a fact." Therefore, in procedures on disputes over private lending, the burden of proof rests on the plaintiff to adduce evidence for two fundamental facts, which are consensus on loan and payment of money. The fundamental fact that "the defendant has not repaid the loan" amounts to "proving the non-existence of the fact." Logically speaking, it is very difficult to directly prove the non-existence. Therefore, the burden of proof is placed on the defendant to produce evidence for "having repaid the loan," which "extinguishes the cause of action" in *Civil Procedure Law of the People's Republic of China*. In the model case provided by the Supreme People's Court, objectively speaking, there are two possibilities: defendant B borrows money in cash without repayment, or B has made the repayment. In the first situation, both plaintiff A and defendant B have no substantial evidence. In the absence of evidence from both parties, it would be unfair to put the burden of proof on B for the fact that the money has been paid back. This is because the evidence is the basis of litigation. Both parties provide only unilateral statements, and A still cannot prove the fact that B did not pay back the money. Naturally, B does not bear the burden of proof for the fact of repayment. Both parties provided only oral evidence, which cannot be differentiated in terms of the strength of evidence. Therefore, it is reasonable to apply the rules of conditional admission and shift the burden of proof to A to adduce evidence that B has not paid back the money. Even if, based on the fact, B has not repaid the loan, based on the principle of legal truth, in the absence of any substantial evidence, A should bear the consequences of losing the

case. As for the second scenario, where B borrowed the money in cash and has made the repayment in cash, A is subject to frivolous litigation, and there is no actual loss even if A loses the case according to the rules of evidence.

Problems and Their Causes in the Application of Provisions on Restrictive Admission in Practice

Through the analysis of cases, considering the rules of restrictive admission in the Provisions we can see that there are still many problems in the application of the rules of restrictive admission in judicial practice.

First, existing laws do not strictly delimit complete admission and restrictive admission, making it difficult to determine certain complicated cases or complicated facts in judicial practice. The current *Civil Procedure Law of the People's Republic of China* and the Provisions of the Supreme People's Court on Evidence in Civil Procedures do not clearly differentiate and define complete admission and restrictive admission, and scholars in the academia have not reached a consensus on the concepts in relation to the two types. Therefore, in judicial practice, judges have not yet developed a clear understanding of complete admission and restrictive admission, which could easily lead to the phenomenon of "different judgments for similar cases." Second, there is no clear classification of restrictive admission, which makes it difficult to identify restrictive admission. Article 7 of the Provisions lists admission "with restrictions" or "with conditions," juxtaposing two different types of restrictive admission. The First Civil Division of the Supreme People's Court classifies restrictive admission into partial admission and conditional admission. Scholars have different perceptions about the connotation of the concept of restrictive admission. Some scholars argue that restrictive admission in the broader sense includes restrictive admission in the narrower sense and conditional admission. Others categorize restrictive admission into partial admission and conditional admission. Existing laws do not adequately demonstrate the differentiation and analysis of partial admission and conditional admission because the categorization of restrictive admission still needs to be perfected in practice. Third, there lacks a clear distribution of the burden of proof when a party makes a restrictive admission, which might affect the facts and results of the case involving restrictive admission. Although relevant laws and regulations stipulate that a party does not need to adduce evidence for the admission by the adverse party, different judges in different cases may determine differently in terms of how to determine the burden of proof for the partial admission or conditional admission in restrictive admission in judicial practice, which may lead to different results of a case. Fourth, there is a lack of a clear and comprehensive revocation procedures for restrictive admission. Article 9 of the Provisions regulates the revocation of admission, listing two circumstances where admission can be revoked, but the procedure for revoking admission is not specified. There is no clear regulation in terms of how the party applies for revocation, whether it requires an application in the written or oral form, or to what degree evidence must be given to prove that admission was made under duress or because of a major misunderstanding. The specific revocation procedure of restrictive admission needs to be further improved.

Explorations of the Routes for Improving the Rules Relevant to Restrictive Admission

Although the Provisions provides new regulations and supplements the content of the rules of restrictive admission, in judicial practice, there are still many problems in the determination of restrictive admission. Theoretical and methodical approaches to address these problems are an imminent need, and it is also imperative to improve rules relevant to restrictive admission.

Clarify Elements for Identifying Complete Admission and Restrictive Admission in Legal Terms

Currently, there is a lack of clear definitions for the subjects, objects, effectiveness, forms, and other elements related to the two types, which might affect the fair judgment of cases. Therefore, the interpretations of elements relevant to the determination of complete admission and restrictive admission need to be further improved. First, in terms of the subjects, the subjects of both complete admission and restrictive admission should be litigants, and only the litigants can make an admission of facts in a case. A litigant should be defined as the defendant, the plaintiff, a third person with independent responsibility, etc. Other participants in the litigation, such as witnesses, authenticator, expert assistants, etc., cannot be the subject of complete admission or restrictive admission because they do not bear the burden of proof. Second, in terms of the objects, for both complete admission and restrictive admission, the admissions by the litigants should be the essential facts directly related to the case, while those facts that are less relevant to the case or do not directly affect the case do not count as an object of admission. Third, the form of admission should be an admission during trial, which should occur during the stages of court investigation or oral arguments in court. If admission is in written form, it should be consistent with the facts stated in open court.

Establish a Unitary, Scientific, and Reasonable Criterion for Classifying Restrictive Admission

According to the identity of the litigants, restrictive admission can be classified into restrictive admission as a counterplea and restrictive admission as a denial. Restrictive admission as a counterplea, while admitting basic facts, asserts to extinguish a cause of action or exclude a cause of action to achieve the effect of eliminating the claim of the adverse party in the lawsuit at the same time. Restrictive admission as a denial asserts another legal relationship on the basis of admitting a basic fact claimed by the adverse party to achieve the effect of negating the claim of the adverse party in the lawsuit. In addition, the party making a restrictive admission as a defense should bear the burden of proof of that assertion, while the party claiming the existence of a valid and effective legal relationship should bear the burden of proof in restrictive admission as a denial. The party making a restrictive admission as a defense only bears the burden of adducing evidence and refuting the adverse party's statements only after the adverse party has fully discharged the burden of proof.

Clarify the Rules of Distribution of the Burden of Proof in Restrictive Admission

According to the distribution of the burden of proof in the *Civil Procedure Law of the People's Republic of China*, the party bearing the burden of proof takes the risk of losing the case, which could potentially lead to injustices due to gaps in the procedures. When partial admission occurs in a case, the adverse party should be exempt from the burden of adducing evidence for the partial fact. When conditional admission occurs in a case, if the conditions are met, the adverse party does not bear the burden of proving the admission; if the condition does not hold, then admission does not exist, and the adverse party still bears the full burden of proof. In distributing the burden of proof in practice, however, it is important to pay attention to correctly ascertaining restrictive admission. restrictive admission is separable. It should be recognized that the fact and the attached condition are both complete expressions of a party. They are therefore separable and could be treated separately. Considering them together is not conducive to determining the fact or distributing the burden of proof.

Improve the Supporting Procedures for the Reply and Revocation in Admission

In court, it is often the judge who controls the rhythm of the session and the situation of pleading. As a result, it is often the case that the parties are resistant to pleading and even enter surprise pleas during the trial. Therefore, some people take advantages of restrictive admission, in particular restrictive admission with conditions, and cause the adverse party to lower their guard. Not only is this practice detrimental to the interests of the plaintiff, but it could also easily lead to delays in litigation, as the plaintiff experiences a delay in knowing the adverse party's claim and cannot effectively counter and debate in court, thus requiring more time to compensate for the lack of preparation in court, which also violates the principle of procedural fairness. In addition, the revocation procedure of restrictive admission is also important as it affects the legitimate interests of both parties. Currently, there should be more specific regulations about the revocation procedure of restrictive admission so that the parties are aware of what means and steps to take to withdraw an admission made under duress or because of a major misunderstanding. This will also enable the court to have rules to follow in the procedures and to better deal with problems related to the revocation of restrictive admission.

Content related to restrictive admission has been added to the Provisions to make the system of rules of admission more comprehensive and standardized. We draw on the Provisions to clarify restrictive admission and investigate the application of the rules of restrictive admission in judicial practice. First, restrictive admission belongs to admission. In contrast, to complete admission, it consists of partial admission or conditional admission. It can also be classified into restrictive admission as a defense and restrictive admission as a denial. Second, in the practice of determining restrictive admission, the primary task is to delimit and clarify the types of restrictive admission. Restrictive admission can be classified into partial admission or conditional admission. Whereas it is easier to identify partial admission, the determination of conditional admission needs to be made regarding whether there is a legal nexus between the attached condition and the admitted

fact. Third, the admission with conditions by a party should not be identified separately in a simplistically and rigidly way. Rather, the attached condition and the admitted fact need to be considered comprehensively, and there should be a legal and objective nexus between the attached condition and the admitted fact. Fourth, there are many problems in the application of restrictive admission in judicial practice. Therefore, it is imperative to clearly define complete admission and restrictive admission in terms of elements, construct a scientific and unitary classification of restrictive admission, rigorously establish the rules for distributing the burden of proof between the parties of restrictive admission of different types, and improve the supporting procedures of reply and revocation of restrictive admission.

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Fiduciary Principles in Chinese Family Law

He Jian*
Peking University

Abstract: The existing literature on fiduciary law focuses primarily on commercial settings, and fiduciary principles in the area of family law have seldom been considered. This essay sheds light on the fiduciary principles in Chinese family law. There is a set of classic fiduciary duty rules under Chinese family law, such as conflict-of-interest rules and remedies for fraudulent transfers. There are also two special sets of rules that might be considered candidates for traditional fiduciary principles in family law, namely the rules on property distribution in a divorce and the rules on property management for different family members. Moreover, the duty of loyalty in Chinese family law, as well as in many other civil law jurisdictions, is much broader in scope than the traditional duty of loyalty under the common law. This broad duty of loyalty includes the duty of sexual fidelity, the duty of notification about certain sexual activities of one spouse during or even before marriage, and the duty of support between family members. This difference may go back to the historical distinction between law and equity, as well as the logical appropriateness of a broad understanding of the term "loyalty."

Keywords: fiduciary principles, fiduciary duty, duty of loyalty, duty of care, duty of sexual fidelity

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Correspondence concerning this article should be addressed to He Jian, School of Law, Peking University, Beijing, 100871, China. Email: hejian@pku.edu.cn

Introduction

Fiduciary law is a special legal field in common law jurisdictions, rooted in the distinction between law and equity, a distinction that is not part of the civil law tradition (Samet, 2016, pp. 139–166; Gelter & Helleringer, 2019, p. 583). Nevertheless, a comparative study of fiduciary principles across common law and civil law traditions is still possible, at least with a functional approach (Michaels, 2006, pp. 339–382). This is because a number of obligations in many civil law jurisdictions pursue ends very similar to those of the fiduciary principles in common law.

The existing literature in this area, mostly conducted by civil law academics, focuses on fiduciary principles in laws of agency, corporation, or finance in Germany, France, and other continental European countries (Gelter & Helleringer, pp. 583–602; Graziadei, 2014, pp. 286–300), as well as in Japan (Ramseyer & Tamaruya, 2019, pp. 643–663) and China (Howson, 2019, pp. 603–622; Wu, 2020, p. 431). As a comparative legal study, this essay will shed light on fiduciary principles in Chinese family law, which is substantially built upon the Marriage Law of the People's Republic of China (2001 Amendment) [hereinafter Marriage Law 2001] and its three judicial interpretations,① and now their successor, the *Book of Marriage and Family* of the Civil Code of the People's Republic of China (hereafter referred to as Civil Code)② and its new judicial interpretation.③ The comparison is valuable from the outsider's perspective because fiduciary duty in the realm of family law has rarely been explored either in China or in other civil law countries (Miller & Gold, 2016; Graziadei, 2014, p. 292; Scott & Scott, 1995, p. 2401; Scott & Chen, 2019, pp. 227–248). It is even helpful to the insider because no study in Chinese academia has viewed the fragmented, yet interrelated, rules of Chinese family law from the perspective of fiduciary principles or from any other unified perspective.

This essay focuses on the similarities and differences between fiduciary duty in Chinese family law and its counterpart in traditional common law. Regarding similarities, Chinese family law has a set of classic common-law fiduciary principles, including those on conflict of interest, remedies for fraudulent transfers, and access to information mechanisms on certain property (e.g., the community property), all classified under "duty of loyalty," and several rules on the duty of care. Moreover, China has special rules that might be considered "natural" or logical extensions and, hence, candidates for common-law fiduciary principles in the context of family law. These rules include: (a) the rule for distributing income, appreciation, and other proceeds of separate property during marriage (as a special type of duty of loyalty); and (b) different standards of duty of care and related rules of allocating risk or losses

① *Interpretation I of the Supreme People's Court (SPC) on Several Issues in the Application of the Marriage Law of the People's Republic of China* (Supreme People's Court Interpretation No. 30, 2001); *Interpretation II of the SPC on Several Issues in the Application of the Marriage Law of the People's Republic of China* (Supreme People's Court Interpretation No. 19, 2003); *Interpretation III of the SPC on Several Issues in the Application of the Marriage Law of the People's Republic of China* (Supreme People's Court Interpretation No. 18, 2011) (hereinafter *Interpretation I, II, and III of Marriage Law*, respectively).

② Promulgated by the Third Session of the 13th National People's Congress on May 28, 2020, effective on January 1, 2021.

③ *Interpretation I of the SPC on the Application of Book of Marriage and Family of the Civil Code of the People's Republic of China* (Supreme People's Court Interpretation No. 22, 2020) (hereinafter *Interpretation on Marriage and Family*).

(as modified versions of the traditional business judgment rule of commercial law). Neither of these examples belongs to traditional fiduciary law, but they share similar ends or functions with common-law fiduciary duty.

Further, this essay will reveal profound differences in the duty of loyalty between Chinese family law and traditional common law. The scope of the duty under Chinese family law is much broader than its counterpart in common law in that it includes the additional duties of sexual fidelity during marriage, disclosure of certain sexual activities to one's spouse during or even before marriage, and support between family members. The duty of loyalty in such a broad sense is not only a general principle of Chinese family law, but also a subcategory of the principle of good faith in the entirety of Chinese civil law. Moreover, such a broad understanding of the duty of loyalty can be observed in many other civil law jurisdictions. For such an interesting and common phenomenon, this essay also offers a preliminary explanation based primarily on historical and logical grounds.

The first three parts of this essay make the aforesaid "similarity" comparison. Part I focuses on the duty of loyalty between spouses under Chinese family law. Part II introduces the further duty of loyalty between parents and children (as well as other family members). Part III describes the duty of care in Chinese family law. Part IV provides the aforesaid "difference" contrast and the related explanation. Then follows the conclusion.

Duty of Loyalty Between Spouses

Under fiduciary law, the duty of loyalty means that the fiduciary must not place his/her personal interests above those of the principal (Scott & Scott, p. 2420).[①] It is the same in Chinese family law. In the spousal relationship, for example, the duty of loyalty centers on community/marital property matters, which concern both spouses' interests yet might be managed or otherwise affected by one spouse. Despite variations, the duty of loyalty in the common law generally refers to the following rules: (a) conflict-of-interest rules, such as avoiding self-dealing; (b) remedies for fraudulent transfers; and (c) the duty of notification concerning the entrusted property (Scott & Chen, p. 237; Bray, 2019, pp. 452–454; McDaniel, 2003, p. 1; McDaniel, 2005, pp. 40–43; Rakow, 2014, p. 771; Gold, 2014, pp. 175–193). Besides, the duty of loyalty may also exist between parents and children (Scott & Scott, pp. 2401–2476). Most of these rules have their counterparts under Chinese family law.

Conflict-of-Interest Rules

Restrictions on disposal of community property.

The statutory matrimonial property regime in China is the community property system. The community property is co-owned by both spouses and shall be "equally" dealt with.[②] That is, disposal

① *see Bayer v. Beran*, 49 N.Y.S.2d 2 (1944) ("The fiduciary must subordinate his individual and private interests to his duty to the corporation whenever the two conflict.").
② *Civil Code of the People's Republic of China*, Art. 1062 para. 2.

of the community property shall be jointly made by both spouses. Where one spouse alone disposes of the community property, the validity of the (unauthorized) disposal is undetermined until it is ratified or rejected later by the other spouse.① As an exception, each spouse is entitled to dispose of community property (usually registered in the disposer's individual name, in his/her possession, or in other ways under that person's control) alone in accordance with the necessaries doctrine, that is, if and as long as the disposal is meant to meet the needs of the family's daily life.②

The disposal restriction on community property makes an unauthorized disposal by one spouse a tortious infringement against the other,③ but it cannot always deter such a disposal. This is because of the application of the *bona fide* purchase rule④ from property law. The co-owned family home would arguably enjoy special protection, and does in a few jurisdictions (Henrich & Schwab, 1995; Berger, 1977, p. 55; He, 2020, pp. 201–218). Under the existing Chinese law, however, the innocent spouse who co-owns the family home is merely entitled to monetary recourse (rooted in tort law) against the other spouse instead of any claim against a *bona fide* purchaser.⑤

The case of "mixture of separate and community property."

In the course of a marriage, the community property owned by both spouses and the separate property owned by each spouse may be mixed in many ways. One spouse's premarital savings (separate property), for example, may be used for the family's daily life. In contrast, one spouse's income during marriage (community property) may be used to repay a mortgage on the family home, which one spouse bought before marriage and is, therefore, separate property. Given the potential of one spouse to exploit community property for the benefit of his/her separate property, Chinese law has developed a set of rules to deter such selfishness, partly by borrowing doctrines or theories from the US (Xia, 1999, pp. 234–245; He, 2014, pp. 134–144). These rules are traditionally not related to the fiduciary principles of the common law (McDaniel, pp. 1–4; Scott & Chen, pp. 235–238), but maybe regarded as a new type of rule due to the functional similarity of discouraging one spouse's selfishness in property matters.

Different modes of mixing separate and community property.

The most typical case of mixing concerns the distribution of the accrued *appreciation* (increase in value) during marriage of a mortgaged house that is a premarital property and hence the separate property of one spouse, but whose mortgage load is partly or fully paid down using community property.⑥ This is a common issue for all modern societies (He, 2015, 97–105, 114–115; He, 2014, pp. 137; Hu, 2010, p. 112). Under Chinese law, first, the community property used to pay down the loan

① The validity of the contract associated with the unauthorized disposal is a different issue from the validity of the disposal under Chinese law. If the contract is concluded by the disposing spouse in that person's own name with a third party, it is valid despite the lack of right of disposal. In contrast, if the contract is concluded by the disposing spouse on behalf of both spouses, it is undetermined in principle due to the unauthorized agency (Id., Art. 171 para. 1), or valid as an exception if there is apparent agency (Id., Art. 172).

② Id., Art. 1060 para. 1. A similar view existed long before the promulgation of the Civil Code; *see Interpretation I of Marriage Law*, Art. 17.

③ *see Civil Code of the People's Republic of China*, Art. 311 para. 2.

④ For the *bona fide* purchase rule in general, *see Civil Code of the People's Republic of China*, Art. 311.

⑤ *Interpretation on Marriage and Family*, Art. 28.

⑥ For a comprehensive comparative legal study with a focus on Chinese law, *see* He, J. (2015). Classifying the appreciation of separate property during marriage: Also on the spirit of the Chinese statutory matrimonial system. *The Jurist, 4*, 95–115.

will be fully reimbursed to the community; and second, the house's appreciation during marriage will be distributed to both spouses (as owners of the community property) on a contribution basis.[①] The rule is also applicable by analogy to other cases where the community property and the separate property are mixed, and the latter has increased in value during marriage.

A special case is the mixture of separate property and marital labor. All marital labor (the income or proceeds of a spouse's labor during marriage) is community property.[②] Obviously, one spouse's marital labor and separate property are very likely to be mixed. For instance, one spouse usually continues a premarital stock investment by devoting time or expertise during marriage, or continues to manage a premaritally established business enterprise. In this case, the separate property might also generate appreciation, income, or other types of proceeds during marriage.

Incoherency of the contemporary rule.

The special quality of the mixture of marital labor and separate property lies in its distribution rule. As mentioned above, a *proportional approach* is adopted regarding the appreciation of separate property in an ordinary mixture case. To maintain coherency, the same rule should apply to the mixture of marital labor and separate property. However, an *all-or-nothing approach* is adopted because of borrowing the widely accepted distinction under the law of the US. That is, *active appreciation* of the separate property resulting from marital labor is fully community property, whereas *natural appreciation* or *passive appreciation* during marriage that is attributed to inflation, or the market remains separate property.[③]

Another stark contradiction is related to the types of proceeds of separate property. Apart from active and passive appreciation, there are also *income* and *investment proceeds*. The separate property's income during marriage is all separate property, while its investment proceeds are all community property. In practice, the most difficult and controversial task would be to define all these three types of proceeds by distinguishing one from another. For instance, rent earned from a premarital house during marriage could be classified as either income or investment proceeds (He, 2015, p. 110; He, 2014, p. 145). Similarly, the appreciation of a premarital stock investment would be either passive appreciation or investment proceeds (He, 2015, p. 113; Cheng & Wu, 2013, pp. 114–116).

All these contradictions curtail the deterrence effect of the distribution rule on proceeds of separate property during marriage. An economically rational spouse might thereby be encouraged to reserve his/her separate property exclusively to generate passive appreciation or more separate property. Obviously, an arrangement of this kind does not necessarily accord with the best economic interests of the whole family. Further, it may even burden the relationship of the spouses.

As an alternative, all the proceeds of each spouse's separate property during marriage could be classified as investment proceeds, which belong to community property. In this case, there is no reason

① The calculation rule of the contribution basis is still controversial. *see* He, J. (2015). Classifying the appreciation of separate property during marriage: Also on the spirit of the Chinese statutory matrimonial system). *The Jurist, 4*, 96–105.
② *see Civil Code of the People's Republic of China*, Art. 1062 para. 1 item 1.
③ *see Interpretation on Marriage and Family*, Art. 5.

for a spouse to be selfish because both spouses share proceeds of any type. A spouse is encouraged to use marital labor and arrange all the (community and separate) property in the best interests of the family (He, 2020, p. 24).

Fraudulent Transfer Rules

Given that the community property embodies the interests of both spouses, it is not infrequent that one spouse tries to infringe the other's interests by a fraudulent transfer of community property. There are basically two ways: first, the community property might be directly concealed or transferred to a third party; second, debts might be forged to burden the community property and, thereby, the innocent spouse. Both ways have long been widely held to be tortious infringements on community property (Hu, 2001, p. 184; Huang, 2020, pp. 185–188). However, the legal remedies that are available have gone through a transition, as explained below.

Ordinary compensation.

The earliest remedy against a fraudulent transfer in a divorce case is ordinary compensation as a tort law claim. This was expressly provided for in a judicial interpretation of 1993 as follows:

> Where one spouse refuses to surrender any community property by illegally concealing or transferring such property, or illegally sells off, destroys, or damages such property, less or no property shall be distributed to this spouse in the case of [community] property partition. To be concrete, the property so concealed, transferred, sold off, destroyed, or damaged shall be treated as actually being distributed to the spouse committing the foregoing conduct, and the [community] property share to which the other spouse is entitled shall be reimbursed with other community property; if the community property available is insufficient for reimbursement, the difference shall be made up by the spouse committing the foregoing conduct… (translation; emphasis added)[①]

It is noteworthy that the emphasized phrase "less or no property" refers to the community property available for partition, not to the property concealed, transferred, sold off, destroyed, or damaged. It is equal to the *reimbursement* in the second sentence cited above. This wording does not punish the wrongful spouse by deprivation of some part of that spouse's otherwise fair share of the community property. In contrast, it merely ensures that the innocent spouse gets exactly what he/she is entitled to in an *ordinary* partition, that is, as if the community property had never been concealed, transferred, sold off, destroyed, or damaged.[②]

Punitive damages or disgorgement.

In 2001, the rule of the aforesaid judicial interpretation was basically integrated into the amended Marriage Law (Ma, 2002, p. 396). However, only the first sentence of the above quotation was retained,

① *Several Specific Opinions of the SPC on the Division of Property Involved in the Trial of Divorce Cases by People's Courts* (Supreme People's Court Interpretation No. 32, 1993) (hereinafter Property Division Opinions), Art. 21.

② *see* similarly The Civil Senate of the Intermediate Court of Guiyang (1988). New issues and measures of property division in divorce cases. *People's Judicature*, *12*, 11.

while the second sentence, starting with the phrase "[t]o be concrete," was deleted as follows.

> If, at the time of divorce, one spouse conceals, transfers, sells off, destroys, or damages the community property, or fabricates any debt in pursuit of seizing the other spouse's property, less or no property may be distributed to the spouse committing the foregoing conduct…[①] (emphasis added)

This is an important change. Literally, "less or no property" in the new provision of the Marriage Law 2001 is not necessarily equal to strict reimbursement in the sense of ordinary compensation, due to the omission of the further clarification found in the judicial interpretation of 1993. Instead, it sounds as if the wrongful spouse may be punished by receiving less community property or none, regardless of what that spouse's strictly fair share would be. In fact, this view is widely accepted in practice (Ma, 2002, p. 398)[②] and, with minimal adjustments, the provision of the Marriage Law on this issue is now also absorbed into the Civil Code.[③]

However, the underlying reasons for the shift in remedies have never been clarified. The legislators of both the Marriage Law and the Civil Code are merely content with the reasoning that a fraudulent transfer in a divorce constitutes a tort or an illegal act; hence, the wrongful spouse "shall obviously bear" the penalty of being awarded less or no property (Hu, pp. 184–185; Huang, p. 187). This is not persuasive. Chinese tort law is based on the principle of compensation to make up for the damages. In line with this, ordinary compensation, as prescribed in the judicial interpretation of 1993, should have been retained in the Marriage Law as well as in the Civil Code. The reason why these two laws provide uniformly for a different remedy, which is similar to punitive damages (Gao, 2001, p. 18; Mo, 2004, November 9) or disgorgement (or accounting for profits) in the common law,[④] may be related to the spousal duty of loyalty. Given the intimacy of the relationship between spouses, such a remedy would properly discourage a fraudulent transfer without raising doubts about its potentially "punitive" character. Similar rules are well established not only in the family law of common law jurisdictions (Scott & Chen, p. 237; Adams, 1997, pp. 449–459), but also in the Company Law of the People's Republic of China (hereinafter Company Law 2005, 2018, respectively).[⑤]

To constitute a fraudulent transfer, the intention (or malice) of a spouse is required. Negligence would not suffice (Hu, p. 184; Huang, p. 186). Currently, the fraudulent transfer may take place at any time during marriage,[⑥] no longer being restricted to the period of a divorce proceeding (i.e., from filing suit to the execution of the decree) (Hu, p. 184).[⑦]

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① *Marriage Law of the People's Republic of China (2001 Amendment)*, Art. 47.
② *see Sun Wenqing v. Guo Meide*, Civil Judgment of the Supreme People's Court Min Yi Zhong Zi [2013] No. 210; *Cui v. Li*, Civil Judgment of the Hebei Provincial High People's Court Ji Min Yi Zhong Zi [2014] No. 28.
③ *see Civil Code of the People's Republic of China*, Art. 1092.
④ For the conceptual difference between disgorgement and accounting for profits, *see* Bray, S. L. (2019). Fiduciary remedies. In Evan J. Criddle, Paul B. Miller & Robert H. Sitkoff (eds.), *The Oxford handbook of fiduciary law* (p. 465). Oxford University Press.
⑤ *Company Law of the People's Republic of China (2018 Amendment)*, Art. 148.
⑥ *see Civil Code of the People's Republic of China*, Art. 1092; Guiding Case No. 66 (a guiding case is noticed but not necessarily adjudicated by the SPC; it bears authority similar to a judicial interpretation in China).
⑦ *see Marriage Law of the People's Republic of China (2001 Amendment).*

Despite the literal ambiguity, the phrase "less or no property" refers to the target property of a fraudulent transfer, not to all the community property (Hu, p. 184).[①] The court has discretion to decide what share of the property is forfeit, depending on the seriousness of the wrongful conduct and the specific circumstances of the case (Hu, p. 184).[②] Such a disgorgement-like remedy seems to be available only in a divorce proceeding (or thereafter) and may not be claimed during marriage.[③]

Partition of community property during marriage.

When one spouse commits a fraudulent transfer, the other spouse can petition the court for partition of the community property during marriage.[④] This saves the burden and trouble of a divorce. As in divorce, the fraudulent transfer must be made intentionally (maliciously) (Huang, 2020, p. 104; Xi, 2011, p. 84). Here, however, the community property subject to partition is not restricted to the target of the fraudulent transfer; instead, all the community property is available for partition (Huang, 2020, p. 102; Xi, 2011, p. 84). This distinction makes sense because a fraudulent transfer usually destroys the trust between spouses, and the other community property is still at risk of being fraudulently transferred. On the other hand, given that partition during marriage is an exception to the principle of the statutory matrimonial property regime, the partition shall also facilitate the maintenance and usage of the community property (Xi, 2011, p. 86). Therefore, a partition of all the community property during marriage may not always occur.

Access to Information on Community Property

Although both spouses co-own the community property under the law, any specific piece of it is usually possessed or controlled by one spouse. To protect the other (non-controlling) spouse's interests therein, the first step is to ensure the latter's access to information regarding community property. Currently, in China, there is no uniform rule. Instead, different local rules are in progress and in competition with each other. They can be divided into two categories.

Right of information during marriage.

Some local regulations on women's protection provide that each spouse has the right of information regarding all the community property during marriage. This is not only a private right but also a public one related to a government agency's duty to assist an inquiry of one spouse about community property registered in the other's name. In Guangzhou, for example, one spouse with proof of the marriage relationship may apply to different agencies to inquire about the property registered in the name of the

① *see Sun Wenqing v. Guo Meide*, Civil Judgment of the Supreme People's Court Min Yi Zhong Zi [2013] No. 210; *Cui v. Li*, Civil Judgment of the Hebei Provincial High People's Court Ji Min Yi Zhong Zi [2014] No. 28; Guiding Case No. 66; Huang, W. (ed.). (2020). *Commentaries on the Book of Marriage and Family of the Civil Code of the People's Republic of China*. Law Press·China, pp. 187–188 (vaguely expressing a similar view).
② *see* Huang, W. (ed.). (2020). *Commentaries on the Book of Marriage and Family of the Civil Code of the People's Republic of China*. Law Press·China, pp. 187.
③ This possibility is not mentioned in the drafter's commentary either. *see* Id. at 187–188.
④ *see Civil Code of the People's Republic of China*, Art. 1066 item 1.

other spouse, including stocks, real estate, cars, and other assets.[①] Personal bank accounts are a rare exception: As a rule, and obviously based on the special confidentiality policy in the financial sector, the spouse of a depositor is not entitled to information about the latter's account (Li, 2011, p. 149).[②]

Duty to file financial statements in divorce.

Another way to ensure access to information on community property is the requirement for each spouse to file a comprehensive financial statement in a divorce proceeding.[③] This is common practice in common law jurisdictions (Hofstein & Weiner, 2003, p. 17; Scott & Chen, p. 237), but only a recent "experiment" in a few provinces or municipalities in China. In Shenzhen,[④] for instance, the divorcing parties must file financial statements covering not only all the community property, but also debts, as well as property obtained before marriage.[⑤] If one spouse files an incorrect statement intentionally or due to gross negligence, the court may apply the "less or no property" remedy to the portion of the property that is misstated.[⑥] Besides, such a misstatement might be regarded as forging or destroying material evidence and thereby obstructing trial. That could result in a fine or detention, and even criminal liability.[⑦]

Duty of Loyalty Between Parents and Children

The parent-child relationship is a classic scenario of fiduciary principles in family law (Scott & Scott, p. 2401; Scott & Chen, pp. 228–235). In contrast to the risk that a marriage may end in divorce, there is generally no such breakup between parents and children. However, this difference only implies that formal legal arrangements, including fiduciary duties, might be applied much less frequently than in the spousal relationship, and correspondingly, that there is much more room for informal, extralegal bonding and monitoring mechanisms (Scott & Chen, pp. 228–231). Given that a child is usually weak and vulnerable in relation to its parents, whereas one spouse is presumably equal to the other, the parent-child relationship is subject to even more comprehensive and stricter legal arrangements. The duty of loyalty is also included.

Special Duty of Loyalty for Divorcing Parents

Divorce is a crisis not only for the divorcing spouses but also for their children. Although the spouses would care for the interests of their children in the ordinary course of a marriage, they might

① *see Provisions of Guangzhou City on the Protection of Rights and Interests of Women (2015 Amendment), Art. 23. see* similarly *Measures of Henan Province for the Implementation of the Law of the People's Republic of China on the Protection of the Rights and Interests of Women (2008 Amendment)*, Art. 19; *Regulations of the Ningxia Hui Autonomous Region on the Protection of Rights and Interests of Women (2019 Amendment)*, Art. 35; *Regulations of Jiangsu Province on the Protection of Rights and Interests of Women (2020 Amendment)*, Art. 32.

② *see Law of the People's Republic of China on Commercial Banks (2015 Amendment)*, Art. 29.

③ The related rules are also applicable in other cases where a property partition is involved, such as in an independent property partition proceeding after the divorce. *see Guidelines of the Intermediate People's Court of Shenzhen Municipality on Implementing the System of Property Declaration for Divorce Cases*, 2019, Art. 9.

④ *see* similarly *Guidelines for Courts in Guangdong Province on the Procedures for Hearing Divorce Cases*, 2018, Arts. 40–45.

⑤ Id. *Guidelines of the Intermediate People's Court of Shenzhen Municipality,* Arts. 1–2.

⑥ Id. Art. 6.

⑦ Id. Art. 8; *Civil Procedure Law of the People's Republic of China (2017 Amendment)*, Art. 111 para. 1 item 1.

ignore or sacrifice the children's welfare for their own interests in a divorce; for example, to get a quick divorce based on agreement[①] or a more favorable financial arrangement (Scott & Chen, p. 234). To discourage incentives of this kind, Chinese family law supports the following measures.

First, the duty of the parent toward the child does not cease upon divorce. The noncustodial parent still has "the right and duty to support, educate, and protect" the children, as does the custodial parent.[②] Especially, under changed circumstances or with other good reasons, more child support could be claimed beyond the agreed or adjudicated amount.[③]

Second, although the custody of a child is in principle subject to the parents' agreement, there are restrictions or exceptions. In the absence of an agreement, the custody shall be decided by the court "in the best interests of the child." If the child has reached the age of eight, its true will—as *prima facie* evidence of its own interests—shall be respected.[④]

Third, the community property shall be distributed, absent any agreement, taking into consideration the actual circumstance of the property and "under the principle of caring for the interests of the children, the wife, and the no-fault party."[⑤] According to the drafter's comments, the order in which the law lists these three parties demands that the children's welfare has priority in a property distribution (Huang, p. 174).

General Duty of Loyalty for Parents as Guardians

In China, most provisions on the parent-child relationship are not in the fifth Book of the Civil Code, *Book of Marriage and Family*, but in the first Book, *Book of General Provisions*. This is because the latter contains a set of rules on guardianship, which primarily applies in the parent-child relationship. Technically speaking, a parent in China is thereby more like a guardian under guardianship law than like a parent under family law. Under the law of guardianship, a parent is generally subject to the following duties, which are similar to the duty of loyalty.

First and most important, a guardian shall perform the duty of guardianship in the best interests of the ward.[⑥] This is a generalized version of the aforesaid principle of the child's best interests in the case of a divorce. It applies to all guardianship duties in protecting the person, property, and any other lawful rights and interests of the ward.[⑦] Especially, the guardian shall not dispose of the ward's property except by way of safeguarding the ward's interests,[⑧] such as for its daily living expenses or education, and such disposal shall be "in its best interests."[⑨]

A guardian is also the statutory agent of the ward. Under agency law, it is well established that

① Spouses in China have two ways of getting divorced, either by agreement or through a lawsuit. *see Civil Code of the People's Republic of China*, Arts. 1076–1080.
② *see Civil Code of the People's Republic of China*, Art. 1084 para. 2.
③ Id. Art. 1085 para. 2; *see Interpretation on Marriage and Family*, Art. 58.
④ Id. Art. 1084 para. 3.
⑤ Id. Art. 1087 para. 1.
⑥ *see Civil Code of the People's Republic of China*, Art. 35 para. 1.
⑦ Id. Art. 34 para. 1.
⑧ Id. Art. 34 para. 1.
⑨ *see* Huang, W. (ed.) (2020). *Commentaries on the Book of General Provisions of the Civil Code of the People's Republic of China*. Law Press·China, p. 96.

in agency by mandate, neither *self-dealing* nor *dual agency* is allowed. Namely, an agent shall not perform any juristic act with itself in the name of the principal, nor shall an agent perform any juristic act in the name of one principal with any other principal represented by it at the same time, unless with the consent or ratification of the related principal(s).[①] However, these two restrictions only apply to an agent under mandate, not to a legal statutory agent. Moreover, the ward, as a person with limited or no legal capacity, is not able to consent to or ratify the juristic act concerned in the event of a self-dealing or dual agency. These agency law restrictions are hence not applicable in the context of guardianship.

Second, the true will of a ward shall be respected because it usually reflects and accords with the ward's best interests. In the case of a minor ward, the ward's true will shall be taken into consideration according to the ward's age and intelligence.[②] In the case of an adult ward, the ward's true will shall be respected to the fullest extent. That is, the guardian shall safeguard and assist the ward in performing juristic acts compatible with the ward's intelligence and mental health, and shall not interfere in any affairs the ward is capable of handling alone.[③]

In the event of a serious default, the court will disqualify the guardian pursuant to a special petition filed by a relevant third party, without affecting the (disqualified) guardian's ongoing duty of support toward the ward.[④] However, in the event of other defaults that may not result in disqualification, the guardianship law does not clearly state the legal remedies. General remedies in tort law are available (Huang, 2020, p. 94), with a special limitation period that starts to run from the day when the statutory agency/the guardianship is terminated.[⑤] There could be more. For example, in the case of a fraudulent transfer of family property (co-owned by the parent guardian and the child ward, similar to spousal community property),[⑥] the remedy of disgorgement shall be available by analogy (see Howson, 612–615, for more detail).[⑦] Actually, a similar remedy does exist for fraudulent transfer of an estate among inheritors.[⑧]

The legal arrangements described above are applicable not only to a parent guardian, but also to other guardians, such as an adult child as guardian of an elderly parent, or a spouse as guardian of the other spouse. The Chinese guardianship law provides thereby a uniform basic framework for all these relationships, which could be further supplemented or modified by rules in family law or in other legal fields.

Third, the selection or designation of the guardian shall follow the principle of the best interests of the ward.[⑨] In line with this principle, there are two priority rules for different cases. Where the ward is a minor child, the guardian, as the person who can best protect the child's interests, shall be chosen

① *see Civil Code of the People's Republic of China*, Art. 168.
② Id. Art. 35 para. 2.
③ Id. Art. 35 para. 3.
④ Id. Arts. 35–36. For a list of various defaults, *see* also *Law of the People's Republic of China on the Protection of Minors (2020 Revision)*, Art. 17.
⑤ *see Civil Code of the People's Republic of China*, Art. 190.
⑥ The term "family property" is rarely defined under Chinese law. *see*, e.g., *Civil Code of the People's Republic of China*, Art. 56.
⑦ A much broader application of the disgorgement remedy exists under the Chinese company law. *see Company Law of the People's Republic of China (2018 Amendment)*, Art. 148.
⑧ *Interpretation I of the SPC on the Application of the Book of Succession of the Civil Code of the People's Republic of China*, Art. 43.
⑨ *see Civil Code of the People's Republic of China*, Arts. 31, 36.

in the following order: (a) parents; (b) grandparents; (c) older siblings; and (d) other individuals or organizations (with further requirements).[①] Where the ward is an adult, in contrast, the guardian shall be chosen in this order: (a) the spouse; (b) parents or children; (c) other close relatives; and (d) other individuals or organizations (also with further requirements).[②]

The executive branch in China rarely intervenes in guardianship matters. This is different from the relatively active monitoring mechanism, with elaborate accounting and reporting duties, found in some of the common law jurisdictions (Scott & Chen, pp. 240–243). The only exception could be the *entrusted caretaking* of a minor, where the minor ward's parents or other guardians entrust the guardianship partially to a third party. Herein the local organizations or agencies (i.e., the minor's school or kindergarten, as well as the related residents' committee or villagers' committee) would intervene to the extent of assisting the minor's parents or other guardians in getting basic information on the minor.[③]

Duty of Care

Property Management

The Chinese Company Law provides expressly for corporate directors' and senior management's duty of diligence—an equivalent of the duty of care (Howson, p. 609)—to the company. Under Chinese family law, in contrast, there is only a set of rules with a similar function.

Property management in the spousal relationship.

Under Chinese law, the only express provision on the duty of care between spouses is related to *squandering* of community property, a serious default in the duty of care in the context of the statutory matrimonial property regime. Squandering is any intentional "arbitrary disposal or waste of the community property beyond a reasonable extent" (Huang, 2020, pp. 104, 186). It leads to the remedy of disgorgement as in the case of a fraudulent transfer.[④]

For other defaults in the duty of care, which are not clearly provided for but may also inflict damages on the community property, the remedies vary from case to case.

In the case of *pure economic losses* (e.g., failure of investments) that might arise in the ordinary course of managing the community property, the managing spouse shall be free of any liability. More accurately, the community property, not the separate property of the managing spouse, shall be liable for losses or debts incurred in the management of the community property. This mechanism encourages a spouse to work his/her best to create more community property without the fear of incurring any disadvantage in doing so (He, 2020, p. 34).

① Id. Arts. 27.
② Id. Arts. 28.
③ *see Law of the People's Republic of China on the Protection of Minors (2020 Revision)*, Arts. 22–23.
④ *see Civil Code of the People's Republic of China*, Arts. 1066, 1092.

In contrast, where one spouse infringes on a specific community asset (e.g., a property right) while managing the community property, that spouse would be liable in tort if at fault. Further, given that the management of the community property is gratuitous, the managing spouse's liability shall be limited to the case of intention or gross negligence, as prescribed in many other gratuitous relationships.[①] As with the *business judgment rule* (Howson, p. 611) in company law, the tort rule excluding slight negligence of the managing spouse also plays a role in liability restriction.

Property management in the parent-child relationship.

In regard to property management between parents and children, as well as between other family members, the law of guardianship plays a critical role. Based on the principle of the ward's best interests, the duty of care in managing the ward's property may be classified as follows.

First, the guardian shall not dispose of the ward's property except in the latter's best interests. This exception is to be strictly interpreted. The ward's best interests are not equal to maximizing its personal wealth, but to sustaining and developing its person. Therefore, instead of being invested in the pursuit of wealth maximization, the ward's property shall be maintained to meet the ward's personal needs. The disposal of the ward's property is therefore an exception; so is its investment. For example, the guardian shall be liable for losses inflicted on the ward's property in the case of an investment failure. This is different from the case of property management between spouses.

Also, the guardian shall be liable in tort for infringement of the ward's property rights. Similarly, given the gratuitous character of the guardianship, the guardian's liability shall be restricted to the case of intention or gross negligence.

In Chinese family law, the duty of care between spouses in the management of the community property is different from the case where other family members are involved. This distinction goes back primarily to the different purposes of property management. The management of the community property aims to create more wealth or community property, whereas the management of a ward's property focuses on the maintenance and development of the child and, hence, only the maintenance of the property. Different purposes lead to different rules of allocating risks or losses. These differentiated duty-of-care obligations may also be regarded as modified versions of the traditional business judgment rule, which is critical for the judgment of duty of care, yet mostly applied in company law or other commercial settings.

The Necessaries Doctrine

The necessaries doctrine (in its modern form) is rarely considered in traditional fiduciary law. In the literature, however, there is an attempt to reconsider this doctrine in terms of fiduciary principles. Based on the doctrine, the courts recognize that "each spouse has a duty to care for the other and provide for basic needs" (Scott & Chen, p. 237).

In my opinion, the duty of *care* should not be confused with the duty of *caretaking*. The duty of

① *see Civil Code of the People's Republic of China*, Arts. 43, 316, 897, 929, 1148.

care, as with its counterpart in tort, is a specific standard of duty. In contrast, the duty of caretaking (for the other spouse) refers to the content of a specific monetary duty, similar to the duty of spousal support.

On the other hand, because the necessaries doctrine involves property matters in the interests of the marital community and is thereby similar to the management of community property, it may be related to the duty of loyalty. Under Chinese law, the necessaries doctrine covers all property matters necessary to meet the needs of the family's daily life, ranging from making a contract to disposing of community property. It discourages a selfish act in that any contract or disposal made by a spouse alone, beyond meeting the needs of the family's daily life, cannot be justified under this doctrine. Such act is hence an unauthorized agency on behalf of both spouses or an unauthorized disposal of the community property, and the acting spouse bears sole liability therefor.

Special Qualities of the Duty of Loyalty in Chinese Family Law

After the similarity comparison in the first three parts, this part will show the difference of Chinese family law from the common law regarding fiduciary principles. Such difference might not only exist between Chinese law and the common law but also, in general, between the civil law and the common law.

Duty of Loyalty Revisited

Duty of sexual fidelity.

Compared with the duty of loyalty, the duty of fidelity is seldom used in legal English.① Chinese, however, uses only one term for both—the duty of loyalty (*zhongshi yiwu*). In this context, there is a long-established rule in Chinese family law (enacted first in Article 4 of the Marriage Law and now in its successor, Article 1043 of the Civil Code) that "the spouses shall be loyal to each other."② It is widely recognized that this duty of loyalty refers primarily to the duty of *sexual fidelity* (Sui, 2011, p. 38; Xu, 2012, p. 77; Hu & Wang, 2020, p. 76).

The duty of loyalty is one of the most controversial issues among scholars of Chinese family law. The first debate is whether it is a legal duty or merely a moral duty.③ Given that damages would be granted in the case of one spouse's bigamy or cohabitation with a third person, which constitutes a serious default in the duty of loyalty, it is logically compulsory that there must be a legal duty of loyalty (Zhang & Miao, 2019, p. 40). In other words, the duty of loyalty cannot be merely a moral one.

Furthermore, the duty of loyalty is not only a specific legal duty, but also a general legal principle, at least in the context of Article 4 of the Civil Code (Fang, Fan & Zhang, 2020, p. 15; Chen, 2016, p.

① But *see*, e.g., *Bayer v. Beran*, 49 N.Y.S.2d 2 (1944) ("The concept of loyalty, of constant, unqualified fidelity, has a definite and precise meaning.")
② *see Marriage Law of the People's Republic of China (2001 Amendment)*, Art. 4; *see Civil Code of the People's Republic of China*, Art. 1043 para. 2.
③ For an overview, *see* Yu, Y. (2007). *On the Law of Family*. Law Press·China, pp. 239–240.

36).[①] It could even be regarded as a subcategory of the principle of good faith—the "emperor clause" of the entire civil law—in family law (Zhang & Miao, 2019, p. 42). As a general principle, the duty of loyalty or the principle of loyalty can help courts to further develop the law in many contexts, as with any general principle under Chinese law.

There are three reasons to regard the duty of loyalty as a general principle of family law. First, as mentioned above, not every breach of duty leads to legal remedies under the existing law. This can only be justified if the loyalty requirement is not a specific duty that inevitably corresponds with a breach of duty and hence a remedy, but is rather a general flexible principle that leaves room for discretion and does not always lead to remedies. Second, it accords with the results of literal and systematic interpretations. Literally, the phrase "both spouses shall be loyal to each other" in Article 1043 of the Civil Code, for example, does not include any specific legal consequence; and systematically, the rule appears in the general part of the family law, together with other well-established general principles. Third, there was a similar interpretation in the Company Law. Before being officially recognized in the Company Law 2005, the duty of loyalty had rested only upon the principle of good faith (Howson, pp. 609–611).

Another debate relates to the validity of the so-called *loyalty agreement*, which often contains an *agreed sum*—similar to a *penalty*, but only as a contractual substitute for the statutory compensation—for certain breaches of the duty of loyalty (Sui, 2011, pp. 38–41; Wu, 2020, pp. 18–20).[②] Despite the underlying public policy controversy, it is logically reasonable to recognize the validity of a loyalty agreement. So long as the duty of loyalty is held as a legal duty, the parties should be allowed to make an estimate of the potential damages in case of a breach. Meanwhile, if the agreed sum is too high, the general rule to adjust the agreed sum can be applied (Liu, 2011, pp. 10–11).

Duty of loyalty in the broader sense.

Although the duty of loyalty refers primarily to the duty of sexual fidelity under Chinese family law, it is used from time to time in a much broader sense in the literature, which additionally includes: (a) the duty of not (intentionally) abandoning the other spouse, and not harming the other spouse for a third person's interests (Yu, 2007, pp. 238–239; Fang, Fan & Zhang, 2020, p. 15); (b) the duties listed in the first category, plus the duty of emotional communication and respect for each other;[③] and (c) all the other duties between spouses, such as all the aforementioned duties, and the duty of spousal support, among others.[④]

As a general principle of family law, the duty of loyalty could be further interpreted in its broadest sense which would include status-related and property-related duties,[①] and its scope could be extended

① For the contrary view, *see* Yang, D., & Long, Y. (eds.). (2020). *The Law of Marriage and Family*. China Renmin University Press, pp. 61–62.
② Apart from an agreed sum as a monetary remedy, other non-monetary liabilities might also exist in a loyalty agreement, such as the waiver of custody, the promise of a divorce agreement, etc. The clauses of such non-monetary liabilities are obviously invalid.
③ *see* Leading Group for the Implementation of the Civil Code of the Supreme People's Court. (ed.). (2020). *Understanding and applying the Books of Marriage, Family and Succession of the Civil Code of the People's Republic of China*. People's Court Press, p. 35.
④ *see* Zhang, J., & Miao, Y. (2019). The spousal duty of loyalty as quasi-debt. *Journal of Central China Normal University (Humanities and Social Sciences)*, *58*(3), 41 (indicating such a definition in comparative law).

from the spousal relationship to all types of family member relationships. This broadest duty of loyalty, or principle of loyalty, accords completely with the Civil Code, which provides that

> Husband and wife shall be loyal to each other, respect, and care for each other. Family members shall respect the elderly, take care of the young, help each other, and maintain a marital and familial relationship of equality, and civility.②

Moreover, this broadest interpretation is compatible with the idea of the duty of loyalty as a general principle, which may not be limited to certain scenarios like sexual fidelity, nor limited to the spousal relationship. The broader its scope, the better it works as a guideline for all of family law.

Duty to Notify Spouse of Sexual Activities during or before Marriage

Obviously, the duty of sexual fidelity only exists during marriage. Regarding sexual activities with a third person before marriage, this duty does not require a spouse to notify the other spouse, either before or during marriage. This brings us to another duty of loyalty of one spouse (usually the wife), i.e., if a child born during marriage may be a nonmarital child (one whose biological parents are not both spouses, but instead are one spouse and a third person), this spouse is obliged to inform the other spouse of the related sexual activity. In such cases, Chinese courts generally admit in a divorce proceeding that the innocent spouse (usually the husband) is entitled to reimbursement of the child support spent during marriage (based on unjust enrichment or tort) and damages for emotional distress (Cheng, 2009, pp. 80–82).

Note that the duty of notification, although related to sexual activities of one spouse before or during marriage with a third person, is not always covered by the duty of sexual fidelity (Zhang & Miao, pp. 41–42); and even where the duties overlap, the duty of notification is not dispensable. For example, a slight breach of the duty of loyalty (e.g., a one-night stand) would not trigger liability under the duty of sexual fidelity, even if it resulted in a pregnancy. However, remedies are still available under the duty of notification if the other spouse is not told about the baby's true parentage.

Duty of Support Between Family Members

In China, the duty of support in the broad sense covers spousal support, child support, support for elderly parents, and support for grandparents, grandchildren, or siblings in certain cases (Huang, 2020, p. 105).③ The duty of support is included in the duty of loyalty (in the broad sense); for example, spouses shall be loyal to and hence care for each other. To encourage performance of the duty, a policy of "carrots and sticks" was adopted.

Regarding the "carrots" impetus, first, one spouse is entitled to reimbursement from the other for

① For a definition of the duty of loyalty in property matters between spouses, *see* Hu, J., & Wang, T. (2020). The mental aspect of the duty of loyalty between spouses. *Journal of Law Application*, *11*, 76.
② *see Civil Code of the People's Republic of China*, Art. 1043 para. 2.
③ *see Civil Code of the People's Republic of China*, Arts. 26, 1058, 1059, 1067, 1068, 1071, 1074, 1075.

assuming more duties in raising children, caring for the elderly, assisting the other spouse in his/her work, etc.[①] Second, the law of succession provides similar encouragement. For example, a decedent's daughter-in-law or son-in-law is not a legal heir, but a widowed daughter-in-law or son-in-law who has made the predominant contribution in supporting the decedent shall be treated as a successor first in order.[②] Likewise, a larger share of an estate may be given to a successor who has made the predominant contribution in supporting the decedent.[③] Moreover, an appropriate share of an estate may be given to a person (other than a successor) who was largely responsible for supporting the decedent.[④]

The "sticks" penalties are similar in essence, using compensatory or even punitive remedies to discourage nonperformance of the duty of support. For instance, if a spouse has the statutory duty of support toward a person who suffers a serious illness and needs medical treatment, but the other spouse refuses to pay medical expenses, the spouse in need of the money is entitled to a partition of the community property during marriage. This is the same remedy as in the case of a fraudulent transfer.[⑤] Besides, the law of succession discourages nonperformance of the duty of support. Where a successor to an estate was able to support the decedent but failed to do so, he/she shall receive no share or a smaller share of the estate.[⑥] In the case of an abandonment, the successor will be disinherited.[⑦] Moreover, under a gift contract, if the donee fails to perform the duty of support to the donor, the donor may rescind the donation.[⑧]

A General Distinction Between Civil Law and Common Law Traditions

From the perspective of comparative law, the duty of sexual fidelity, the duty of notification, and the duty of support in Chinese family law have two characteristics in common.

First, none of them is included in the duty of loyalty or the fiduciary principles of the traditional common law, although some commentators believe that the common-law duty of loyalty relates to sexual fidelity in the case of adultery,[⑨] and that the duty of care includes the duty of support in the case of abandonment (Scott & Chen, p. 236).[⑩] However, as analyzed above the alleged relationship between duty of care and duty of support goes back primarily to the confusion between *care* and *caretaking*. Similarly, the connection of loyalty and sexual fidelity may be the result of overinterpretation of the plain meaning of the term "loyalty," which nevertheless has a fixed content in the context of the duty of loyalty in the common law tradition.

Second, the duty of loyalty depicted in this part also appears, to a greater or less extent, in other

① *see Civil Code of the People's Republic of China*, Art. 1088.
② Id. Art. 1129.
③ Id. Art. 1130 para. 3.
④ Id. Art. 1131.
⑤ Id. Art. 1066 item 2.
⑥ Id. Art. 1130 para. 4.
⑦ Id. Art. 1125 para. 1 item 3.
⑧ Id. Art. 663 para. 1 item 2.
⑨ Adultery may not only generally result in family law consequences (e.g., reduction of maintenance), but also tort liability in certain common law jurisdictions. *see* McMillian, L. (2012). Adultery as tort. *North Carolina Law Review*, *90*(6), 1987–2032.
⑩ "Under traditional law, for example, violations of the duty of loyalty (adultery, cruelty) and duty of care (desertion) were grounds for divorce." It is an interesting question whether sexual infidelity with members of the same sex could be classified as adultery in different jurisdictions. However, this will not affect the relationship between sexual fidelity and the duty of loyalty, and hence will not be discussed here.

civil law jurisdictions.[①] In Switzerland, for example, it is provided that the spouses "owe each other loyalty and support."[②] The duty of loyalty therein demands "loyalty in all emotional, sexual, spiritual, social and economic areas" (Schwander, 2018).[③] Moreover, in Germany, the German Civil Code provides, at first glance, that "[t]he spouses have a mutual duty of conjugal community; they are responsible for each other,"[④] without mentioning the duty of loyalty. However, the duty of loyalty is widely held as being included in this provision, with two different meanings.[⑤] In the broad sense, it contains all marital duties between spouses. It has a similar meaning in family law as the principle of good faith for the law of obligations.[⑥] In contrast, the duty of loyalty in the narrow sense refers to sexual fidelity.

The reason for the different understanding of the duty of loyalty between the common law and the civil law is historical. Fiduciary duty under the common law, which originates from the distinction between law and equity, is more the product of history than of logic. Only in this context is it possible and understandable to discuss whether, for instance, fiduciary law comes under contract law or tort law (Bray, 2019, pp. 463–464), or law schools should teach a separate fiduciary law course (Chodos, 2011, pp. 837–850); and only in this context is the fiduciary duty or the duty of loyalty restricted to its traditional scope.

On the contrary, civil law jurisdictions have no comparable distinction between law and equity, so fiduciary obligations reside perfectly well under contract law, tort law, family law, and other legal fields. This is logically almost inevitable.[⑦] In this context, as a general principle of family law, the duty of loyalty may enjoy much broader room in adjusting the family relationship than may its counterparts in the common law. It is logically coherent that the duty of loyalty is extended to both personal and property relationships, and from the spousal relationship to most family relationships. Besides, the misunderstanding of the duty of loyalty and the duty of care in the common law also illustrates that the contemporary meaning and scope of the duty of loyalty in the common law would be broader if logic rather than history had been followed.

Conclusion

Based on the functional method of comparative law study, this essay examined several fiduciary duty rules under Chinese family law, which can be divided into two groups.

The first group of fiduciary duty rules in Chinese family law pursues similar ends as do the

① *see* generally, Zhang, J., & Miao, Y. (2019). The spousal duty of loyalty as quasi-debt. *Journal of Central China Normal University (Humanities and Social Sciences), 58*(3), 41. (on the law of France, Germany, Japan, Germany, Austria and Switzerland).
② Swiss Civil Code, Art. 159 para. 3 ("They owe each other loyalty and support.").
③ "Die Treuepflicht gebietet Loyalität in allen emotionalen, sexuellen, seelisch-geistigen, gesellschaftlichen und wirtschaftlichen Bereichen."
④ German Civil Code, Art. 1353 para. 1.
⑤ Reinhard Voppel, *§ 1353 BGB, in Staudinger BGB, §§ 1353-1362, Wirkungen der Ehe im Allgemeinen*, Sellier-de Gruyter (Berlin), Neubearbeitung 2018, Rn. 29.
⑥ Id. Rn. 18.
⑦ *see*, e.g., Graziadei, M. (2014). Virtue and utility: Fiduciary Law in Civil Law and Common Law jurisdictions. In Andrew S. Gold & Paul B. Miller (eds.). *Philosophical Foundations of Fiduciary Law* (p. 290). Oxford University Press (discussing the relationship between contract law and fiduciary law). For the contrary view, *see* Bray, S. L. (2019). Fiduciary remedies. In Evan J. Criddle, Paul B. Miller & Robert H. Sitkoff (eds.). *The Oxford handbook of fiduciary law* (pp. 451, 464). Oxford University Press.

fiduciary principles in common law jurisdictions. They are similar in function. Apart from a set of rules in common, including conflict-of-interest rules, remedies for fraudulent transfers, access to information on certain property (e.g., community property) and the duty of care in different cases of property management, there are two special rules in China, which might be regarded as "natural" or logical extensions of the common law fiduciary principles in the context of family law and, hence, the candidates for its future. These special rules comprise: (a) the rule for distributing income, appreciation, and other proceeds of separate property during marriage (as a special type of duty of loyalty); and (b) different standards of duty of care and related rules of allocating risk or losses (as modified versions of the business judgment rule in commercial settings).

The second group of fiduciary duty rules in Chinese family law are the duty of loyalty rules, which are different. The Chinese term *zhongshi yiwu* is translated literally as "duty of loyalty," but this only *sounds* like its counterpart in the common law. *Zhongshi yiwu* extends to the duty of sexual fidelity during marriage, the duty of notification about certain sexual activities of one spouse during or even before marriage, and the duty of support between family members.

The duty of loyalty in Chinese family law, as a combination of related rules in the aforesaid two groups, turns out to be a general principle of Chinese family law, and is similar to and even a subcategory of the principle of good faith throughout the civil law. The duty of loyalty in such a broad sense also appears in other civil law jurisdictions. Such a widespread distinction in the scope of the duty of loyalty may go back primarily to the historical distinction of law and equity in the common law tradition, and to the logical appropriateness of a broad understanding of the term (duty of) "loyalty," which exists in many civil law jurisdictions. The latter may have contributed to the distinction, in the common law tradition, between the duty of loyalty and the duty of sexual fidelity in the case of adultery.

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A Study on the Evaluation System and Mechanism of CSR Stakeholder in Food Enterprises

Li Ke*

Sichuan Academy of Social Sciences

Abstract: The establishment of the evaluation system of corporate social responsibility (CSR) stakeholder in food enterprises includes the determination of evaluation objects, the selection of evaluation subjects, the formulation of evaluation standards, and the establishment of evaluation institutions. The establishment of the stakeholder evaluation system is a static institutional design, while the establishment of the stakeholder evaluation mechanism is a dynamic institutional arrangement based on the stakeholder evaluation system. The establishment of the stakeholder evaluation mechanism requires the government to guide and promote enterprises to undertake social responsibilities, establish a moral evaluation system of CSR, and create a cultural atmosphere for enterprises to undertake social responsibilities. Establishing a CSR labeling system in food enterprises can be an effective solution to reflect the interests of stakeholders in the supervision and evaluation system and to systematize the stakeholders' supervision and evaluations of CSR in food enterprises.

Keywords: food enterprises, CSR, stakeholders

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* Li Ke, Research Institute of Law, Sichuan Academy of Social Sciences.

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Correspondence concerning this article should be addressed to Li Ke, Research Institute of Law, Sichuan Academy of Social Sciences, Chengdu, 610071, China. Email: 183026663@qq.com

Introduction

As an "economic man," an enterprise needs to obtain material resources, human resources, and management resources from society and apply them to the whole process of production, operation, and management to maximize economic benefits. As a "social man," an enterprise needs to maintain a benign interactive relationship with its environment and other related social subjects (such as creditors, consumers, shareholders, communities, etc.), and give back the wealth created by the enterprise (including material wealth and spiritual wealth) to society, that is, to undertake social responsibility.

CSR mainly covers the responsibility of enterprises to protect the environment and prevent pollution, the responsibility to provide quality assurance products and services to consumers, the responsibility for employee development and labor rights protection, and the responsibility for community development. Enterprises with different industry attributes provide different types of products and services for society, which determines that the social responsibilities undertaken by enterprises in various industries are different. The social responsibility of food enterprises is very special because the food produced and distributed by food enterprises is directly related to people's lives and health, and the target consumer groups are huge. Once there are problems and hidden dangers in food, they can easily lead to a wide range of food safety crises and public health problems. Therefore, in addition to the CSR in the general case, the social responsibility of food enterprise should also strengthen the moral responsibility, information disclosure responsibility, food quality and safety responsibility, food traceability responsibility, partner audit responsibility, and legal responsibility.

In the process of fulfilling social responsibility, enterprises are driven and influenced by the profit maximization mechanism, so they tend to have opportunistic tendencies which affect the effectiveness and quality of social responsibility implementation. Therefore, the realization of enterprise social responsibility cannot rely solely on enterprise self-regulation. A check and balance mechanism for stakeholders should also be introduced. The diverse participation and supervision of stakeholders is the driving force for the sustainable development of CSR management. Public participation is an effective supplement to government supervision, and an effective public participation mechanism is conducive to preventing and reducing food safety risks. To improve food safety, both the supervision of government management departments and the social supervision of stakeholders should be strengthened. Multiple forces should be utilized to realize social co-governance of food safety. The food safety legislation and supervision experience in developed countries have taught us that food safety management needs a gradual transition from the supervision and management of government administration departments to the joint management of social forces such as consumers, industry organizations, and special third-party institutions.

The current legislation and management of CSR in food enterprises lack effective transmission and application of CSR information transmission mechanism among government administration

departments, food industry organizations, and stakeholders. The social responsibility information transmission mechanism of food enterprises includes two two-way processes, information disclosure of CSR in food enterprises and stakeholders' evaluations and feedback. In these two dynamic processes, we urgently need to integrate stakeholders' evaluations of food enterprises' social responsibility into the government regulatory process and construct the evaluation system and evaluation mechanisms.

Establishment of a Evaluation System of CSR Stakeholder

The establishment of a evaluation system of CSR stakeholder in food enterprises includes the determination of evaluation objects, the selection of evaluation subjects, the formulation of evaluation standards, and the establishment of evaluation institutions.

At present, there only exists the food enterprises' CSR standards formulated by special research institutions. It has been suggested that the government should guide the establishment of the CSR evaluation mechanisms in food enterprises, clarify the evaluation subjects, evaluation institutions, and evaluation objects, and promote the construction of the CSR evaluation system from the aspects of institutional settings, rulemaking, and institutional construction.

Evaluation Subjects

With the establishment and development of China's market economy system, China's capital market has gradually improved. The diversification of capital composition is the main feature of China's modern enterprises. Every modern enterprise must fully pay attention to issues such as protecting the rights and interests of stakeholders including enterprise investors, satisfying the reasonable demands of stakeholders, pursuing the development of the enterprise itself, and reaching a "win-win" contractual agreement with stakeholders. To strengthen the supervision of enterprise investments, the investor evaluates the operation and management performance of the enterprise. Based on the evaluation, the investor influences and motivates the enterprise to adjust strategic management objectives and improve the management level, thereby maximizing the corporate value and achieving a win-win situation between the investor and the enterprise. This evaluation method can cause enterprises to blindly pursue economic benefits while ignoring the social responsibilities, environmental responsibilities, and even the legal responsibilities that they should undertake. In the process of integrating into economic globalization and internationalization management, Chinese enterprises required a brand-new enterprise performance evaluation method. The evaluation subject has changed from a single enterprise owner to various stakeholders of the enterprise. The evaluation object has changed from the past financial performance to the social responsibility evaluation that combines financial performance with social performance.

The Code of Corporate Governance for Listed Companies in China emphasizes that listed companies should respect the rights of stakeholders, pay attention to issues such as environmental

protection and public welfare, and undertake social responsibility. This regulation introduces the "stakeholder theory of corporate governance." Under the condition of modern market economy, a company is essentially a set of contracts between various stakeholders, and the company's development depends on the long-term cooperation and interactions between the various stakeholders. Corporate governance institutional arrangements need to fully consider the interest of each stakeholder before establishing a corporate governance structure involving stakeholders such as shareholders, creditors, employees, and the government (Ding, 2007, p. 134). In the process of transforming the food enterprises' social responsibility into the optimization of the corporate governance structure, the evaluation model of corporate governance has changed from a simple performance evaluation of shareholders or managers to an evaluation based on the investment returns of multiple stakeholders and a corporate governance evaluation indicator system based on the value orientation of stakeholders.

According to the stakeholder theory, the stakeholders of an enterprise are the individuals or groups who can influence the realization of the enterprise's objectives or be affected by the realization of the enterprise's objectives (Freeman, 1984). Only when an individual or organization has invested certain resources into the enterprise and can influence or be affected by the business activities of the enterprise, such an individual or organization can be regarded as a stakeholder in CSR and can truly own and exercise the right to evaluate such CSR. Therefore, the media and the environment are excluded. Considering the empirical analysis of relevant domestic and foreign theoretical literature on the impact of stakeholders on CSR behavior, there are seven types of stakeholders who can greatly influence food enterprises' CSR behaviors. The seven types of stakeholders are the government, consumers, shareholders, employees, creditors, communities, and food industry organizations. Therefore, these seven types of stakeholders are listed as the evaluation subjects of food enterprises' social responsibility.

Evaluation Institutions

In general, the construction of food enterprises' CSR evaluation institutions can be divided into three stages. In the first stage, under the uniform guidance of the government administration department, relevant departments such as industry associations and consumer organizations act as the evaluation institutions to participate in the evaluation of food enterprises' social responsibility, and actively cultivate and promote the construction of special third-party evaluation institutions. In the second stage, the evaluation and certification of food enterprises' social responsibility are performed by third-party institutions under the guidance and supervision of the government. In the third stage, special third-party evaluation institutions that are independent of government administration institutions and enterprises are guided and established to evaluate food enterprises' social responsibility.

Government evaluation institution for CSR.

In recent years, the central and local governments in China have established CSR promotion institutions. In May 2012, the State-Owned Assets Supervision and Administration Commission of the State Council (SASAC) established the Central Corporate Social Responsibility Steering

Committee to promote central enterprises to actively fulfill CSR. Under the guidance of the Central Corporate Social Responsibility Steering Committee, most central enterprises have clarified that the management department should be primary in fulfilling CSR and should set up a special social responsibility department to identify and coordinate activities. Some local governments in China have also successively established CSR promotion institutions. For example, Hebei province, Hangzhou, and other regions have respectively established guidelines on the promotion of CSR, established special CSR leading institutions, and established joint meeting systems for CSR.

The author suggests that the government evaluation institution for CSR should take the following explicit actions. First, the government evaluation institution should establish a national CSR leading institution as soon as possible. Second, based on the establishment of CSR promotion institutions by local governments, the government evaluation institution should improve the work functions of CSR promotion institutions, incorporate the evaluation function of CSR into their work functions, or establish a government management evaluation department specifically for CSR. Third, local governments can cooperate with relevant institutions such as the Administration for Market Regulation and Health Administration Department to establish a joint meeting system for food enterprises' social responsibility and conduct regular official evaluations of social responsibility fulfillment by food enterprises. Fourth, government management departments should actively cooperate with food industry organizations, consumer organizations, and special intermediary institutions to establish a stakeholder evaluation organization of food enterprises' social responsibility.

Special third-party evaluation institution.

The Third Plenary Session of the 18th Central Committee of the CPC emphasizes that it is necessary to transform government functions and exercise government administration in an innovative way, and build a law-based and service-oriented government. The endogenous law of the market economy states that "the market plays a decisive role in resource allocations," and thus the government must change its past administrative management functions. The government's market management functions need to transform into a sound and comprehensive function in which the government gives way to the market and promotes market functions, that is, to establish a management pattern of "big market, small government." After the government takes the lead in building the evaluation system framework of CSR stakeholder, evaluation affairs of CSR stakeholder will gradually be separated from government functions, and eventually transition to professional evaluation by market intermediary organizations. In this process, it is necessary for the government to actively cultivate intermediary market organizations such as special third-party evaluation institutions.

A third-party evaluation institution for CSR refers to a third-party subject other than the government, enterprises, and stakeholders, which specializes in CSR evaluation, and it is also an authoritative special organization. Special third-party evaluation institutions mainly include third-party specialized audit institutions for CSR reports, and third-party specialized evaluation institutions for CSR.

In general, there are four main types of institutions that evaluate CSR in China, namely industry organizations, experts, consulting institutions, and certified public accountants. But at this stage,

China's CSR is mainly evaluated by industry associations and experts. For example, in recent years, the China Federation of Industrial Economics has formulated a series of industry internal normative documents on CSR and established a star rating system to evaluate the social responsibility fulfillment by Chinese industrial enterprises. Since 2010, the Corporate Social Responsibility Research Center of the School of Economics of the Chinese Academy of Social Sciences has formulated and published the "China Corporate Social Responsibility Report Rating Standards" every year and established the "China Corporate Social Responsibility Report Rating Expert Committee" to rate the CSR reports that participate in the evaluation. In China, CSR reports still lack third-party evaluations by consulting institutions and certified public accountants. In developed countries, professional consulting institutions and certified public accountants have played an important role in the evaluation and audit of CSR reports. There is still a big gap between China and developed countries in the professionalism and overall level of CSR audit evaluations.

Some regions in China have explored and attempted to conduct third-party evaluations of CSR. In 2012, Changsha formulated the "Changsha Corporate Social Responsibility Evaluation System," and the third-party institution conducted an evaluation of CSR every two years. In 2015, the Shenzhen Social Work Committee planned to openly select third-party administration institutions for CSR evaluations, and these institutions were required to have dedicated staff, expert teams, management systems, and direct or related experience in conducting CSR evaluations.

The author suggests that the establishment of a special third-party evaluation institution for CSR can follow the three steps of government entrustment, market incubation, and independent third-party evaluation. The first step is the government entrustment stage. The government employs a special third-party institution to evaluate CSR in the form of purchasing services. The second step is the market incubation stage. The government actively cultivates special third-party institutions such as certified public accountants, consulting institutions, and audit institutions. The third step is the independent evaluation stage of special third-party institutions. In a more mature condition, a special third-party institution can form an independent supervision and evaluation mechanism for CSR, such as conducting third-party independent verification and evaluations of CSR reports.

Design of Evaluation Indicator Systems

Evaluation principles.

The first principle is to combine quantitative evaluations with qualitative evaluations. When designing evaluation indicators, it is first necessary to design qualitative evaluation indicators based on the social responsibility fulfillment by food enterprises. On this basis, stakeholders' evaluations of the social responsibility fulfillment by food enterprises are quantified to ensure the strong practicability of the designed evaluation indicators and facilitate real and effective stakeholder evaluations of the social responsibility fulfillment by food enterprises.

The second principle is to combine financial indicators with non-financial indicators. CSR includes not only economic responsibility, but also legal responsibility and environmental responsibility.

Stakeholders' evaluation of CSR should be comprehensive and multifaceted. It should not only evaluate the economic performance of the enterprise but also comprehensively evaluate the social performance and environmental performance. The financial indicator is an important indicator to measure the performance of business management. In addition, stakeholders' evaluations of CSR also involves several non-financial indicators such as food quality and safety, environmental protection, and the protection of employees' rights and interests. When designing non-financial indicators of CSR, it is necessary to facilitate stakeholders to quantitatively evaluate CSR. For example, when designing corporate reputation evaluation indicators, we can consider quantitative factors such as customer complaint rates, return rates, bank overdue debt repayment rates, etc.

The third principle is to combine daily indicator designs with expected indicator designs. The evaluation indicators should not only evaluate and intuitively reflect the stage management performance of the enterprise but also be predictable and motivating. Stakeholders can urge the enterprise to incorporate social responsibility into the implementation of enterprise development strategy through the evaluation of CSR. Daily indicators refer to the indicators that can timely measure and reflect various specific features of the social responsibility fulfillment by enterprises in the process of daily operation and management. Expected indicators are strategic, holistic, and forward-looking indicators that focus on the long-term development of the enterprise.

Fourth, the evaluation indicators should be able to measure the sustainable development ability of the enterprise. The evaluation indicators should not only reflect the economic benefits of the enterprise but also reflect the environmental and social benefits of the enterprise. It is necessary to consider not only the contribution of food enterprises to society but also the size of the burden they bring to society. For example, we can design evaluation indicators such as market share, rate of qualified products, customer satisfaction, environmental pollution, and governance.

The fifth principle is to balance the interests of stakeholders. A modern enterprise is an aggregation of various interests formed by the economic and social interests of multiple stakeholders such as shareholders, creditors, employees, and the government. The evaluation indicators we design should not only satisfy the interests of one or certain types of stakeholders but also reflect the expected interests of various stakeholders for the social responsibility fulfillment by food enterprises. Only the evaluation indicators that can balance the expected interests of all stakeholders can improve the self-management level of food enterprises' social responsibility with the joint effort of the interests of all stakeholders and promote the active fulfillment of social responsibility by food enterprises. Therefore, a balance can be reached between the economic interests and social interests of the ternary relationship between the managers, owners, and stakeholders of enterprises.

Evaluation standards.

The CSR standard is a reference scale for measuring the fulfillment of CSR. At present, China's CSR standards mainly include national and local standards for social responsibility. The social responsibility standards in the food industry mainly include the food enterprises' CSR evaluation standards formulated by special institutions.

National standards for social responsibility.

The national standards for CSR in China refer to the three national standards for social responsibility officially approved and issued by the General Administration of Quality Supervision, Inspection and Quarantine and the Standardization Administration of the People's Republic of China (now the State Administration for Market Regulation) in 2015, namely the "Guidance on Social Responsibility," "Guidance on Social Responsibility Reporting," and "Guidance on Classifying Social Responsibility Performance." In general, the national standards for social responsibility provide framework guidelines for enterprises to conduct social responsibility activities, and various industries can formulate and improve their social responsibility guidelines and performance evaluation standards based on the national standards.

Local standards for social responsibility.

In recent years, some local governments have actively promoted CSR strategic practice, formulated local standards and evaluation systems of CSR, and produced some valuable experience.

In 2015, Shenzhen issued the "Opinions on Further Promoting the Construction of Corporate Social Responsibility" and took the lead in launching the local standards for CSR in China, namely "Corporate Social Responsibility Requirements" and "Guidance on Corporate Social Responsibility Evaluation," which specified an implementation plan with strong operability to further promote local enterprises to actively fulfill their social responsibility. These two standardization guidance documents were formulated based on the international standard ISO26000 "Guidance on Social Responsibility." They are the first guidance documents on social responsibility evaluation published in the form of local standards, and they have a leading role in China. Shenzhen emphasizes the participation of various social forces, implements the rating evaluation of CSR by specialized third-party institutions through the qualification management system, improves the information standardization management mechanism of CSR, and establishes a special corporate social responsibility information disclosure and release platform.

Evaluation standards for food enterprises' social responsibilities formulated by special institutions.

In September 2015, the China Food Newspaper and the Beijing Institute of Technology jointly formulated an evaluation standard for Chinese food enterprises' social responsibilities. The release of this industry standard for food enterprises' social responsibilities had an important role in guiding us to formulate food enterprises' CSR evaluation standards from the perspective of stakeholders. The indicator system of China's food enterprises' CSR evaluation standards is based on the Guidance on Social Responsibility issued by the International Organization for Standardization and the Guidance on Social Responsibility officially issued by the Standardization Administration of China. The indicator system uses industry units to design CSR evaluation indicators. Based on the establishment of evaluation indicators such as consumers, environments, community participation, and development, the indicator system also sets up some unique indicators of the food industry according to the particularity of the food industry.

Establishment of stakeholder evaluation standards for food enterprises' social responsibilities.

The three national standards for social responsibility officially approved and released by the General Administration of Quality Supervision, Inspection and Quarantine of China (now the State Administration for Market Regulation) and the Standardization Administration of China in 2015 can be used as the overall principles and guiding framework to formulate the stakeholder evaluation standards for food enterprises' social responsibilities. The three national standards are the "Guidance on Social Responsibility," "Guidance on Classifying Social Responsibility Performance," and "Guidance on Social Responsibility Reporting." The evaluation standards also refer to the practical experience of the local standards and evaluation systems of CSR in Shenzhen and other cities. From the perspective of stakeholder evaluation, the evaluation standards learned from the Chinese food enterprises' CSR evaluation standards formulated by special institutions in 2015 incorporate consumers, the environment, community participation, development, and food quality and safety into the stakeholder evaluation indicator system of food enterprises' social responsibilities.

Evaluation indicators.

Selection of evaluation indicators.

In general, the indicators for stakeholders to evaluate CSR mainly include legal compliance management and legal liability, staff training and development and benefit protections, consumer services and protection of rights and interests, environmental protections and pollution control, community participation and job creation, stakeholder communication, and information feedback. The most basic social responsibility of food enterprises is food safety. The selection of stakeholder evaluation indicators of food enterprises' social responsibilities should not only consider the characteristics of food enterprises different from other enterprises but also consider the particularities of different types of enterprises in the food industry. We can classify food enterprises based on the risk levels[①] of food production enterprises defined by the Food and Drug Administrative Department of China (now the State Administration for Market Regulation), and design corresponding social responsibility evaluation indicators for food production enterprises with different risk levels.

Basic evaluation indicators of food enterprises' social responsibilities.

CSR mainly includes the responsibility of enterprises to protect the environment and prevent pollution, the responsibility to provide quality assurance products and services to consumers, the responsibility for employee development and labor rights protection, and the responsibility for community development. Specifically, enterprises with different industry attributes provide different types of products and services for society, so the social responsibilities undertaken by enterprises in various industries are different. The social responsibility of food enterprises is very special because the food produced by food enterprises is directly related to people's lives and health, and the target consumer groups are huge. Once there are problems and hidden dangers in food, poor quality

① Since December 1st, 2016, China Food and Drug Administration Department (now the State Administration for Market Regulation) has begun to determine the risk level of food production enterprises and implement classified supervision, and divided food production enterprises into four levels of ABCD in the order of low risk to high risk and implemented classified management according to the four risk levels of ABCD.

control will easily lead to a wide range of food safety crises and public health problems. Therefore, in addition to the CSR evaluation indicators in the general case, the CSR evaluation indicators of food enterprises should also strengthen the moral responsibility, information disclosure responsibility, food quality and safety responsibility, food traceability responsibility, partner audit responsibility, and legal responsibility.

First, moral responsibility is the responsibility to guarantee that the life, health, and safety of consumers are not violated by the food produced by the enterprise. "Food is the first necessity of the people." Food is essential for survival, and food is directly related to people's life and health. Food enterprises mass-produce food, so once food safety problems occur, it will affect a huge number of consumers and pose a threat and damage to public health. Therefore, the most basic social responsibility of food enterprises is to make food that meets standards, to provide consumers with safe, healthy, and nutritious food, and to ensure that the food produced by the enterprise does not cause any threat or damage to the life and health of consumers.

Second, information disclosure responsibility is the responsibility to label the true condition of the food. To let stakeholders such as consumers know the true condition of the food, food details such as nutrition, additives, country of origin, production date, and shelf life are clearly labeled on the food packaging. Therefore, consumers can know the true condition of the purchased food, compare, and select the food. When a food safety problem occurs, it is also convenient for administration institutions and consumers to find the source of the problem.

Third, food quality and safety responsibility are the responsibilities to ensure food quality and safety. In the process of food production, food enterprises shall not sell seconds at the best quality-price, combine or adulterate food products, produce or sell fake, low-quality, shoddy, spoiled, or expired food.

Fourth, food traceability responsibility is the responsibility to trace back to the source of the food when food safety problems occur. In general, food production and operation need to go through many steps, including the purchase of raw material, cleaning, processing, warehousing, logistics, and many others. If a food quality problem occurs in one of the steps, it will affect the food quality and safety of the entire food production and operation chain. When a problem food is found on the market, we need to find out the cause of the problem food as soon as possible to prevent the continued expansion of the damage. At this point, it is necessary to activate the food traceability mechanism, and trace back at what step the problem occurred. Therefore, food enterprises should establish a food traceability mechanism, and keep food traceability records on purchase, production, processing, warehousing, and other steps, thus making it convenient to trace the source and find the responsible person if a food safety problem occurs.

Fifth, partner audit responsibility is the food supply chain responsibility. Technically, this belongs to the extended part of food enterprises' social responsibilities, and in a broad sense, it is the food traceability responsibility. It includes procurement in all steps of the food industry chain and quality and safety checks of food raw materials to ensure the quality and safety of food raw materials and food products in the upstream and downstream of the food industry chain.

Sixth, legal responsibility is the responsibility to penalize food production enterprises that violate food safety laws.

Evaluation methods.

The balanced scorecard method is a commonly-used method of enterprise performance evaluation in the world. The characteristic and advantage of the balanced scorecard method are its balance of multiple aspects, namely, the balance between corporate strategic indicators and daily indicators, the balance between the internal management and the external supervision of the enterprise, and the balance between different stakeholders. The balanced scorecard method provides a unique perspective for us to establish a stakeholder evaluation mechanism of food enterprises' social responsibilities.

Based on the balanced scorecard method, we can establish a "multi-dimensional integration" stakeholder evaluation system and use the government, creditors, consumers, shareholders, employees, communities, and food industry organizations as the seven dimensions of a comprehensive evaluation of food enterprises' social responsibilities. From the perspective of stakeholders, we can establish a comprehensive and multi-dimensional stakeholder evaluation mechanism of food enterprises' social responsibilities. In this balanced framework system of the evaluation mechanisms, the realization of the interests of various stakeholders and the maturity of CSR complement each other. Only when the interests of these seven types of stakeholders are realized does the strategic management practice of social responsibility of food enterprises achieve an optimal state.

Establishment of Stakeholder Evaluation Mechanisms

The establishment of the stakeholder evaluation system is a static institutional design, while the establishment of a stakeholder evaluation mechanism is a dynamic institutional arrangement based on the stakeholder evaluation system.

Moral Evaluation

The establishment of the stakeholder evaluation mechanism requires the government to guide and promote enterprises to undertake social responsibility, establish a moral evaluation system of CSR, and create a cultural atmosphere for enterprises to undertake social responsibility.

The enterprises' subjective consciousness of taking the initiative to undertake social responsibility in economic activities is what we usually call business ethics. Traditional Chinese business ethics emphasizes the proper attitude toward benefit and duty, which has commonality with the CSR we advocate now. Benefit means commercial profits and economic interests. Duty means morality and responsibility. In ancient times, the morality of business was mostly used to refer to the businessman's behavior and conscience. In addition to promoting integrity, modern CSR also pursues deeper value goals such as environmental protection and social welfare. Based on traditional business ethics, modern CSR is endowed with broader content and deeper meaning.

To continue traditional Chinese business ethics, advocate enterprises to actively fulfill their social

responsibility, and establish a moral evaluation system of CSR, The author proposes the following suggestions.

First, the government actively guides enterprises, combines the idea of CSR with the country's overall development strategy, and gradually establishes a social evaluation system for CSR.

Second, the government's guidance and promotion of CSR require both the gradual improvement of CSR legislation and the establishment of a business ethics system that is compatible with commercial law at the conceptual and institutional levels.

Third, the enterprise itself actively advocates and fulfills social responsibility. The enterprise itself should also integrate the fulfillment of social responsibility into the modern corporate culture of integrity and harmony and internalize it into the optimization of the internal corporate governance model. This is also the specific behavior of enterprises to form their own business ethics standards and fulfill social responsibilities according to their own characteristics. Updating the concept of "integrating CSR into corporate culture" is not enough to face the practical problems of how enterprises should undertake social responsibilities and how to realize various interests of stakeholders. We need to incorporate the corporate culture covering CSR into the enterprise (corporate) governance mechanism and institutionalize it through explicit provisions in legislation and articles of association.

Evaluation Methods

At this stage, the government department can establish a special CSR administration institution to be responsible for the stakeholder evaluation of food enterprises' social responsibilities. On this basis, third-party intermediary organizations are gradually cultivated. The government takes the form of purchasing services to entrust a special third-party service institution to evaluate CSR. When the condition is mature, it will eventually transition to the independent evaluation by special third-party institutions.

First, government management departments, food industry organizations, and food enterprises need to set up special CSR administration institutions. Government administrative departments such as administration for market regulation in each region shall set up special administration institutions to be responsible for collecting, sorting, and aggregating the social responsibility information disclosure report information released by various food enterprises and the stakeholders' evaluation information of food enterprises' social responsibilities. Each food enterprise should also set up an internal CSR administration department, which is responsible for collecting and arranging the information records of the enterprise's social responsibility fulfillment, regularly issuing CSR reports, collecting information feedback related to stakeholders' demands for CSR, and timely report the relevant information of the enterprise's social responsibility fulfillment and the evaluation information of stakeholders to the food industry association. Food industry associations in various regions should also set up corresponding CSR administration institutions to establish CSR standards, action guidelines and guidance on CSR reporting for food enterprises, guide food enterprises to actively fulfill their social responsibility, collect information from stakeholders on the supervision and evaluation of social responsibility fulfillment

by food enterprises, and regularly report this relevant information to government administration departments.

Second, each region can establish an information integrated management system that integrates information disclosure, evaluation, feedback, and management of food enterprises' social responsibilities to connect government administration departments, food industry organizations, food enterprises, and stakeholders. Food enterprises can use this information management system to release CSR reports and communicate with stakeholders. Stakeholders can use this platform to give feedback on social responsibility evaluation information to the enterprise. Food industry organizations can use this platform to understand the performance of social responsibility fulfillment by food enterprises and provide active guidance. Government administration departments can use the information on this platform to conduct a comprehensive evaluation of social responsibility fulfillment by food enterprises, and regularly select social responsibility star-rated enterprises. The government can award a CSR star label to the food enterprise that reaches a certain star rating.

Third, the evaluation methods of stakeholders include two types of evaluations, which are the evaluation of external stakeholders, and the evaluation of internal stakeholders of the enterprise.

Evaluation methods of external stakeholders of the enterprise.

Government evaluation methods include legal evaluation, moral evaluation, as well as the CSR star rating system discussed above, which awards social responsibility star labels to enterprises. Creditors, such as banks and other financial institutions, can evaluate the financial credit rating of food enterprises based on their credit performance and credit status of investments and financing, and include the evaluation information in the credit management system. The credit management system of the banking industry can be networked with the CSR evaluation system of the government administration department. The relevant data of financial credit rating evaluation can be used as an evaluation indicator for the final selection of social responsibility star-rated enterprises by government administration departments. The environmental protection department can provide real-time monitoring and evaluation data related to environmental protection and pollution control of food enterprises. Food industry organizations and food administration departments can integrate the data and use it as an important reference for the final evaluation of social responsibility star-rated enterprises. The community can regularly organize community residents to evaluate the performance of social responsibility fulfillment by food enterprises. The evaluation content includes the quality and safety of food produced by food enterprises, and the contribution to providing jobs for the community, helping families in need, caring for elderly and disabled persons, charitable donations, etc. The community administration institution can timely send the collected evaluation information to local administration for market regulation. Industry organizations can conduct CSR evaluations within the industry, set up star rating evaluations, and award social responsibility star labels to enterprises. We should pay attention to consumers' feedback on food quality and safety evaluation information and implement consumers' supervision and evaluation of food quality and safety into a certification and labeling system. For example, food enterprises that have achieved a certain evaluation rating can

use labels such as "brand with high customer satisfaction on food enterprises' social responsibilities," which can become a major influencing factor for potential consumers to decide whether to purchase such food or catering services. Therefore, we can extensively absorb consumers' first-hand evaluation information on the quality of food industry brands, further influence the purchase or investment intentions of potential consumers and other stakeholders, and ultimately generate positive incentives or negative reductions for the long-term economic interests of food enterprises.

Evaluation methods of internal stakeholders of the enterprise.

A social responsibility administration institution can be set up within the enterprise, that is, the internal social responsibility audit institution, which is called the corporate ethics department in Europe and the US. It is responsible for CSR strategic planning, information disclosure of CSR, internal audit of CSR reports, communication with, and coordination of, stakeholders, and daily management of CSR. The functions and authority of the corporate ethics committee that is responsible for reviewing the performance of corporate social responsibility fulfillment are mainly derived from the company's board of supervisors (Supervisors). The audit power of the corporate ethics committee on CSR should not be controlled by the resolution of shareholders. Only on the premise that the function of the company's board of supervisors (Supervisors) is positioned to supervise the management team on behalf of the company's stakeholders, the position and specific function of the corporate ethics committee in the corporate governance structure and social responsibility management can be precisely located. Therefore, the "Company Law of the People's Republic of China" or the company's articles of association should separately clarify the relatively independent nature and functions of the corporate ethics committee and modify the functions of the board of supervisors accordingly.

In view of the scale effect and demonstration effect of listed enterprises, it is recommended that all listed food enterprises establish a special internal social responsibility administration institution, regularly announce the information about CSR fulfillment and receive feedback from stakeholders on CSR behavior.

Establishment of the Food Enterprises' Social Responsibilities Labeling System

The government work report of the State Council in 2014 clearly pointed out that it is necessary to establish a whole-process supervision mechanism from production and processing to circulation and consumption, a social co-governance system and a traceability system, and improve the food and drug safety supervision system from the central and the local level to the grassroots level. It can be found that management has raised the social co-governance of food safety to a new level.

Public participation is an effective supplement to government supervision, and a carefully developed public participation mechanism is conducive to preventing and reducing food safety risks. Food safety cannot rely solely on government supervision. To achieve social co-governance of food safety, the participation of more stakeholders is also required. It is recommended to implement the

stakeholder evaluation of food enterprises' social responsibilities into the establishment of a food enterprises' social responsibilities labeling system so that the social responsibility label can effectively affect the recognition and behavioral choices of food enterprises by potential stakeholder groups including consumers.

CSR Labeling System

The CSR label is a method to evaluate CSR, and it is also a kind of proof and recognition of CSR fulfillment. The CSR label is the evaluation of an enterprise by a special certification institution. The certification institution is a third-party certification institution independent of government administration institutions and the public. As a special identification symbol, the CSR label connects enterprises, certification institutions, consumers, and government administration departments. On the one hand, the CSR label is a certification of the maturity of CSR fulfillment. On the other hand, it can convey to consumers and other stakeholders the information about whether an enterprise is qualified to fulfill its social responsibilities. Therefore, consumers and other stakeholders can realize their right to know the performance of CSR fulfillment, and the label can guide business stakeholders to make reasonable choices.

In some countries, the CSR label has been in use for several years and has received relatively good results. Since 2001, Belgium has been awarding social responsibility labels to enterprises that fulfill social responsibilities. Some European countries, such as the UK, adopted the Eco-label, which focused on the supervision, and evaluation of environmental protection. The French government actively cooperated with enterprises and non-profit organizations and participated in the development of the CSR label. A customer call center for social responsibility labels was established with cooperation between the French Council for Employment, Income, and Social Cohesion, the French Association of Customer Relations (AFRC), and the French Trade Union of Contact Centers (SP2C). In addition, France has also set up an Eco-label related to CSR and sustainable development. The Association Française de Normalisation (AFNOR) launched Eco-label management in 1989, aiming to identify and reward enterprises that protect the environment throughout the life cycle of products and provide guidance to consumers. Any organization can voluntarily apply for an Eco-label. The management organization of the French Eco-label is composed of multiple stakeholders, including 18 representatives of manufacturers, traders, consumers, and other interested groups (Xiao, 2015, p. 87).

At present, China does not have a national CSR, nor a recognized certification institution or certification program for CSR labels. Only some local governments have explored and established responsibility evaluations and certification systems, but these responsibility certifications are mostly concentrated in the field of environmental protection. For example, in August 2009, the Department of Ecology and Environment of Zhejiang Province, the Shanghai Municipal Bureau of Ecology and Environment, and the Department of Ecology and Environment of Jiangsu Province jointly formulated the "Evaluation Standard for Enterprise Environmental Behavior Information in the Yangtze River Delta Region," established the evaluation standard for corporate environmental behavior information

and classified corporate environmental behavior into five levels which are green, blue, yellow, red, and black (Zhong, 2010, p. 88).

Establishment of the Food Enterprises' Social Responsibilities Labeling System

Establishing a food enterprises' social responsibilities labeling system can be an effective solution to reflect the interests of stakeholders in the supervision and evaluation system of food enterprises' social responsibilities and to systematize the stakeholders' supervision and evaluation of food enterprises' social responsibilities. It is recommended to implement the stakeholder evaluation of food enterprises' social responsibilities into the establishment of a food enterprises' social responsibilities labeling system so that the social responsibility label can effectively affect the recognition and behavioral choices such as investments and consumption of enterprises' food products by potential stakeholder groups including consumers.

The government should play a leading role in promoting the establishment of a framework system of food enterprises' social responsibilities labels. The ultimate purpose of establishing the food enterprises' social responsibilities labeling system is to enable all stakeholders to participate in the supervision and evaluation of food enterprises' social responsibilities so that the interests of stakeholders for food enterprises' social responsibilities can be reflected and implemented in the dynamic mechanism of food enterprises' social responsibilities labeling system.

At this stage, the establishment of a food enterprises' social responsibilities labeling system in China requires the following essential elements.

The first is to set up a special food enterprises' social responsibilities label administration institution. It can be divided into two steps. In the first step, the government takes a leading role and cooperates with industry organizations, stakeholders, and special evaluation and certification institutions to establish a food enterprises' social responsibilities certification and labeling system. The second step is to establish a food enterprises' social responsibilities label management organization composed of food industry organizations, communities, consumers, and other stakeholders.

The second is to improve relevant legislation, including the trademark certification and management system of CSR labels, the supervision and evaluation system for consumers and other stakeholders on CSR, and the legal systems in the fields of CSR internal control management and external supervision.

The third is the implementation of the idea of food enterprises' social responsibilities, which involves the attention and advocacy of government departments, publicity and popularization through the media, improvement in the awareness of stakeholders, and extensive discussions and influence in academia.

The fourth is to connect with the current system. For example, connections between the food enterprises' social responsibilities labeling system and the current food production license, food and agricultural products certification, food safety management system certification, and other appropriate government and public entities.

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(Editor: Gerald)

The New Result of Studies in the History of Medieval Calligraphy: A Review of *The Manual of Calligraphy by Sun Guoting of the Tang: A Comprehensive Study on the Manuscript and Its Author*

He Miao*

Southwest Jiaotong University

Abstract: *The Manual of Calligraphy by Sun Guoting of the Tang: A Comprehensive Study on the Manuscript and Its Author* is one of the representative monographs by the Italian sinologist Pietro De Laurentis, which includes the textual and historical research of Sun Guoting (a famous calligrapher and calligraphic theorist in the Tang Dynasty) and his calligraphy. The integrity and circulation of *Shu pu* (one of Sun Guoting's most famous calligraphic works, which is an important work of traditional Chinese calligraphic theory) and its textual content and visual form, featuring meticulous historical analysis and unique insights, have created a dialogue with the existing studies of *Shu pu* in China. The English translation of *Shu pu* and historical records regarding Sun Guoting are presented in this monograph, with informative notes in the translation that convey Sun Guoting's aesthetic ideas and experiences while learning calligraphy. This book enriches the studies of calligraphy history in China by presenting a new perspective and approach, and the research-based translations provide inspiration and reference for the transmission of Chinese calligraphy in the West.

Keywords: *Shu pu*, Sun Guoting, calligraphy history, translation of Chinese classics

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* He Miao, School of Foreign Languages, Southwest Jiaotong University.

Correspondence concerning this article should be addressed to He Miao, School of Foreign Languages, Southwest Jiaotong University, Chengdu. Email: hm.echo@163.com

The Book under Review: *The Manual of Calligraphy by Sun Guoting of the Tang: A Comprehensive Study on the Manuscript and Its Author*. By Pietro De Laurentis, Rome, Herder International Book Centre, 2011, xxiii+126 pp.

Overseas studies on the history of Chinese calligraphy have, in recent decades, undergone a period of boom and now is in a relative downtrend. At the beginning of the 20th century, Western sinologists with deep knowledge of Chinese language and philology, represented by Herbert Allen Giles (1882) and Friedrich Hirth (1905), made pioneering contributions to the introduction to Chinese calligraphy in the West. Then, the American scholar John C. Ferguson's (1919) publication of *Outlines of Chinese Art* in 1919 made calligraphy a separate art discipline in the West on a par with Chinese painting. Later, the Chinese American scholar Jiang Yi's (1938) masterpiece *Chinese Calligraphy: An Introduction to Its Aesthetics and Techniques* addressed the doubts of Western society at that time about the relationship between modern Western abstract painting and Chinese calligraphy. The first scholar in the West to begin studying Chinese calligraphy was the Dutch sinologist Robert Hans van Gulik (1910–1967), who made the initial effort to fill the gap in the Western literature on traditional methods of appreciation of the art of Chinese painting and calligraphy. Currently, calligraphy research in Germany is the most outstanding in Europe. Professor Lothar Ledderose of Heidelberg University has done research on the *Zhuan* script in the Qing Dynasty and the classical tradition of Chinese calligraphy. Adele Schlombs, the curator of the Oriental Museum of Berlin (Museum für Ostasiatische Kunst), has studied the emergence of the wild cursive script of the cursive calligrapher Huai Su. While in the US, Princeton University cannot be neglected. For instance, Fang Wen reached high attainments in exploring the history of Chinese art and culture, and has trained several Ph.D. students who are devoted to calligraphy research. Their research findings cover many branches of calligraphy, including many influential calligraphers throughout history, the aulic calligraphy in the early Tang Dynasty, the stone carving calligraphy of the Northern Wei Dynasty in Luoyang, and the relationships between the political leanings and the various styles of calligraphy. Also, Peter Sturman, professor of Chinese Painting and Calligraphy at the University of California, Santa Barbara, has focused on the calligrapher Mi Fu of the Song Dynasty, and stresses text-image relationships. However, since their research is not done from the perspectives of sinology and the history of Chinese civilization, they have not clearly defined some of the fundamental calligraphical issues, nor have they fleshed out many of the specific calligraphical issues. Meanwhile, virtually no attention had been paid to *Shu pu* [书谱] and its author Sun Guoting, even though both the text and the author are of great significance in the history of Chinese calligraphy. Among the scholars in this field, the Italian sinologist Pietro De Laurentis is widely recognized as the most outstanding at present. Compared with other researchers, he is concerned with what the Chinese calligraphic tradition really is and sorts out the many intricacies of the relationships between calligraphy, culture, and society. Since the publication of the reviewed book, he has produced much more research, contributing substantially to the academic research related to Chinese calligraphy.

Laurentis' study of Chinese calligraphy is inextricably linked to his learning of the Chinese language and calligraphy, and it was in 1998 that he came to China for the first time and was exposed to the culture of calligraphy and stone inscriptions. Later in 1999, he found Wang Chengxiong, a Chinese calligraphy teacher living in Italy, and began to learn calligraphy under

his guidance. During his learning, he gradually realized that the connotations of calligraphy are more than the aesthetics of the characters, which led him to study the history of calligraphy and focus on the spread of Chinese calligraphy in the West. Since his first trip to China, he has made many field trips to China to collect first-hand materials and information. He visited many museums and forests of steles around China, such as the Xi'an Stele Forest, Inscriptions on Cliffs of Hanzhong, Tai'an in Shandong province, Wangcheng in Changsha, and the Taipei Palace Museum to observe the original monuments and authentic manuscripts, as well as to communicate with local experts and residents to gather research data. He frequently visited various bookshops, second-hand markets, and even auction markets to buy calligraphy copies, rubbings, and reference books. In addition, due to the close relationship between Japanese and Chinese calligraphy, he also made trips to Nagoya, Tokyo, Osaka, Kyoto, and Nara and acquired many useful books. He met teachers and friends in related fields, such as Tian Shusheng, Zhang Tian Gong, Zhang Naizhu, Bi Fei, and Yao Yuliang, who provided a great deal of help to his research on the history of calligraphy. Moreover, he was invited to some top Chinese universities as a visiting scholar, giving lectures and participating in academic seminars as a way of reaching out to Chinese scholars in related research fields, sharing his own research, and gaining access to developments in Chinese academia. Reflecting on Laurentis' research journey, he attached great importance to the fundamental elements that underpin the art of calligraphy, "I wanted to get my calligraphy research on the track of sinology, otherwise, it would always be floating on a superficial surface. Given the large number of calligraphic treatises collected through the ages, I could start with the original documents describing calligraphy. Thus, I gradually began to focus on early calligraphic treatises" (Laurentis, 2019). Laurentis has done solid research on the history of Chinese calligraphy and took *Shu pu* as the starting point for his research, as it is the most direct way to see the background and status of the literati's writing in the Chinese tradition of the Middle Ages. His study of *Shu pu* goes far beyond the study of art on a visual level and is solid sinological research, which is an entry point into Chinese civilization in his view.

The reviewed work is a revised and enlarged English version of Laurentis' Italian Ph.D. dissertation and two Chinese papers. It aims at providing a new approach regarding some key questions related to Sun Guoting (647–690) and his *Shu pu*, such as the core meaning of *Shu pu*, and its relations with the life of its author, a calligrapher and calligraphic theorist of the Tang Dynasty during the reigns of Emperors Gaozong and Empress Wu Zetian. There was a great deal of research and preparation that went into the completion of this book. In 2008, Laurentis arrived in China and went on his study tour in Hangzhou. During this time, he devoted himself to exploring the relations between Sun's aspirations and the literary form of *Shu pu*. Later, he further examined Sun's biography, and the relationships between characters and their strokes in classical Chinese calligraphy by starting from the eight methods of the character *yong* [永]. Although he had been studying calligraphy since 1999 and had made several field trips

to China to gather first-hand information, such solid groundwork led him to the successful completion of this book.

Apart from an introduction, the book is composed of three chapters. Chapter One explores the biography of Sun, from the years of his birth and death to his relationship with the society of his time, and many aspects of his life are included. Laurentis believes that Sun's biography is essential to appreciating and fully understanding the content of *Shu pu*, which is both a calligraphic work in cursive script and a text about calligraphic theory. In his view, Sun was a very outspoken person who liked expressing his inner heart in a direct way, an example of which there were very few in China at that time. Many literati in those days, due to their personal habits, covered up much of their real opinions about Chinese characters, writing, practicing, and appreciating calligraphy. *Shu pu* was different in that Sun spoke of many of his own experiences.

Unlike some famous ancient Chinese calligraphers or literati who have many biographical sources, very few records are available regarding Sun's life. Nevertheless, based on previous research, Laurentis collected all the possible information related to Sun, which he translated and attached as an appendix to Chapter One. The current information shows that Sun was born in the year AD 646 and died in AD 691. However, through an intensive reading of the last column of *Shu pu* and the *Epitaph* written by Chen Zi'ang, the exact year of his birth and death, 647 and 690, were deduced by combining the ancient Chinese rule of counting age and tombstone conventions. Then, Laurentis clarified Sun's personal and courtesy names, birthplace, the official posts he achieved, and the place where he died. More of the information presented in Chapter One is on Sun's social relationships. By analyzing the limited sources, Laurentis discovered that Sun kept great friendships with famous literati and high officials like Chen Zi'ang, Wang Shaozong, Lu Cangyong, Du Shenyan, Song Zhiwen, and many others, which demonstrates that Sun had a great reputation during his life and played an active role in the cultural circle though few records of this have survived. The reason for Sun's death also could be deduced from his nature and connections. Till now, Laurentis' exploration of Sun is the most exhaustive and the best supported by the evidence, leading to a better understanding and more extensive discussion of this prominent figure once neglected by academia. Furthermore, this more precise biography of Sun benefits our knowledge of his aspirations, which is one of the key factors contributing to confirmation of the literary forms of *Shu pu*.

Chapter Two offers the transcription and translation of *Shu pu*. Since the manuscript of *Shu pu* is in cursive script, which is difficult for westerners to recognize and read, and even most Chinese readers for that matter, Laurentis used the Chinese literature and studies conducted by Western scholars to help decipher and analyze *Shu pu*'s cursive script. A total of 369 lines of precise transcription are listed in the format of the original manuscript, and the characters omitted by Sun and those missing due to the damage to the manuscript are marked with () and [], respectively. Moreover, the doubtful characters are footnoted with explanations and

deductions. After that, the translation of *Shu pu* is the highlight of Chapter Two. In order to serve the research and better convey Sun's aesthetic views, Laurentis did not adopt the existing two English versions translated by Sun Dayu and Chang Ch'ung-ho and Hans H. Frankel, but presented his own work. Due to the demand for a deep and thorough exploration of *Shu pu*, Laurentis worked diligently to make his translation as literal and unembellished as possible. He declared that his version is merely one of the possible interpretations of the original text. Detailed textual criticisms are included in his translation, and there are seventy-four annotations.

Chapter Three, with many creative points, focuses on the textual content and visual form of *Shu pu*, and is the key part of the book. Since the character *pu* [*谱*] in the title had been rendered differently, Laurentis tried to clarify the true meaning of *pu* by exploring its usage in ancient Chinese literature and combining them with the explanation in the *Great Dictionary of Chinese Characters* (*hanyu da zidian* *汉语大字典*) and more importantly, the structure and content of *Shu pu* itself. Meanwhile, it was demonstrated by Laurentis that Sun frequently expressed his confidence and determination to teach calligraphy. Through the close reading of *Shu pu*, Laurentis determined that Sun made every effort to stress the uniqueness of *Shu pu* to prove his talent for teaching calligraphy and speaking frankly about the core knowledge of this fine art. He concluded that the word "manual" interprets the connotation of *pu* as far as possible. Moreover, "discussion on the movements of the brush" (*yunbi lun* *运笔论*) is found to be just a common noun to describe *Shu pu*, and not another heading of this work. The Chinese illustrious calligrapher and scholar Qi Gong (1999) once discussed this issue and asserted that what Zhang Huaiguan referred to as *yunbi lun* is exactly *Shu pu*. Although Qi Gong has authority and great influence in academia, Laurentis did not have a negative idea about his conclusion based on thorough analysis. Then, Laurentis analyzed the writing techniques within the text and the influence of this work. In particular, he suggested with concrete proof that the calligraphic technique described in *Forbidden Classics of the Jade Hall* [*玉堂禁经*] written by the influential calligrapher of the Tang Dynasty, Zhang Huaiguan, was quite similar to that of *Shu pu*. Besides *Forbidden Classics of the Jade Hall*, Laurentis analyzed other texts relating to the technique of calligraphy and pointed out that the authors were likely to quote Sun's words directly or be enlightened by *Shu pu* and tried to make them their own. At the same time, comparisons between *Shu pu* and other works on calligraphy in the pre-Tang period have been made. From a wide perspective of calligraphy during Sun's era, Laurentis confirmed his view that Sun's *Shu pu* should be considered a manual, as it is superior to other calligraphic treatises from the Tang Dynasty and unique in dealing with writing techniques, aesthetic possibilities as well as the several stages of learning calligraphy. As Sun did not have high status at that time, he repeatedly stated his legitimization in teaching calligraphy in *Shu pu*. His aspiration to demonstrate his unparalleled talent in calligraphy was revealed by Laurentis' analysis. Finally, Laurentis focused on whether *Shu pu* is just a preface to another work or a whole text

in itself. The date of the completion of *Shu pu*, its transmission during the Tang and early Song dynasties, and some Dunhuang Buddhist manuscripts are listed to discuss the integrity of the scroll. Laurentis' conclusion on this issue is that *Shu pu* is neither a preface nor a whole work, but an undetermined text with a hastily written ending, perhaps due to Sun's health, which is also the most probable reason for the "knot-strokes" phenomenon in the manuscript of *Shu pu*, based on Laurentis' speculation.

In the history of Chinese calligraphic theory and ancient Chinese theories of literature and art, *Shu pu* plays a momentous role, which is imbued with Chinese traditional culture and Chinese peculiar philosophical thinking. Because of its superb calligraphy and incisive viewpoints, it has been drawing scholars' attention at home from the time it was written to now. Many classics and series included the words in *Shu pu* before the Ming Dynasty, but they did not deal with the theoretical aspects of calligraphy. The first to comment on *Shu pu* was Ge Shouzhi (1720–1786), a literatus in the Qing Dynasty, but the commentary was limited to separate words and sentences and was not systematic. A comprehensive study of *Shu pu* was made by Bao Shichen (1775–1855), a calligrapher in the Qing Dynasty, but it was mainly used to advocate "stele study" and failed to fully elaborate the essential theoretical ideas therein. Modern research on *Shu pu* began with Zhu Jianxin's monograph published in 1963, which pointed out that the manuscript of *Shu pu* that has come down to us was the full text, not just a preface, and specifically delineated the beginning and end of the six chapters and two volumes. In 1964, Qi Gong and Zhen Yu, both famous scholars, did research on *Shu pu*, during which Sun Guoting's biography, its transmission and circulation, and the copies and the editions of *Shu pu* were discussed. Meanwhile, Zong Baihua (1962) and Zhu Tong (1980), with their philosophical thinking and focus on aesthetics, were concerned with the ideological and theoretical significance of *Shu pu*. In addition, as the understanding of *Shu pu* itself is the foundation of studies and comments on it, books explaining and annotating *Shu pu* by scholars like Feng Yongqiang, Wu Fangping, Feng Yiwu, and Li Lianmin were published, which demonstrates that the research of *Shu pu* was becoming increasingly comprehensive, and the methods and perspectives more varied and broader. In recent years, many articles have been published in related journals discussing different aspects of *Shu pu*, from general criticism to theoretical content and artistic characteristics, increasingly touching on the exploration of core arguments, but there are still many unanswered questions and no comprehensive monographs. As calligraphy has developed considerably in Japan, research on *Shu pu* in Japanese scholarship is also worthy of consideration. Laurentis' book seems to have created a dialogue between the past and present, at home and abroad, addressing Sun's strengths and perceived inadequacies through new methods and perspectives, and publishing complementary reviews regarding Sun and his calligraphic skill. Laurentis' book is a comprehensive study, covering the author Sun, the integrity and transmission of his manuscript, the text itself, and his calligraphy. The book offers readers the opportunity to acquire an immersive experience, a panoramic, deep

understanding of *Shu pu*, the great calligrapher Sun, and the calligraphic culture embedded in it, and provides valuable reference material for subsequent researchers, and takes the study of *Shu pu* to new heights.

It should also be noted that in addition to Laurentis' English translation of *Shu pu*, which has been widely recognized by academia, there have been several Western works published that present and review Chinese calligraphy, but there remains only a handful of translations of the original texts of calligraphy theory, and it is these texts that are the foundational work in the study of calligraphy and that have first-hand documentary value. In 2016, the new version of Laurentis' English translation of *Shu pu* was first cited in a master thesis (He, 2016), in which Laurentis' translation motive and the translator's quality were discussed. Prior to He's paper, there had been more than ten published papers written from perspectives, such as thick translation, translators' subjectivity, memetics, and skopos theory. Since *Shu pu* is a landmark in the progress of calligraphic theory, its translation versions are beneficial to transmitting Chinese culture and intercultural communication. Compared with the existing versions by Sun Dayu, Chang Ch'ung-ho and Hans H. Frankel, Laurentis' version is the most precise and academic among the three versions. Being different from the previous versions that are translated as a single text, it is conducted in the context of the whole calligraphic literature system, and its target readers are calligraphy or art history researchers in academia. Considering that *Shu pu* was written in ancient Chinese, featuring succinctness, the meaning of the original text would not be very clear to today's readers without the addition of explanations and annotations. Also, Laurentis, in his pursuit of a doctoral degree, presented a rigorous academic attitude. Almost all the terminology, culturally loaded words, and mentioned celebrities and allusions are briefly and naturally explained in the inserted brackets, without breaking the sentence structure, or introduced in detail in the footnotes. It is also due to his strong sense of rigor and ambition to conveying Sun's aesthetic view as accurately as possible, that Laurentis paid attention to every detail in the original text; thus the translations of some allusions and analogies are a little wordy, which slightly hinders the smooth reading. Except for this single shortcoming, it well achieves cultural equivalence.

In today's situation of advocating the introduction and translating of Chinese culture to foreign countries, it is worth thinking about who should be doing the translating. Due to the vast differences in linguistic and cultural perceptions between China and the West, a collaboration between Chinese and Western translators would be a workable and complementary mode of translation. Among the Western translators, sinologist-translators such as Laurentis should be given much attention. This is because most of their translations are closely linked to their sinological studies and premised on a deep understanding of the translated object. At the same time, as native speakers of the translated language, they are, to some extent, able to accommodate the habits of the readers of the translated language. However, sinologist-translators tend to apply the technique of "thick translation," as a result, the extensive

annotations, explanatory notes, prefaces, and postscripts can also hinder the dissemination and reception of the translation. To maximizes the benefits of translation, further thoughts, explorations, and practices are needed.

From the reviewed book, the research methods and unique perspectives Laurentis applied when dealing with calligraphic history could be concluded in three aspects.

At first, he paid special attention to the close connection between the work and its author and the socio-historical context in which it is set. Being different from previous research that focused on the work itself, he made a comprehensive and in-depth exploration of the author Sun, leading to a much better understanding of the purpose for writing *Shu pu*, as well as adding new perspectives to the study of calligraphic history and the study of calligraphers. Meanwhile, a work of art cannot be produced without the context in which it is produced. Laurentis tried to enter the real context of calligraphy culture in the Tang Dynasty to sort out the meaning and function of *Shu pu*. In ancient China, there was a unique way of passing on skills, which was very different from the modern transmission of knowledge. Those who had truly mastered the tips of calligraphic brushwork kept them secret and only passed them on to a few of their own students. Combined with an intensive reading of the content, Laurentis revealed Sun's strong willingness to unveil the techniques of calligraphy and enable students to avoid being misled. He further pointed out the significant status of *Shu pu* in his conclusion, which was possibly the most direct expression of calligraphic theory as practiced during the middle ancient period.

The second aspect that should be mentioned is Laurentis' research methods. The distinguishing feature of his studies is a research approach that places equal emphasis on documentary sources and the visual form of calligraphic works. He made full use of traditional bibliographical methods, such as historical sources, editions, proofs, and catalogs while introducing scientific and empirical methods to extend the problem logically from a cultural and sociological perspective. Many scholars in the West who study Chinese painting and calligraphy prefer to use methods of analyzing images to study artistic styles, which appear to be novel and effective, but in fact, fall into the misconceptions of fragmentation and diversion. Such a perspective is indeed refreshing, but it also ignores the holistic concept of Chinese art, which emphasizes atmosphere and vividness. In contrast, Laurentis stressed more on the continuity of calligraphy. In his view, both Chinese characters and phonetic scripts are composed of small units of meaning that make up a larger unit of meaning, and as it seems possible to construct an infinite number of characters from a small number of units, he argued against the independent existence of the strokes of ancient Chinese characters, holding the opinion that the fundamental aspect of the strokes was to embody the particular form of the Chinese character as a whole. Therefore, Laurentis' research established its uniqueness and insightfulness through the integration of Chinese and Western academic methodologies, as well as his holistic vision, which prompted him to explore the inspiration behind Chinese art and the spiritual aspirations of Chinese culture.

Finally, the extensive references to existing literature should also be noted. Laurentis provided an eighteen-page bibliography, including ancient Chinese books, monographs, and papers by Western, Chinese, and Japanese scholars. Some of which have several versions, and through which we can perceive his prudence. Based on his extensive review of the literature, he made precise selections of materials to use and included copious citations supporting his research findings and conclusions. The listed references not only reflect his broad academic horizon and the accuracy of his conclusions, but they are also reliable sources for related research. Moreover, Laurentis included the plates of nearly all the mentioned steles and autographs in his book, providing readers with visual impressions of the objects of his research.

This book expands our research horizons on Chinese calligraphic theory and calligraphy history, as well as proposes possible entry points for exploring famous ancient calligraphic works. Since calligraphic literature is not so valued in the West, Laurentis' efforts in translating them also have great significance in introducing calligraphy culture and promoting overseas calligraphy research. In Laurentis' view, as calligraphy is the essence and the most representative carrier of Chinese traditional culture, it helps westerners to understand Chinese culture. Among the thousands of years of Chinese calligraphy history, he specifically explored that from the Han Dynasty to the Tang Dynasty, when calligraphy was at the peak of its development. Laurentis holds the opinion that only by putting insights into Chinese culture from minute angles can Western countries and westerners truly understand the value and charm of Chinese calligraphy. At the same time, the reviewed bookmarks the rise of a new generation of sinologists studying Chinese calligraphy through new perspectives and methods, following the generation of scholars represented by Prof. Ledderose. In this area of research, it is a breakthrough that the connection between Sun's temperament and the context in which *Shu pu* was written has been linked, giving a more realistic picture of the cultural situation during Sun's time, thus enabling readers to better understand its meaning and Sun's writing talent.

On the other hand, there are also a few minor inadequacies. The author did not provide a scholarly landscape of the relevant research on *Shu pu*, so it is a bit difficult for readers to clearly realize the creative points of this study. Meanwhile, when discussing the description of calligraphic techniques in *Shu pu*, Laurentis mainly focused on rising and falling (*qifu* 起伏) and believed it is equal to lift and press (*ti'an* 提按). However, according to the writing techniques in the time Sun lived and the era before him, the rising and falling within a stroke was achieved by giving full play to the brush's performance. As what is mentioned in *Shu pu*, wielding and moving (*huiyun* 挥运) is the exact way of controlling the brush, meaning the hand was basically in a natural state of flat movement, without deliberate lifting and pressing movements. Finally, it would be better if more writing techniques and Sun's view of calligraphic appreciation were discussed in this book.

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Submissions Invited

Contemporary Social Sciences is a bimonthly English language periodical published by Sichuan Academy of Social Sciences. *Contemporary Social Sciences* publishes outstanding research in the field of social sciences in China, promotes academic achievements supporting China's going global and enhances China's international discourse in the field of social sciences. Our primary audience are the scholars and students whose primary research interests include humanities and social sciences in contemporary China, both at home and abroad.

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Postcode: 610072
China
Tel: (0086)–28–61352442

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Political Science, Sociology, Philosophy: css1639_xw@163.com
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A Brief Introduction to Sichuan Academy of Social Sciences

Sichuan Academy of Social Sciences is the think tank for the People's Government of Sichuan Province and the Sichuan Provincial Committee of the CPC, with full financial backing of the Party and the government. The Academy consists of 15 institutes, 1 graduate school, 10 departments of scientific research management services and 17 branches. At the end of 2015 the staff numbered 1,200, including 710 employees with full financial allocation (459 on-the-job employees and 265 retired employees), and 405 master graduate students. Among the scientific research personnel, 62 employees have senior professional titles, and 125 employees have associate senior professional titles; 19 employees are experts entitled to special allowances of the State Council, 21 employees are provincial academic and technical leaders, 16 employees are experts with outstanding contributions at provincial level; and 115 employees have doctorate degrees. The publications sponsored by the Academy are 9 magazines and 1 newspaper, namely *Social Science Research, Mao Zedong Thought Study, Deng Xiaoping Research, Reform of Economic System, Rural Economy, Forum on Chinese Culture, Western China, Contemporary County Economy, Contemporary Social Sciences (English), and Entrepreneur Daily;* three websites are hosted (namely the portal website of provincial philosophy and social sciences-Sichuan Social Sciences online, website of the Academy-Tianfu Think Tank, English website). With abundant literature information resources, Sichuan Academy of Social Sciences has a collection of 720,000 books, and over 2,000 kinds of Chinese and foreign periodicals. Besides its own database resources, the Academy has access to a variety of academic databases, including China National Knowledge Infrastructure, SOSHOO, Zhonghongwang.com, Duxiu.com, Chaoxing.com, National Social Sciences Database, Communist Party of China's political and theoretical resources database, Dachengdata.com, and DRCnet.com.cn. It has 8 provincial key disciplines and 11 excellent disciplines, 5 first-level disciplines and 44 graduate degree programs of second-level disciplines, 1 joint PhD program, and 1 national post-doctoral research station.

Under the guidance and support of the leadership of the provincial party committee and government, Sichuan Academy of Social Sciences will adhere to the theoretical system of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era as a guide for scientific research work and completion of its main objective: to accelerate the construction of a strong theoretical position, a high-end decision-making think tank, a first-class academic institution and an important base for popularization of science. Its comprehensive strength in local academies of social sciences is among the best nationwide.