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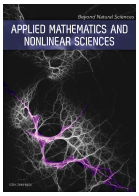

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Characteristics of Local Officials and High Quality Development of Chinese Agriculture - Evidence from Chinese Governors and Secretaries of the Provincial Party Committee

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Abstract

Local officials play active and important roles in the high-quality agricultural development process in China. In this study, the DEA-SBM model was used to measure the level of agricultural quality development in China, and Tobit regression was conducted to analyze the impacts of officials on agricultural quality development in China. The results showed that between 1997 and 2016, the agricultural GTFP exhibited a downward trend before following an upward trend in China. The personal characteristics of officials had important effects on the development of agricultural quality. In different development stages, officials had diverse effects on agricultural quality development.

Keywords: DEA-SBM model; High-quality agricultural development; Local official; Personal characteristic; Tobit regression
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1 Introduction

After the reform and opening up of China, the comprehensive deepening reform in rural areas characterized by the household co-production contract responsibility system promoted the rapid development of agriculture [1–3]. Agricultural productivity has improved greatly but the intensive production mode has degraded the utilization efficiency and ecological function of agricultural resources, and thus the ecological system has

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been damaged [4]. At the 19th National Congress of the Communist Party of China, it was stated that the Chinese economy has changed from a stage of high-speed growth to a stage of high-quality development. In 2018, the No. 1 Central Document of the Central Committee clearly proposed "quality and green agriculture," and in 2019, the No.1 Central Document of the Central Committee further indicated the need for "strengthening the guidance of high-quality green development." Thus, accelerating the transformation of agriculture from quantitative growth to quality development, as well as continuously improving the quality of the agricultural supply system and exploring the key factors responsible for driving agricultural green total factor productivity (GTFP) growth are important for developing attractive countryside and facilitating the sustainable development of agriculture.

The agricultural GTFP is a composite index based on overall economic development and ecological protection, which aims to regulate the input relationship with respect to production from agricultural production activities in a reasonable manner in order to minimize the consumption of resources and the generation of pollutants, and to maximize the agricultural output [5,6]. The GTFP is increasing for agriculture in China but it is still at a relatively low level [7]. Improving the total factor productivity (TFP) is essential for the current high-quality transformation of economic growth [8, 9]. Previous studies of TFP mainly focused on factors such as resource endowment [10], the industrial structure [11, 12], and technological progress [13], whereas few have considered the effects of officials and their personal characteristics. In the economic development and ecological environment governance process in China, government decisions are mainly made by officials, so official preferences, especially those of local leaders with decision-making power, have active and important effects on government behavior [14]. In contrast to the direct factors (labor, capital, and technology) and "market role theory" emphasized by traditional mainstream economics, the present study focused on the national conditions in China from the innovative perspective of local officials in order to explore their important effects on the development of high-quality agriculture in China.

2 Theoretical analysis

The sustainable development of the economy is inseparable from the tangible hand of the government and the intangible hand of the market. The agricultural economy is the basis of economic activities. The mechanisms that allow officials to affect agricultural GTFP can be traced back to their impacts on economic activities. Local officials have crucial impacts on economic development through decision making and the implementation of economic policies [15]. At present, China's local economic growth target is short term and local officials prefer to invest in projects with "short, flat, and fast" returns [16]. Any increases in the economic growth rate during the term of an official will help to enhance the possibility of their promotion [17]. This is a problem that must be solved in order to allow China to develop a national governance system for high-quality development [18]. Political incentives will encourage local officials to respond to economic growth in their jurisdiction by actively developing the local economy, expanding the scale of the economy [19–21], and promoting "promotion tournaments" [22, 23]. In addition, the impacts of local officials on the local economy will vary depending on personal characteristics, such as their age, tenure, and academic qualifications [24, 25].

The basis of high-quality agricultural development is "green development," where the fundamental goal is to change the traditional intensive economic development mode comprising "high pollution, high energy consumption, and high emission" [26]. In the critical period of "adjusting the structure and changing the development mode" of China's economy, local governments should consider the overall development of economic growth and environmental governance [27, 28]. Government officials will be faced with a trade-off between seeking economic performance and environmental protection [29], but at present, some regions and officials do not consider the social costs such as environmental protection, energy conservation, and reduction of emissions. In addition, an information asymmetry exists between the government and residents, which severely affects the efficiency of energy conservation and environmental protection expenditure [30]. Finally, due to the incentive of promotion, local government officials only consider quantitative growth in the economic development process and they do

not actively perform their environmental protection duties. This short-sighted behavior is not conducive to the long-term sustainable development of society. Under the Gross Domestic Product (GDP) tournament system, local government officials may even act to damage the environment in order to obtain liquidity elements and secure local resources [31–33]. In order to "constrain" the behavior of local governments and officials as well as improving the quality of the ecological environment, it is necessary to include environmental indicators in the assessment system used for determining the promotion of officials [34–36].

In summary, officials have two main functions in the economic development process, with a positive role in terms of a "helping hand effect" and a negative role comprising a "grabbing hand effect". However, previous studies of the effects of officials on economic growth and environmental pollution have treated these functions as two separate fields, thereby ignoring the possibility of combining both. Therefore, it is of great theoretical significance to investigate the effects of the heterogeneity of officials on agricultural GTFP.

3 Research design

3.1 Model Selection

3.1.1 SBM-undesirable model

Data envelopment analysis (DEA) is a commonly used method for evaluating efficiency. Färe [37, 38] introduced the DEA method into environmental efficiency evaluation research for the first time and proposed the unexpected output concept, thereby providing the basis for environmental efficiency evaluations. Many studies have used the slacks based measure (SBM) undesirable model [39–41]. The SBM-undesirable model is a non-radial and non-angular DEA model constructed by Tone [42, 43], which solves the problem of neglecting the input-output relaxation in the traditional DEA model and unexpected output is also added to the model, thereby allowing more accurate evaluations of agricultural GTFP. In the present study, the SBM-undesirable model was employed to measure and evaluate the agricultural GTFP in 31 provinces and autonomous regions of China.

The model assumes n independent DMUs, where each comprises m input variables x, s_1 expected outputs, and s_2 undesired outputs, which can be expressed as a vector with $x \in s^m$, $y^a \in s^{s_1}$, $y^b \in s^{s_2}$. X, Y^a, and Y^b are matrices such that $X = [x_1 \cdots x_n] \in s^{m\times n}$, $Y^a = [y_1^a \cdots y_n^a] \in s^{s_1\times n}$, and $Y^b = \left[y_1^b \cdots y_n^b\right] \in s^{s_2\times n}$. The SBM-undesirable model is constructed as follows [44].

$$\min = \frac{\frac{1}{m}\times\sum_{i=1}^{m}\left(\frac{\bar{x}}{x_{ik}}\right)}{\frac{1}{(s_1+s_2)}\times\left[\sum_{c=1}^{s_1}\frac{\overline{y^a}}{y_{ck}^a}+\sum_{d=1}^{s_2}\frac{\overline{y^b}}{y_{dk}^b}\right]} \tag{1}$$

$$\begin{cases} \bar{x} \geq \sum_{j=1,\neq k}^{n}(x_{ij}\lambda_j)\, i = 1,\cdots m \\ \overline{y^a} \geq \sum_{j=1,\neq k}^{n}\left(y_{cj}^a\lambda_j\right) \mathrm{c} = 1,\cdots s_1 \\ \overline{y^a} \leq \sum_{j=1,\neq k}^{n}\left(y_{dj}^b\lambda_j\right) \mathrm{d} = 1,\cdots s_2 \\ \lambda_j \geq 0 j = 1,\cdots n; j \neq 0 \\ \bar{x} \geq x_k k = 1,\cdots m \\ \overline{y^a} \leq y_k^a d = 1,\cdots s_1 \\ \overline{y^b} \geq y_k^b b = 1,\cdots s_2 \end{cases} \tag{2}$$

3.1.2 Tobit model

The tobit panel data model was used to investigate the impacts of officials on agricultural GTFP in China. The efficiency range for agricultural GTFP in China ranges between 0 and 1, this kind of data is more suitable

for Tobit model, and the tobit model can avoid the shortcomings of ordinary least squares estimation in terms of biased parameter estimation and inconsistent parameter estimation. Therefore, the tobit model was selected for empirical analysis. The mathematical expression of the tobit model is defined as follows:

$$y_m^* = \alpha_0 + \sum_{n=1}^{i} \alpha_n x_{mn} + \varepsilon_m \tag{3}$$

$$\begin{cases} y_m = y_m^* 0 < y_m^* \leq 1 \\ y_m = 0 y_m^* < 0 \\ y_m = 1 y_m^* > 1 \end{cases} \tag{4}$$

where y_m^* is a latent variable, y_m is an actual dependent variable, x_{mn} is an independent variable, α_0 is a constant term, α_n is a correlation coefficient vector, and ε_m is independent, where $\varepsilon_m \sim N\left(0, \sigma^2\right)$.

3.2 Selection and description of input-output index for agricultural GTFP

3.2.1 Construction of input-output evaluation index system

Agriculture includes arable agriculture, forestry, animal husbandry, and fisheries. In a narrow sense, agriculture mainly comprises the arable farming industry. As the basis of agriculture, the arable farming industry is crucial for promoting the development of green ecological agriculture. The production input-output factors for forestry, animal husbandry, and fishery are very different from those for the arable farming industry, and the input-output accuracy is low. Therefore, we selected the arable farming industry to evaluate the agricultural GTFP.

According to previous research and the current agricultural development situation in China, we selected seven input indicators and three output indicators (including one desirable output indicator and two undesirable output indicators) to evaluate the TFP for agriculture in China [47–49]. Table 1 shows the specific input-output indicators as well as their characteristic variables and descriptions.

3.2.2 Data sources and descriptive statistics

This study considered 31 provinces, municipalities, and autonomous regions in China from 1997 to 2016. Most of the data were derived from the "China Statistical Yearbook" and "China Rural Statistical Yearbook," which include 620 decision-making units. Table 2 shows the specific descriptions of the statistics used.

3.3 Selection of Factors that Influence Agricultural GTFP

3.3.1 Explained variable

In order to reduce the effects of multiple collinearity and heteroscedasticity, the logarithmic value of agricultural GTFP efficiency in China was selected as the explained variable.

3.3.2 Core explanatory variables

The core explanatory variables comprised the personal characteristics of the secretaries and governors of 31 provincial units. The data were mainly collected from the "Official Records of the People's Republic of China" and personal websites. The specific variables are described as follows.

(1) The terms of office for the secretaries and governors were determined based on published records [50,51], and dates of appointment and departure for the secretaries and governors were used to calculate the terms of service.

(2) In a certain year in a specific province, if an official entered or left office, an official change was determined in that year and it was recorded as 1; otherwise, it was recorded as 0.

(3) Official education or educational background of a secretary or governor. Middle school and below was recorded as 1, junior college was recorded as 2, undergraduate was recorded as 4, master's degree was recorded as 4, and doctoral degree was recorded as 5.

Table 1 Evaluation indexes for agricultural GTFP.

First-level Indicator	Secondary Indicator	Variables and Descriptions
Input indicator	Labor	Practitioners of agriculture, forestry, animal husbandry, and fisheries x (total agricultural output value/total output value of agriculture, forestry, animal husbandry, and fisheries) (10^4 people)
	Land	Total area planted with crops (10^3 hectares)
	Agricultural film	Amount of agricultural film used (10^4 tons)
	Chemical fertilizer	Conversion of chemical fertilizer into pure amount applied (10^4 tons)
	Pesticides	Amount of pesticides used (10^4 tons)
	Machinery	Total power of agricultural machinery (10^4 kilowatts)
	Irrigation	Effective irrigation area (10^3 hectares)
Desirable output indicator	Total agricultural output value	Total agricultural output value converted from 1978 as the base period (10^8 yuan)[1]
Undesirable output indicator	Carbon emissions	Total carbon emissions due to agricultural film, chemical fertilizer, pesticides, agricultural diesel, agricultural irrigation, and agricultural planting (10^4 tons)[2]
	Pollution discharge	Losses of nitrogen and phosphorus in chemical fertilizer, ineffective use of pesticides, and agricultural film residues (10^4 tons) as a composite index (calculated using entropy method)[3,4]

Notes: 1. In order to eliminate the influence of price factors, the data were adjusted to constant price output value in 1978.

2. Emission coefficients for six types of emission sources: agricultural film = 5.18 kg/kg, chemical fertilizer = 0.8956 kg/kg, pesticides = 4.9341 kg/kg, diesel oil = 0.5927 kg/kg, agricultural irrigation = 20.476 kg/hm^2, and agricultural tillage = 312.6 kg/km^2 [45, 46].

3. Pollution discharge coefficients based mainly on the manual of the 鈥渇irst National Pollution Survey鈥 湖ublished by the National Bureau of Statistics, and further corrections and determinations in previous studies.

4. The entropy method uses the original information provided by each indicator to more objectively weight the indicators. By using entropy method, a number of agricultural pollution indicators are integrated into an index, in order to reduce the undesirable output indicators and improve the accuracy of agricultural GTFP measurement.

(4) The ages of secretaries and governors were rounded to the nearest year.

(5) Official place of origin. If the incumbent official was a native of the province, then in each year of his term of office, the province's native place variable value was 1. If the incumbent official was a not native of the province, then the variable was recorded as 0.

(6) In order to improve the quality and ability of leading cadres, the Chinese government has implemented a system of exchange of officials in different places. If an official in office transferred from another province, then the exchange official variable was recorded as 1 for each year of their tenure. If the official in office was promoted from within the native province, then the variable was recorded as 0. Descriptive statistics for the core explanatory variables are shown in Table 3.

Table 2 Descriptive statistics for agricultural GTFP evaluation indexes from 1997 to 2016.

Variable	Mean Value	Standard Deviation	Minimum Value	Maximum Value
Labor	514.85	415.52	17.52	2277.23
Land	5111.30	3543.20	151.40	14472.30
Agricultural film	6.13	6.03	0.01	34.35
Chemical fertilizer	162.01	134.09	2.50	716.10
Pesticides	4.97	4.29	0.04	19.88
Machinery	2464.05	2548.78	77.50	13353.00
Irrigation	1871.07	1456.54	128.50	5932.70
Total value of agriculture output	719.40	647.45	19.41	3252.44
Pollution discharge	5.10	4.35	0.05	18.42
Carbon emissions	399.66	289.56	10.37	1318.68

Table 3 Descriptive statistics for personal characteristics of officials.

Variable	Mean Value	Standard Deviation	Minimum Value	Maximum Value
Secretary term	4.497581	2.843427	0.5	15
Secretary change	0.23871	0.426295	0	1
Secretary education	3.416129	0.852547	1	5
Secretary age	59.55645	4.054672	47	70
Secretary birthplace	0.08871	0.284324	0	1
Exchange secretary	0.727419	0.445287	0	1
Governor term	3.096371	1.925656	0.25	12
Governor change	0.256452	0.436674	0	1
Governor education	3.503226	0.827933	1	5
Governor age	57.90323	3.987115	43	65
Governor birthplace	0.319355	0.466227	0	1
Exchange governor	0.330645	0.470445	0	1

3.3.3 Control variables

Eight indicators that are closely associated with the agricultural development process were selected as control variables. These data were obtained from the 鈥滵hina Statistical Yearbook鈥濧nd 鈥滵hina Rural Statistical Yearbook.鈥漵he specific variables and descriptions are shown in Table 4.

4 Empirical analysis

4.1 Evaluation and analysis of agricultural GTFP in China

MaxDEA7.8.0 software (Beijing Realworld Software Company Ltd; http://www.maxdea.cn/) was used to measure the agricultural GTFP in China. We selected global Malmquist under the constant returns to scale (CRS) assumption to process the panel data and obtained the agricultural GTFP efficiency values for 31 provincial units over 20 years.

Figure 1 shows that the total green elements in Chinese agriculture tended to decrease initially before increasing, with a decline from 1997 to 2000. The efficiency value of 0.5725 in 2000 was the lowest value for the agricultural GTFP during the study period. The value then continued to increase from 2001 to 2005, with a relatively small dynamic trend from 2006 to 2015 when it was generally at a high level at between 0.8 and 0.85. In 2016, the agricultural GTFP decreased slightly to 0.7703. In terms of subregions, the trends in the eastern and

Table 4 Control variables and description.

Control Variable	Variable Specification
Income	Per capita net income for rural households (10^4 yuan/person)
Disaster rate	Affected area/total area planted with crops (%)
Scale level	Total area planted with crops/agricultural employees (Mou/person)
Machinery density	Total power of agricultural machinery/total area planted with crops (kilowatt/hectare)
Per capita value added	Agricultural added value/Population at the end of the year (logarithm)
Industrialization level	Industrial value added/GDP (%)
Financial support for agriculture	Agricultural, forestry, and water expenditure/total local financial expenditure (%)
Location factor	Eastern region = 1; central region = 2; western region = 3

Note: 0.165 acre, or 666.5 square meters = 1 Mou

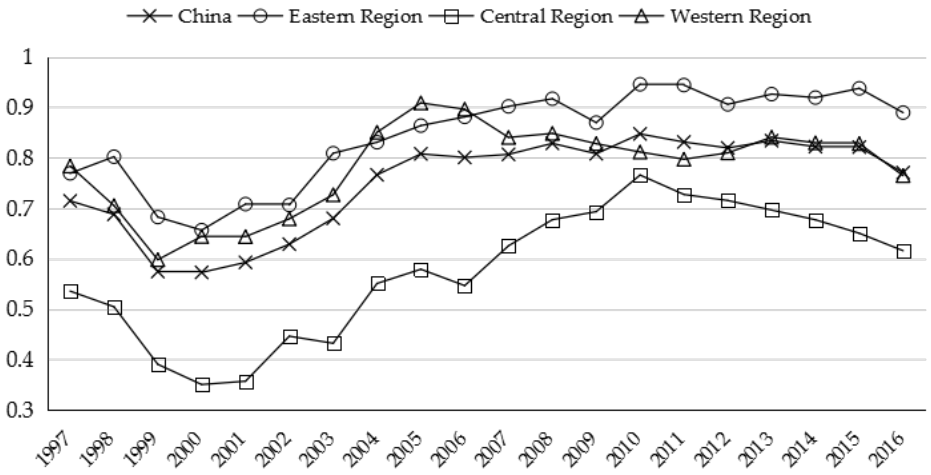

Fig. 1 Trends in agricultural GTFP in China and three separate regions from 1997 to 2016.

western regions were roughly the same as that in the whole country. The agricultural GTFP in the central region exhibited a volatile trend with an initial decrease, before increasing and then decreasing, and the agricultural GTFP was lowest among the three regions.

4.2 Impact of heterogeneity of officials on agricultural GTFP

4.2.1 Impact of officials on agricultural GTFP in China

Table 5 shows the results estimated using the model. In order to gain a deeper and more intuitive understanding of the impacts of officials on high-quality agricultural development, we regressed the agricultural GTFP and the total agricultural output value. The agricultural GTFP represents the quality of agricultural development. The total agricultural output value represents an increase in the quantity of agriculture.

If officials affect agricultural GTFP, then a longer term of office for the secretary will increase the possibility of the agricultural GTFP increasing because their governance concept will be more mature and they will have greater management experience. The economic and ecological environment of China is well understood, and

the relationship between the development of the agricultural economy and agricultural ecology protection can be balanced in a reasonable manner. Moreover, agriculture is a weak industry with long production cycles, large environmental impacts, and slow returns. Therefore, officials only had significant impacts on the agricultural GTFP in the long term. The age of a secretary had a significant negative impact on the growth of agriculture GTFP. As their age increases, officials will have a greater expectation of promotion, and thus they are relatively more likely to ignore the development of agricultural quality. By contrast, young officials are more likely to accept advanced political ideas and be more adaptable to transformation and development in the new era. The birthplace of governor had a significant impact on the agricultural GTFP. A governor who works in their native area is more likely to improve the agricultural GTFP. Indeed, a "hometown preference" is a global phenomenon, where officials have a strong affection for the hometown where they were born and grew up. Thus, in order to ensure the development of their hometown, officials with local origins have a requirement for "quantitative" as well as "quality" development.

Table 5 Impacts of officials on agricultural GTFP.

Variable	Model I Agriculture GTFP	Model II Total Value of Agriculture Output
Secretary term	0.010* (0.005)	7.367* (3.907)
Secretary change	-0.006 (0.024)	9.270 (18.893)
Secretary education	-0.003 (0.017)	-60.606*** (13.120)
Secretary age	-0.006* (0.004)	-13.995*** (2.758)
Secretary birthplace	-0.044 (0.042)	83.539** (33.091)
Exchange secretary	-0.019 (0.029)	55.315** (23.037)
Governor term	0.010 (0.006)	-0.791 (4.822)
Governor change	-0.016 (0.024)	-14.408 (18.506)
Governor education	-0.022 (0.017)	-12.948 (13.498)
Governor age	-0.002 (0.003)	-4.476* (2.581)
Governor birthplace	0.062* (0.032)	12.125 (25.055)
Exchange governor	0.035 (0.029)	147.574*** (22.438)
Income	-0.021 (0.052)	237.264*** (41.394)
Disaster rate	-0.023 (0.082)	17.401 (64.398)
Scale level	0.002 (0.003)	0.358 (2.321)
Machinery density	0.010 (0.007)	4.226 (5.742)
Per capita value added	0.336*** (0.042)	623.105*** (33.125)
Industrialization level	0.469* (0.244)	-111.005 (198.072)
Financial support for agriculture	-1.082*** (0.343)	-587.043** (268.367)
Location factor	-0.042 (0.072)	-143.006* (86.118)
Constant	0.762* (0.388)	3523.184*** (338.947)
Sigma_u	0.329*** (0.045)	403.752*** (52.747)
Sigma_e	0.239*** (0.007)	187.133*** (5.457)

Note: *, **, and *** indicate significant differences at the 10%, 5%, and 1% levels, respectively. The numbers in parentheses are the standard errors of each coefficient.

In terms of the impact of officials on the total agricultural output value, an increase in the tenure of the secretary was also conducive to the growth of the total agricultural economy. If the tenure of officials is shorter, this will lead to short-sighted behavior, thereby making it difficult for them to promote increases in the quality and quantity of the agricultural economy. The educational level of secretaries also had a significant negative effect on the growth of the total agricultural output. A highly-educated secretary has a more advanced understanding of development and they will not focus only on the quantitative development of agriculture. The ages of secretaries

and governors had negative effects on increases in the total agricultural output, where the results indicated that as the officials became older, their desire for promotion was greater and they had increased expectations of high economic growth. However, the contribution of the total agricultural output value to the aggregate economic level is relatively small, which could also make officials ignore agricultural development. A secretary who worked in their native area was more likely to the increase the total agricultural output, thereby indicating that the promotion of young officials from a province will have a highly positive impact on local economic development. The off-site exchanges between secretaries and governors significantly promoted agricultural economic growth, thereby suggesting that implementing an off-site exchange system for officials could help to promote development of the agricultural economy.

In general, the individual characteristics of officials had significant impacts on the agricultural GTFP and agricultural output value, and they were highly significant indicators of the impacts of officials on the agricultural output value, thereby demonstrating that officials pay more attention to agricultural economic growth but ignore the development of agricultural quality. In addition, secretaries had more significant impacts on agricultural development than governors because the secretary is the actual decision-maker in the local government under China's political system.

4.2.2 Effects of officials on China's GTFP during different periods

In 2005, the State Council issued the 欽淒ecision of the State Council on Implementing the Scientific Outlook on Development and Strengthening Environmental Protection,欽淡hich stated that environmental protection should be included during the selection, appointment, rewarding, and punishments of leading groups and cadres. In 2007, the State Council issued the "Notice on Printing and Distributing a Comprehensive Work Plan for Energy Conservation and Emission Reduction," which clearly stated that the completion of energy conservation and emission reduction targets should be treated as an important basis for performance evaluations in a "one-vote veto" system. The State Council issued two consecutive articles that placed binding provisions on the assessment standards for officials, which mean that the requirements for economic development in the new era can only be met by internalizing GTFP and environmental protection into promotion incentives. As a consequence, we examined the effects of officials on the agricultural GTFP in China during different periods. Thus, we analyzed the changing roles of officials and their impacts on agricultural GTFP, and investigated the effects of implementing the central government's policy demanding the incorporation of environmental protection policy into the official promotion assessment system.

Table 6 shows that during the period from 1997-2006, the birthplace of secretaries had a significant impact on the agricultural GTFP. A secretary from the local area was conducive to growth in the agricultural GTFP. The educational level of provincial governors had a significant negative impact on the agricultural GTFP, possibly due to the low level of economic development at the beginning of the reform and opening up in China, and the lack of food and other materials. Thus, in order to solve the basic problems related to food and clothing, quantitative economic growth was the focus during this stage. After rapid economic growth, the pressure on resources and environment constraints inevitably increased, and thus a high educational level did not improve the overall quality of economic growth

Between 2007 and 2016, the tenure of secretaries, exchanges, and the birthplace of governors had positive impacts on the agricultural GTFP, whereas the educational background, age of secretaries, and age of governors had significant negative impacts. It should be noted that secretaries undergoing non-local exchanges during this stage had a significant positive impact on the GTFP of agriculture. The officials who participated in exchanges had more experience of management and administration, as well as a more diversified economic and ecological environment, and thus they possessed more solutions in order to balance the agricultural economy and agricultural ecology. In addition, during the stage from high-speed economic growth to high-quality development, the official exchange system played an important role in agricultural GTFP growth. Compared with the full sample model and the previous model, the impacts of the characteristics of officials on the agricultural GTFP were significantly greater in this stage, thereby indicating that the roles of individual officials in promoting the high-quality development of agriculture became increasingly important with the deepening of the reform of the

Table 6 Impacts of officials on green agricultural TFP in different periods.

Variable	Model III (1997-2006)	Model IV (2007-2016)
Secretary term	-0.003(0.007)	0.020***(0.004)
Secretary change	0.025(0.027)	-0.024(0.018)
Secretary education	-0.029(0.021)	-0.026*(0.015)
Secretary age	-0.003(0.005)	-0.010***(0.003)
Secretary birthplace	0.098*(0.058)	-0.036(0.057)
Exchange secretary	-0.018(0.040)	0.049*(0.025)
Governor term	0.008(0.007)	-0.003(0.005)
Governor change	-0.006(0.026)	-0.002(0.018)
Governor education	-0.037*(0.021)	-0.023(0.018)
Governor age	0.005(0.005)	-0.007**(0.003)
Governor birthplace	0.003(0.040)	0.052*(0.032)
Exchange governor	-0.034(0.035)	0.015(0.025)
Income	0.652**(0.254)	-0.140***(0.048)
Disaster rate	-0.024(0.085)	-0.050(0.073)
Scale level	-0.005(0.007)	-0.004(0.003)
Machinery density	0.010(0.016)	-0.015**(0.008)
Per capita value added	0.657***(0.092)	0.231***(0.045)
Industrialization level	-0.210(0.469)	0.187(0.252)
Financial support for agriculture	-2.044*(1.058)	-0.456(0.307)
Location factor	0.058(0.093)	-0.156**(0.070)
Constant	1.252*(0.643)	1.814***(0.368)
Sigma_u	0.419***(0.061)	0.317***(0.045)
Sigma_e	0.182***(0.008)	0.125***(0.005)

Notes: *, **, and *** indicate significant differences at 10%, 5%, and 1% levels, respectively. The numbers in parentheses are the standard errors of each coefficient.

market system.

In general, the impacts of officials on the agricultural GTFP were relatively low during 1997-2006, but they increased significantly in 2007-2016. These results demonstrate that the central government's assessment mechanism for officials improved continuously and the incorporation of the ecological environment into official assessment standards achieved significant results. These changes also explain why the agriculture GTFP was generally low before 2006, as shown in Figure 1.

5 Conclusion

In this study, we measured the agricultural GTFP in 31 Chinese provinces (municipalities and autonomous regions) from 1997 to 2016. We systematically examined the effects of the personal characteristics of the provincial secretaries and governors on the agricultural GTFP, and we verified how the changing roles of officials influenced the development of agricultural quality during different periods. The results showed the following. First, the GTFP tended to decrease initially, before increasing and then fluctuating in the research area. Second, the tenure length, educational background, age, birthplace, and communication with officials had important impacts on agricultural development, but officials paid more attention to quantitative agricultural growth and less to the GTFP of agriculture. Third, our analysis during two periods showed that after the central government incorporated the ecological environment into the assessment standard for officials in 2007, they became more

concerned with agricultural GTFP growth.

In order to receive promotions, officials may focus on the agricultural economic growth performance based on short-term goals and ignore the ecological environment, natural resources, and other issues. Since the incorporation of green development indicators such as resources and the environment into the official promotion assessment mechanism, officials have become increasingly concerned with the coordinated development of agricultural economic growth and ecological environment protection. Thus, constructing a diversified performance evaluation index system for local officials is conducive to improving the overall quality of agricultural economic development, especially by considering resources and the environment as key factors that can determine the promotion of officials. In the agricultural development process, it is necessary to increase the tenures of officials in an appropriate manner as well as providing opportunities for exchange between different locations. The terms of office for officials can affect their administrative behavior and development strategy, but agricultural development is a slow process. If the terms of office are short for officials, it will be difficult to conduct objective evaluations of the work performed by officials, as well as hindering long-term agricultural development planning. Encouraging the implementation of an improved system can effectively reduce the monopoly of local officials on local resources and the ability to intervene in the agricultural economy, but it is also necessary to improve the supervision of local officials, give full play to the mutual supervision between exchange officials, and promote a virtuous cycle based on good systems and policies in different areas. Thus, this study identified relationships between the personal characteristics of officials and agricultural development, but the governance of local officials in China is clearly a rather complex process and many factors can affect the development of agriculture. This study did not explore the role of government governance in agricultural development from the deeper level of institutional environment change, but this will be addressed in future research.

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