Evaluation of the effects of land supervision policy on Agricultural output value: The Chinese Perspective

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Abstract. The purpose of this study is to discuss whether the implementation of Land Supervision System has a positive impact on agricultural output value and the degree of effects, to further improve the Land Supervision System, protect the quantity and quality of arable land, and provide reference for increasing agricultural output value. This study use method of mixed model and fixed effect model to analyse the province-level panel data. The results show that land supervision has a positive impact on the growth of agricultural output value. The paper concludes that the policy of land supervision should be continued and the process of land consolidation should be emphasized in order to promote the balance of the number of arable land. In this process, more attention should be paid to arable land and the construction of agricultural infrastructure so as to facilitate the wider application of agricultural machinery in agricultural planting.

1. Introduction

The development of urbanization has accelerated the process of farmland conversion, causing sharp decline in the area of arable land since 2005, nearly approaching the red line of 1200 million hectare of arable land. Since 2006, the state has promulgated the policy of balanced between occupying and compensating arable land, implemented the pilot reform of land increase and decrease linking urban and rural, and continuously strengthened the policy of protecting arable land. In the same year, the State set up the Ministry of Land Supervision, construct the land supervision system, and set up nine land supervision bureaus under direct administration, to supervise the implementation of the objectives of arable land protection responsibility at the provincial level. Supervised the changes in the quantity of arable land, the implementation of the balance between the occupation and compensation of arable land, the occupation and supplement of permanent basic farmland, and high standard farmland construction. Arable land quality protection and promotion, arable land protection system construction, the implementation of all-round supervision and management, Accountability the land illegal behaviour of local governments and enterprises and institutions and ordered them to rectify within a specified period of time. The implementation of the land supervision system has achieved some results. That's the arable land area in China has gradually increased from the lowest value of 1217.15 million hectares in 2008 to 1351.63 million hectares in 2013. The land supervision has played a positive role in the balance of occupation and compensation (Zhao Y T, 2012). The existing literature mainly uses the methods of content analysis (He W 2013), complete information static game (Zhan C H, 2010), factor analysis (Lu L, 2008), tendency value matching (Ju X, 2016) to prove the effect of land supervision system on arable land protection (Li X S, 2009; Zhong T Y, 2011), reduce the loss of land income (Peng J W, 2012), protect the balance of arable land occupation and compensation (Zhao Y T, 2012), land marketization (Tan M, 2012), land law enforcement (Zhong J X, 2011), illegal containment (Tan S K, 2013), and protect natural resources (Yan J M, 2018) has obvious effect.
However, it has been more than ten years since the implementation of the land supervision system. With the continuous evolution of the land supervision function, land supervision not only promotes the balance of arable land occupation and compensation, but also reduces the loss of land income and other effects, is it has a positive impact on agricultural economic growth? At present, the goal of protecting arable land is not enough to pursue a simple quantitative balance. More attention should be paid to the overall productivity effect of arable land. Therefore, it is more important to study the relationship between land supervision system and agricultural economic growth. Based on the above problems, this paper intends to evaluate the impact of the current land supervision system on the growth of Agricultural output value, to solve this problem, and put forward targeted recommendations, it is helpful to protect arable land strictly, which mention on the Third Plenary Session of the nineteenth and nineteenth CPC National Congress. It is also helpful to realize the Strategy of Vitalizing Rural Areas, and have important guiding and practical significance on protecting ecosystems.

2. The influence mechanism of land supervision system on Agricultural output value growth

First, land supervision directly affect the balance of quantity of arable land. In the process of implementing the balanced policy of arable land occupation and compensation and the pilot reform of land increase and decrease linking urban and rural, local governments and their entrusted agencies are the main participants, and the administrative functions and powers are the main operating modes to carry out the work of arable land supplement and land consolidation. In the absence of effective supervision, local governments and individual organizations often lead to 'rent-seeking' behaviour because of their own interests, misappropriation of arable land supplementary funds, resulting in the imbalance of occupation and compensation or inadequate supplement, resulting in the imbalance of arable land or the decline of arable land quality, thus affecting agricultural production and agricultural development. Therefore, the establishment of a national land supervision system, through vertical discovery, audit and error correction mechanism, as well as horizontal routine supervision, audit and special supervision means, the supervision of arable land requisition by local governments and their entrustment agencies at various levels should be supervised by multiple entities, restricting local governments to abuse their power to land acquisition behaviour. There are various problems in illegal occupation, examination and approval, requisition and transfer of arable land, non-agricultural land transfer, and in the balance of arable land occupation and compensation, and the land increase and decrease link between urban and rural. We should timely supervise and correct acts harmful to the protection of arable land quantity, urge arable land to be supplemented in accordance with quality and quantity, and maximize the protection of the target of 120 million hectare red line of arable land.

Second, land supervision is conducive to improving the quality of cultivated land. Land supervision, through technical and professional means, assess the quality level of supplementary arable land, identify and correct the problems of the supplementation of inferior quality by occupation in the process of supplementary arable land, ensure that the quality grade of supplementary arable land is not lower than that of occupied arable land, especially in the near future, implement key supervision in the delimitation of basic farmland and the construction of high-standard farmland to protect the superiority of our country. To protect the high-quality cultivated land resources in China, and strictly supervise the special fund for arable land protection to ensure the effective improvement of arable land quality.

Third, land supervision may lead to positive externalities in land consolidation. In addition to the balance between quantity and quality, land consolidation is mainly carried out through the consolidation of existing inferior arable land, reclamation of disaster-stricken land and development of unused land. The newly consolidated land should be more conducive to the application of agricultural mechanization, attracting agricultural investment and new agricultural projects than the original land. Thus producing positive externalities.

3. The influence mechanism of land supervision system on Agricultural output value growth
3.1. Research methods and model settings

According to the classical economic growth theory, this paper uses the production function as the foundation of this model. The model holds that the agricultural output value growth is affected by the following factors: first, the investment of capital, in the agricultural production process, the investment of capital plays a positive role in production; second, the input of arable land, the quality and quality of arable land. Quantity is an important material basis for agricultural production. Third, the input of human capital. Rural human capital is the main force of agricultural production. In addition, agricultural production technology and other factors have an important impact on agricultural production. Therefore, the model can be briefly summarized as follows:

\[ Y = F(A, \text{LAND}, L, K) \]

Where Y represents agricultural output, A represents technical level and other factors, LAND represents arable land input, L represents the level of agricultural labor force, K represents the level of agricultural assets input. In view of the purpose of this study, the upper linear and panel data mixture models are expressed as follows:

\[ Y = \alpha + \delta \text{SUP}_t + \sum \beta \text{control}_i + \mu_t + \epsilon_t \]

\( \alpha \) is a constant term, \( \delta \) is a variable coefficient of land supervision, \( \text{SUP}_t \) is land supervision, \( \beta \) is variable coefficient, \( \text{control}_i \) is series of control variables, \( \epsilon_t \) is a random perturbation term, and an independent and identically distributed error term and \( E(\epsilon_t) = 0 \). \( \mu_t \) and \( \epsilon_t \) respectively represent the time effect and individual effect.

3.2. Variable selection

Considering that agriculture output value growth comes from technological progress, land resources, capital and labour input, Therefore, in addition to the explanatory variables of land supervision, the arable land area, the newly added arable land area, the total power of agricultural machinery, water conservancy, environment and public facilities investment, and the rural population were selected as the control variables.

(1) Interpreted variable Y: The narrow sense of agricultural output value in this paper is selected as the interpreted variable. Considering that the narrow sense of agricultural output value is closely related to cultivated land area, the analysis of this paper does not include forestry, fisheries, animal husbandry and side-line.

(2) Explanatory variables SUP: The explanatory variable is the land supervision variable, the land supervision adopts routine supervision, audit supervision and special supervision. Due to the combination of audit inspectors and routine examination and approval records, involving all provinces, special assignments are not allowed. Suppose that land inspection is a dummy variable, if a province only executed one of the land routine supervision or special supervision, assign the SUP variable to 1, if the land routine supervision and special supervision were carried out simultaneously, assign the SUP variable to 2, indicating that the intensity of supervision increased. If the land supervision were not implemented, the SUP variables would be assigned to 0, indicating no land supervision. If the coefficient of explanatory variable is more than 0, land supervision has a positive effect on growth of agricultural output value. If it is less than 0, land supervision has a negative effect on agricultural economic growth.

(3) Control variables

The control variables included the arable land area (GM), the newly added arable land area (BG), the total power of agricultural machinery (JX), water conservancy, environment and public facilities investment (SL) and the rural population (POP).

The first type considers the amount of arable land, which is characterized by arable land area (GM) and newly-built arable land area (BG) under land consolidation. The arable land area is the most
important material basis of agricultural production, the quantity and quality of arable land directly affect the level of agricultural output. Land consolidation is an important means and way to supplement arable land at present. It is also an important means to improve the existing arable land conditions, deal with disaster-stricken land and exploit unused land. As an important means and foundation to supplement the reserve force of arable land resources, land consolidation plays an inestimable role in ensuring the growth of agricultural output value. The number of new arable land is expected to have a positive impact on agricultural output value growth.

The second kind of control variables consider the application of agricultural technology, represented by the total power input of agricultural machinery (JX). Usually, the more flat and concentrated the arable land, the more conducive to the application of agricultural machinery and the improvement of agricultural technology, obviously has a positive role in promoting the development of agricultural output value.

The third index is the level of agricultural investment (SL). The level of investment in water conservancy, environment and public facilities affects the agricultural production environment and agricultural infrastructure construction, and also plays an important role in agricultural output.

The fourth type of indicators takes into account the level of agricultural labour and population. Rural population (POP) is the most important foundation of agricultural economic development. Rural population obviously plays a positive role in promoting agricultural output level.

3.3 Descriptive statistics analysis of data sources and variables

In view of the availability of data, this paper analyse data from 2003 to 2015. The data were compiled from China Statistical Yearbook from 2004 to 2016, China Agricultural Statistical Data Compilation (1949-2004) and China Land and Resources Yearbook from 2004 to 2016. The data of land supervision came from the National Land Supervision Bulletin (2009-2016) published by the website of the former Ministry of Land Supervision, the website of the former Ministry of Land and Resources and the website of the Ministry of Natural Resources. In order to keep the consistency of provincial panel data, this paper merges the single-listed cities of land supervision into their provinces without listing them separately. The indicators include 13-year data of 31 provinces, totally 403 samples. Data descriptive statistics are as follows.

| Index   | Index meaning                                      | Mean  | Maximum | minimum | Std. Dev. |
|---------|----------------------------------------------------|-------|---------|---------|-----------|
| Explained variable | Y | Agricultural output value (billion Yuan) | 62.19 | 253.95 | 2.481 | 49.203 |
| Explained variable | SUP | Land supervision | 0.83 | 2 | 0 | 0.82 |
| control variable | GM | arable land area(Hectare) | 3852006 | 15864106 | 188012.8 | 2874344 |
| control variable | BG | additional arable land area(Hectare) in land consolidation | 8279.77 | 88500 | 0.57 | 8745.01 |
| control variable | POP | Number of rural population (ten thousand people) | 2126.07 | 7968.77 | 194.00 | 1618.25 |
| control variable | JX | Total power of agricultural machinery (Ten thousand kilowatts) | 2460.41 | 13353.02 | 95.32 | 2472.62 |
| control variable | SL | Investment in water conservancy, environment and public facilities(Ten thousand Yuan) | 672.65 | 3868.82 | 8.58 | 703.62 |

4. The impact of land supervision system on agricultural output value growth

4.1 Data unit root and stability test

The panel data contains both time dimension and cross-sectional dimension. In order to exclude the sequence correlation of the model and set the model type correctly, the unit root test of all data is needed to verify its stability. The results are as follows:
Hausman test results are shown in Table 4: the model was used to mix the regression data of 2004-2015 years’ provincial panel data, and the results were shown in Table 3:

From the above table, we can see that in the case of significance level 0.05, except Y, GM, JX, SL accepts the original hypothesis test, other variables reject the original hypothesis, that is, the BG, POP, SUP time series have stability, further on the Y, GM, JX, SL unit root test of the first-order difference square, found that its first-order difference. The results show that the agricultural growth in this period is affected by area of arable land, input of total power of agricultural machinery and investment in water conservancy, environment and public facilities in the previous period.

4.2 Effect analysis of land supervision in promoting agricultural output value growth

The model was used to mix the regression data of 2003-2015 years' provincial panel data, and the results were shown in Table 3:

Note: ‘*, **, and ***’ are significant at the levels of 10%, 5% and 1% respectively; ‘①’The values in brackets are t statistics.

From the above results, before and after the implementation of land supervision, the Coefficient of arable land (GM), the amount of land reclamation and supplementary arable land (BG), the number of rural population (POP), the total power of machinery (JX) and investment in water conservancy and environmental public facilities (SL) have changed. After the implementation of the land supervision policy, the promotion effect of land consolidation and supplementary arable land on agricultural economic growth in this period has increased significantly. The coefficient has risen from 0.0029 to 0.0031, and the proportion has risen to 6.9%. The coefficient of agricultural machinery total power on agricultural output value has risen from 0.1101 to 0.1103, indicating that increasing land is more conducive to agricultural mechanization.

4.3 Timing effect of land inspectors in promoting agricultural output value growth

Before analyzing the effect of land supervision on agricultural output value growth area, Hausman test was conducted to determine whether the model should be based on random effect or fixed effect. Hausman test results are shown in Table 4:

Note: ‘*, **, and ***’ are significant at the levels of 10%, 5% and 1% respectively; ‘①’The values in brackets are t statistics.
Hausman test results show that rejecting the original hypothesis test of the random effect model, the fixed effect model should be used to analyze the model. Therefore, the fixed effect model is applied to analyze the effect of land supervision system on the growth of agricultural output value.

In the process of implementing land supervision, the effect of supervision varies with the strength of supervision. Considering the sequential effect of land supervision, the above model is analyzed by time-varying intercept model. The results show that both before and after land supervision, the arable land area of the previous period, the supplementary arable land area of land consolidation in the current period, all have significant effects on the growth of agricultural output value. From the perspective of influence coefficient, after land supervision, The growth coefficient of agricultural output value affected by the area of arable land reclamation was 0.0029, which was 0.0001 higher than that without supervision.. The total dynamic coefficient of the machinery is 0.1101, which is 0.0005 higher than that before the supervision. It shows that the application of agricultural machinery is more extensive after the land supervision. The results are shown in Table 5.

| Year | 2004–C | 2005–C | 2006–C | 2007–C | 2008–C | 2009–C |
|-----|--------|--------|--------|--------|--------|--------|
| C   | 2.5833 | 1.02E-05 | 1.02E-05 | 1.0967 | 1.0967 | 1.0967 |
| t-Statistic | (0.1358) | (2.5686) | (2.4973) | (10.160) | (18.1248) | (8.4630) |

Table 5 Time varying intercept model of land supervision on agricultural output value growth

| Year | 2010–C | 2011–C | 2012–C | 2013–C | 2014–C | 2015–C |
|-----|--------|--------|--------|--------|--------|--------|
| Coefficient | -0.9933 | -4.8912 | 8.7448 | -8.7111 | -22.4053 | -42.2418 |
| R-squared | 0.9037 |

| Year | 2004–C | 2005–C | 2006–C | 2007–C | 2008–C | 2009–C |
|-----|--------|--------|--------|--------|--------|--------|
| C   | -32.6474 | 9.79E-06 | 0.0029*** | 0.0929*** | 0.1101*** | 0.1849*** |
| t-Statistic | (-1.5284) | (2.4704) | (2.891) | (10.160) | (18.3426) | (7.9672) |

5. Main conclusions and recommendations

Using 31 provincial panel data of China from 2003 to 2015, this paper studies the impact of national land supervision system on the growth of agricultural output value by using mixed model and fixed effect model of panel data. The results showed that:

Firstly, since the implementation of land supervision in 2007, the overall effect of the national land supervision system on agricultural economic growth is obvious. In 2007-2015, land supervision promoted the growth of agricultural output value by 46.017, 76.672, 105.880, 159.535, 164.393, 157.009, 234.652, 212.103 billion Yuan respectively. The effect of supervision was mainly transmitted through two channels: Land improvement to supplement arable land area and promoting the application of agricultural machinery in agricultural production. We should continue to strengthen land supervision and ensure the effect of its implementation, and promote the balance of the amount of arable land and the increase of the amount of arable land.

Secondly, land supervision has changed the impact of new arable land area and total power of agricultural machinery on agricultural output value. Among them, The coefficient of change of new arable land area to agricultural output value increased by 0.0001 after land supervision, which indicated that the new arable land has changed in quantity or quality, resulting in positive externalities.
On the other hand, the land supervision promoted the wider application of agricultural machinery. The influence coefficient of the total power of agricultural machinery on agricultural output value increased by 0.0005 after supervision, indicating that the land after regulation is more conducive to agricultural machinery operation. Therefore, it is necessary to strengthen the reclamation of existing arable land, the reclamation of disaster land and the development of unsuitable agricultural land. In the process of land consolidation, we should consider how to benefit the application of agricultural machinery and improve the technical level of agricultural production; delimit and construct high-standard basic farmland as soon as possible, further guarantee the quantity of arable land and increase the reserve of arable land; and strengthen the investment of water conservancy, environment and other public infrastructure. In order to promote the growth and development of agricultural economy, we should further enhance the knowledge and technology level of rural labour force involved in agriculture.

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