Asian Agricultural Research 2015, 7(7): 75 – 80

Urbanization and Grain Production Efficiency

Xiaoyang LI * , **Dongge LIU**

College of Economics and Management, Southwest University, Chongqing 400715, China

Abstract Based on DEA-Malmquist method, this paper calculated the integrated technology efficiency of grain production and total factor productivity and analyzed factors influencing the grain production technology efficiency using working documents of panel structure. Research results indicate that grain production integrated technology efficiency of China is relatively low, technology utilization level is low, and it remains at the stage of decreasing returns to scale, and the pure technology efficiency still has space to increase. Total factor productivity is declining and the total factor productivity of many provinces is relatively low. Since the total factor productivity of eastern areas is higher than central and western areas, it is required to strengthen technological support for grain production. The implementation of urbanization is helpful for promoting increase of grain production technology efficiency in central and eastern areas, but it will exert negative influence on western areas.

Key words Grain production, Technology efficiency, Total factor productivity, Urbanization, DEA-Malmquist

1 Introduction

Grain is the basic food for survival of human beings. For any country or nation, grain production and safety is an issue of wide concern. In 2013, China's total grain yield reached 601.935 million tons, increasing about 12.356 million tons compared with 2012, showing growth of 2.1%, and realizing ten consecutive years of growth. However, even with consecutive years of growth, more than half provinces are still not self-contained in grain supply and there is serious problem of grain production exceeding consumption. With population increase and acceleration of urbanization and industrialization, constant improvement of people's living conditions, and changes of food structure, China's grain demand will constantly rise. According to *OECD-FAO Agricultural Outlook* 2013 – 2022, the growth of China's grain consumption will be slightly faster than grain yield, and the annual average growth of consumption will be 0.3% higher than the yield growth. According to white paper *Grain Issue in China*, total grain demand of China will be 640 million tons in 2030. In future 10 – 20 years, it is required to increase at least 100 million tons to cover the gap of grain supply and demand. In 2013, China's urbanization rate would reach 53%. In the process of urbanization, annually 17 million farmers will move to cities and become citizens, and the transformation of consumption habit and life style will generate huge grain demand pressure. However, in the process of urbanization, the farmland area is close to 1.8 billion mu red line, young and middle-aged rural labor flows to other industries, agricultural workers are greatly reducing, which will exert profound influence on China's grain production. Therefore, in the situation of constantly acceleration of urbanization, it is of great realistic significance to increase grain yield at the same time of reasonably allocating resources.

There are numerous research documents about grain production efficiency, and many empirical methods about grain production efficiency. Qiao Shijun (2004) studied spatial distribution and influence factors of China's grain production technology efficiency using transcendental logarithmic stochastic frontier production function, and concluded that natural conditions of agricultural production and some social economic factors exert significant impact on grain production technology efficiency. Li Zhou and Yu Fawen (2005) using DEA method analyzed agricultural production efficiency of western county-wide areas, including changes of scale efficiency, technology efficiency, and total factor productivity (TFP). Quan Jiongzhen (2009), using nonparametric Malmquist productivity index model and SFA-Malmquist index model of stochastic frontier production function, calculated the TFP change index for agriculture of all provinces, eastern, central and western areas, and pointed that increasing agriculture technology efficiency is a potential power for increasing agricultural TFP. Xie Jie (2007), through econometric methods such as stepwise regression and weighted least-squares method, found that land and chemical fertilizer application are essential factors influencing grain production, and held that technological progress is a new approach for increasing China's grain yield in the context of extreme use of land and chemical fertilizer. Li Yueyun (2007) pointed negative influence of urbanization on grain production: excessive occupation of farmland leads to sharp reduction of grain planting area and decline of total grain yield; attraction of high quality labor leads to aging, woman-like, and weak agricultural labor, and low per unit area yield. Liu Ning (2011), using Super-efficiency Output-DEA Model, studied grain production capacity of 13 major grain production provinces in China in 2008. The results indicate that inefficient technology of many provinces is resulted from low scale efficiency. There is input redundancy in inefficient provinces, so reducing redundant input is of great role in reducing grain production cost. Similar researches include Xiao Hongbo, Wang Jimin

Received: May 6, 2015 Accepted: June 11, 2015

Supported by Project of National Natural Science Foundation (71373215); Key Project of Fundamental Research Funds for Southwest University (SWU1309003); Fundamental Research Funds for the Central Universities in 2015 (SWU1509317).

* Corresponding author. E-mail: 1064033955@qq.com

(2012), Kang Xia, and Liu Xiumei (2005). Du Yu'neng (2013) contended that farmland shrinkage and outflow of rural labor significantly influence urbanization, and urbanization inevitably brings about changes of grain consumption structure and increase of total grain consumption, consequently threatens grain production resources.

In sum, existing literature mainly studies grain production efficiency of different areas of China in different periods, to provide powerful reference for formulation of related national policies. However, there are few researches about change trend and regional difference in China's grain production efficiency. Based on this, we will focus on the change trend and regional difference of China's grain production efficiency in the context of promoting urbanization and further analyze major factors influencing grain production efficiency.

2 Study methods

The DEA (data envelopment analysis) is a non-parametric efficiency evaluation method put forward by Charnes, Cooper and Rhodes. It is based on input and output data, and calculates efficiency value through calculating the distance from production curve of decision making unit (DMU) to optimum frontier surface, and measures whether the DMU reaches the most effective input or output ratio. DEA method has benefits of not necessary for determining form of frontier production function in advance, not necessary for limiting shape of efficiency frontier, not necessary for estimating parameters of frontier efficiency function, and not necessary for making standardized processing.

Malmquist index was firstly introduced by Caves *et al* (1982). It measures productivity through comparing the output observation value from period s to period t and the maximum output value using the input (keeping the output combination unchanged). We defined Malmquist productivity change index with output as indicator with reference to Fare et al (1994).

Assume there are n production units, in the period $t = 1, 2, L, T$, change the factor $x^t = (x_1^t, x_2^t, \mathrm{L\ to\ } x_n^t) \in R_+^m$ to $y^t = (y_1^t, \cdots, y_n^t) \in R_+^m$, as follows:

$$T^t = \{x^t, y^t\} / x^t \text{ can generate } y^t$$

where T^t is also called set of production possibility, and the maximum economic output subset of a given input is the frontier of production technology. On this basis, we defined the distance function of production unit in the time t:

$$D_0^t(x^t, y^t) = \inf\{\theta : (x^t, y^t/\theta) \in T^t\}$$

Generally, $D_0^t(x^t, y^t) \leqslant 1$, only when the production unit is situated on the frontier surface, there is equal situation, and the technology efficiency is 100%, indicating it realizes maximum output in given input. Similarly, it is able to define the distance function with technology level as reference (x^{t+1}, y^{t+1}) in the time t:

$$D_0^t(x^{t+1}, y^{t+1}) = \inf\{\theta : (x^{t+1}, y^{t+1}/\theta) \in T^t\}$$

Based on the above analysis, it is able to calculate Malmquis index with technology level as reference in the time t:

$$M(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)}$$

Similarly, we can calculate Malmquist index with production technology level as reference in the time $t+1$: In order to avoid random in selecting production technology reference system, Fare proposed taking geometric mean of both values as Malmquist index:

$$M(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)}\right]^{1/2}$$

In the condition of returns to scale not changed, Malmquis index can be decomposed into technology efficiency index (effch) and technological progress index (techch):

$$M(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)}\right]^{1/2} = \mathrm{effch} \times \mathrm{techch}$$

In the condition of changeable returns to scale, the technology efficiency index (effch) can be further decomposed into product of pure technology efficiency index pech and returns to scale index sech.

3 Empirical analysis

Considering data availability and necessity for measuring China's grain production efficiency, we took total grain yield as grain output indicator, and took following indicators as input indicators: number of rural workers, total power of agricultural machinery, total sown area of major crops, effective irrigated area, fertilizer consumption, pesticide consumption, plastic film consumption, rural power consumption, and agricultural diesel oil consumption. To understand changes of China's grain production efficiency and difference of different provinces and areas, we selected data of 31 provinces in 2003 – 2011 as survey object. We divided China into eastern, central, and western areas. Eastern areas include Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan; central areas include Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan; western areas include Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Tibet and Xinjiang. The data in this study were selected from *China Statistical Yearbook*, *China Agriculture Statistical Yearbook*, and *China Statistical Yearbook of Agriculture in* 1949 – 2008.

3.1 Analysis on technology efficiency and returns to scale of grain production For the technology efficiency, the average value of grain production integrated technology efficiency is 0.758, the average value of pure technology efficiency is 0.844, and the average value of scale efficiency is 0.904, as listed in Table 1. The grain production integrated technology efficiency of China is relatively low, technology utilization level is low, and it remains at the stage of decreasing returns to scale, and the pure technology efficiency still has space to increase. For integrated technology level, 8 provinces have the value of 1, remain on the frontier surface of grain production, and the pure technology efficiency and scale efficiency are also 1, reaching the optimum state. In these 8 provinces, except Jilin and Heilongjiang, other 6 provinces in central and western areas realize optimum integrated technology efficiency after overcoming adverse influence of little farmland and harsh natural environment. However, such economically developed areas as Beijing, Shanghai, and Tianjin, the grain production efficiency is lower than the average national level. The low level of Beijing and Tianjin is due to low pure technology efficiency but high scale efficiency; the low grain production efficiency of Shanghai is low due to low scale efficiency, but the pure technology efficiency of Shanghai is 1. Liaoning, Jiangxi, Hunan, Guangdong and Sichuan have integrated technology efficiency of 0.8 – 1; Sichuan and Hunan have pure technology efficiency of 1; Guangdong has scale efficiency of grain production of 1; Jiangxi and Liaoning have scale efficiency higher than the national average level. 11 provinces have integrated technology efficiency of 0.6 – 0.8, mainly distributed in central and western areas. Low scale efficiency in Henan, Shandong and Hainan leads to integrated efficiency of these provinces lower than the national average level. Shanxi and Qinghai have scale efficiency reaching optimum level, but their pure technology efficiency is not high. Both pure technology efficiency and scale efficiency of other provinces fail to reach the optimum level, leading to decline of integrated technology efficiency.

For the returns to scale, except Xinjiang, other 7 provinces with increasing returns to scale are mainly distributed in eastern areas. Considering higher economic level and urbanization rate but less sown area of crops, increasing the sown area will increase the per unit area yield of grain. Henan, Anhui, Hunan, Hubei and Jiangxi have decreasing returns to scale, because these provinces gradually increase grain crop sown area which may have exceeded the sown area with scale efficiency up to optimum value. Near one third provinces have returns to scale not changed. These provinces are mainly distributed in central and western areas, indicating stability of grain production in certain period.

Table 1 Grain production technology efficiency and breakdown of all provinces

Province	Integrated technology efficiency	Pure technical efficiency	Scale efficiency	Returns to scale
Beijing	0.392	0.438	0.896	Increasing
Tianjin	0.497	0.527	0.942	Increasing
Hebei	0.577	0.826	0.698	Decreasing
Shanxi	0.614	0.614	1.000	Unchanged
Inner Mongolia	1.000	1.000	1.000	Unchanged
Liaoning	0.841	0.842	0.998	Increasing
Jilin	1.000	1.000	1.000	Unchanged
Heilongjiang	1.000	1.000	1.000	Unchanged
Shanghai	0.491	1.000	0.491	Increasing
Jiangsu	0.672	0.894	0.751	Decreasing
Zhejiang	0.584	0.587	0.995	Increasing
Anhui	0.586	0.833	0.704	Decreasing
Fujian	0.591	0.595	0.994	Increasing
Jiangxi	0.859	0.883	0.973	Decreasing
Shandong	0.659	1.000	0.659	Decreasing
Henan	0.614	1.000	0.614	Decreasing
Hubei	0.659	0.745	0.885	Decreasing
Hunan	0.885	1.000	0.885	Decreasing
Guangdong	0.807	0.807	1.000	Unchanged
Guangxi	1.000	1.000	1.000	Unchanged
Hainan	0.769	1.000	0.769	Increasing
Chongqing	1.000	1.000	1.000	Unchanged
Sichuan	0.975	1.000	0.975	Decreasing
Guizhou	1.000	1.000	1.000	Unchanged
Yunnan	0.663	0.686	0.966	Decreasing
Tibet	1.000	1.000	1.000	Unchanged
Shaanxi	0.796	0.904	0.881	Decreasing
Gansu	0.608	0.624	0.974	Decreasing
Qinghai	0.702	0.703	1.000	Unchanged
Ningxia	1.000	1.000	1.000	Unchanged
Xinjiang	0.647	0.666	0.971	Increasing
Average value	0.758	0.844	0.904	–

3.2 Total factor productivity analysis of grain production

Calculation results of total factor productivity (TFP) for grain production of all provinces indicate that the average TFP of 31 provinces in 2003 – 2011 is 0.996, dropping 0.4% on average; the average value of technology efficiency index is 1.003, the average value of technological progress index is 1.004, showing slow improvement of technology efficiency and technological progress; pure technology efficiency and scale efficiency separately drop 0.7% and 0.1% on average, showing a great space of improvement and the influence of technological application and improvement on TFP of China's grain production is not prominent, as listed in Table 2.

Table 2 Changes of TFP in all provinces

Province	Change of technology efficiency effch	Change of pure technology efficiency pech	Change of scale efficiency sech	Change of technological progress techch	Change of TFP tfpch
Beijing	1.068	1.050	1.017	1.035	1.105
Tianjin	1.023	0.994	1.029	1.022	1.046
Shanghai	1.071	1.071	1.000	0.972	1.041
Heilongjiang	1.000	1.000	1.000	1.040	1.040
Jiangsu	1.007	1.014	0.993	1.031	1.038
Henan	1.044	1.044	1.000	0.991	1.034
Hebei	1.004	1.011	0.993	1.028	1.032
Shandong	1.002	1.028	0.975	1.029	1.031
Liaoning	0.999	1.000	0.999	1.027	1.026
Anhui	1.032	1.009	1.023	0.985	1.017
Zhejiang	0.986	0.995	0.991	1.029	1.014
Fujian	0.976	0.993	0.983	1.030	1.005
Jiangxi	1.019	1.002	1.017	0.984	1.003
Shanxi	1.015	0.997	1.018	0.987	1.001
Xinjiang	1.018	1.012	1.006	0.983	1.001
Gansu	1.007	0.993	1.014	0.993	0.999
Hunan	1.015	1.015	1.000	0.982	0.997
Inner Mongolia	1.000	1.000	1.000	0.996	0.996
Shaanxi	1.027	1.014	1.013	0.970	0.996
Yunnan	0.984	0.993	0.991	1.009	0.993
Jilin	1.000	1.000	1.000	0.992	0.992
Ningxia	1.000	1.000	1.000	0.989	0.989
Hubei	1.009	0.999	1.010	0.978	0.987
Chongqing	1.000	1.000	1.000	0.981	0.981
Qinghai	0.986	0.970	1.016	0.991	0.977
Sichuan	1.003	1.003	1.000	0.963	0.966
Guangdong	0.948	1.000	0.948	1.010	0.957
Guangxi	0.942	0.994	0.947	1.007	0.949
Hainan	0.931	0.931	1.000	1.019	0.949
Tibet	1.000	1.000	1.000	0.884	0.884
Guizhou	1.000	1.000	1.000	0.874	0.874
Average value	1.003	0.993	0.999	1.004	0.996

From Table 2, we found that the TFP of 31 provinces is higher than 0.85 and the TFP of 15 provinces takes on positive growth. Beijing has the highest TFP, up to 10.5%, which is related to higher technology efficiency and technological progress. 8 provinces have TFP above 2%, and the rest 6 provinces have smaller TFP. Tianjin has the highest scale efficiency index and Shanghai has the highest pure technology efficiency index, possibly related to their higher economic level and higher agricultural scientific and technological content.

16 provinces have TFP lower than 1, Tibet and Guizhou have TFP lower than 0.9, mainly because of their low technological progress index. 9 provinces have technology efficiency index higher than technological progress index, indicating that weak technological progress is the major reason for drop of TFP index. Low TFP of Yunnan, Guangdong, Guangxi, Hainan and Qinghai is due to the fact that technology efficiency is lower than technological progress index.

For areas, nearly all provinces in eastern areas have TFP higher than 1, accounting for 60% provinces, which is related to higher technology efficiency index and technological progress index. Technology efficiency of Guangdong and Hainan is lower than their technological progress index and lower than the national average level. In 8 central provinces, 5 provinces have TFP higher than 1, but the technological progress index of 7 provinces is lower than national average level, and the technological progress index takes on decline trend. Most provinces in western areas have TFP lower than 1, mainly due to lower technological progress index, but the technology efficiency index takes on positive growth.

3.3 Factors influencing technology efficiency of grain production Factors influencing grain production efficiency are various, including natural environment, climate change, policy change, and labor quality. Considering data availability and research demand, with reference to practice of Qiao Shijun and Huang Jinbo, we selected per capita total mechanical power (JX), per capita sown area (BZ), chemical fertilizer application per mu (HF), the proportion of areas covered by disasters (SZ), urbanization rate (UR), and effective irrigation rate (GG) to analyze the marginal influence on grain production efficiency and technology efficiency. JX, BZ, HF, SZ and GG data are obtained through calculation of related statistical data, while the urbanization rate is expressed as the ratio of urban population to total population. The data of urbanization rate before 2005 are replaced with the percentage of non-agricultural population.

Considering great difference in grain production efficiency of different areas, we built panel structural models for eastern, central and western areas separately. With the aid of Eviews software, we estimated panel structural data, mainly including Pool object and Panel working documents. Pool objects are mainly suitable for narrow but long data with few cross section members but with long period, while panel data are mainly suitable for wide but short data. We made estimation of eastern and western provinces using panel structural working documents, and made estimation of central provinces using Pool objects, and obtained following regression results (as shown in Table 3).

Table 3 Regression results of grain production technology efficiency in different areas

Variables	Eastern provinces		Central provinces		Western provinces	
	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect
Constant	0.687 2***	1.145 2***	0.416 0***	0.438 8***	0.969 0***	0.6177***
JX	-0.075 6**	-0.202 2	-0.025 5	-0.025 6	0.0298	-0.015 4
BZ	0.078 3*	0.013 8	0.015 2	0.009 9	0.0143	0.090 4**
HF	-0.465 4**	-0.427 3	0.648 5	1.055 8***	-0.195 0	0.063 8
SZ	-0.074 2	-0.071 3	-0.038 7	-0.035 9	-0.0989**	-0.106 2**
UR	0.358 9***	0.597 7***	0.810 1***	0.658 1***	-0.149 4	-0.201 6
GG	-0.166 5	-0.718 7***	-0.371 6	-0.544 4*	-0.205 9*	-0.007 5
Hausman	24.518 3***		17.450 12***		11.450 59*	
R2	0.185 8	0.686 6	0.495 7	0.94 07	0.092 5	0.906 5
Adj. R2	0.132 7	0.625 4	0.449 1	0.92 74	0.038 6	0.888 8
F	3.498 4***	11.227 5***	10.648 2***	70.791 2***	1.716 4	51.309 6***
D. W.	1.068 1	1.407 5	1.281 6	1.666 4	0.800 3	0.956 2

Notes: ***, **, and * denote significance at 1%, 5%, and 10% level respectively.

In the model selection, Hausman test indicates that eastern and central provinces and western provinces reject original assumption of random effect at 1% and 10% significance level. Therefore, we made regression for all models using fixed effect model. F value passes the test at 1% significance level, indicating that linear relationship between variables in the model is significant and overall fitting is excellent.

Table 3 indicates that the influence of JX on grain production technology efficiency is negative but not significant. The influence of BZ on grain production technology efficiency is positive and more significant in western areas. SZ obviously restricts western provinces, but has no significant negative influence on central and eastern areas, possibly related to well-established grain production disaster prevention and reduction system in central and eastern areas. HF has significant positive influence on central and eastern provinces, indicating that increase of grain yield in central and eastern provinces is still mainly relying on input of materials, which is high consistent with low pure technology efficiency of central areas. GG is a key factor influencing grain production technology efficiency of central and eastern areas, and the improvement of GG fails to really promote increase of grain production technology efficiency.

The urbanization rate of central and eastern provinces has significantly positive promotion on grain production technology efficiency, but has no significant negative influence on western areas. This indicates that the grain production technology efficiency of central and eastern areas is increased with the development of urbanization rate, while urbanization development restricts increase of grain production technology efficiency in western provinces to a certain extent.

4 Conclusions and implications

Based on DEA-Malmquist method, we calculated the integrated technology efficiency of grain production and total factor productivity and analyzed factors influencing the grain production technology efficiency using working documents of panel structure. Our study indicates that the grain production integrated technology efficiency of China is relatively low, technology utilization level is low, and it remains at the stage of decreasing returns to scale, and the pure technology efficiency still has space to increase. The grain production of 8 provinces shows increasing returns to scale. These provinces are mainly distributed in eastern areas, while returns to scale of central and western areas are mainly decreasing. Average drop of TFP of grain production is up to 4% , more than 50% provinces have TFP lower than 1. TFP of eastern areas is higher than central and western areas. The implementation of urbanization is helpful for promoting increase of grain production technology efficiency in central and eastern areas, but it will exert negative influence on western areas. Therefore, in the serious situation of grain production, it is recommended to properly determine urbanization rate according to local situations, enhance raising grain production technology level, and increase grain production technology efficiency and total factor productivity, to ensure safe grain production.

References

[1] QIAO SJ. The positive analysis of technical efficiency in China's grain production: A stochastic frontier approach[J]. Application of Statistics and Management,2004, 23(3):11 -16. (in Chinese).

[2] LI Z, YU FW. The study of agricultural production efficiency in China's western region based on DEA method[J]. China Rural Survey, 2005(6): 2 -10. (in Chinese).

[3] QUAN JZ. An empirical analysis on agricultural total factor productivity in China during 1978 -2007[J]. Chinese Rural Economy, 2009(9): 36 -47. (in Chinese).

[4] XIE J. On the construction and quantitative analysis of China's grain production function[J]. Statistics and Decision,2007(20):74 -76. (in Chinese).

[5] LI YY. The industrialization, urbanization and food safety[J]. Modern Economic Research, 2007(1): 27 -30. (in Chinese).

[6] DU YN. On national food security in the urbanization of industrialized agriculture modernization process[D]. 2013:6. (in Chinese).

[7] LIU N. Evaluation on the grain production capacity of major grain production area based on super - efficiency output - DEA model[J]. Soft Science, 2003, 25(3):79 -83. (in Chinese).

[8] KANG X, LIU XM. Analysis on the technical efficiency of food production in China —Based on the method of stochastic frontier analysis[J]. China Rural Survey,2005(4):25 -32. (in Chinese).

[9] XIAO HB, WANG JM. Analysis on food comprehensive technical efficiency and total factor productivity in China since the new century[J]. Journal of Agrotechnical Economics,2012(1):36 -46. (in Chinese).

[10] Charnes A,Cooper WW,Rhodes E. Measuring the efficiency of decision making units,European[J]. Journal of Operational Research, 1978, 2(4): 429 -444.

[11] Caves D,Christensen LC, Diwert WE. The economic theory of index numbers and the measurement of input, output and productivity[J]. Econometrica, 1982(50):1393 -1414.

[12] Fare R, Grosskopf S, Norris M, *et al*. Productivity growth,technical progress and efficiency changes in industrialized countries[J]. American Economic Review,1994, 84(1): 66 -83.

(From page 74)

5.5 Establishing and improving land circulation security mechanism Firstly, establishing and improving rural land circulation service system. It is recommended to set up land circulation service center with fixed personnel, fixed post and fixed funds, to collect and issue land circulation information, and carry out land circulation registration management, and guide land circulation contract signature, and urge the implementation of land circulation contract. Secondly, making positive exploration to establish long-term mechanism for land circulation through market adjustment. It is recommended to take full advantage of achievements of land assessment, collect and issue land circulation market price and information, determine proper land price according to market supply and demand relationship, and circulate rural land on a large scale. Ultimately, it is expected to realize legal, standardized and programmed land circulation. Thirdly, enhancing training of rural labor, especially in agricultural practical skills, producing vegetable, planting technologies, and animal husbandry skills, and providing labor export guidance and service, to promote liberation of more farmers from land. Finally, it is recommended to establish and improve coordination, mediation, correspondence and visitation, arbitration, and judicial channels to solve problems of disputes of rural land contract, to properly settle disputes arising out of land, and to safeguard rural land circulation.

References

[1] WANG DP. Study on rural land circulation supported by financial innovation—— Taking the case of Dazhou[J]. Southwest Finance, 2013 (11): 34 -38. (in Chinese).

[2] WANG C. Survey and thoughts on land transfer in Kaijiang County[J]. Dazhou New Magazine, 2010 (3):61 -64.(in Chinese).

[3] LI CJ, LIANG J. Domestic and foreign summary research and forecast on rural land circulation[J]. Journal of The Guangxi Institute of Socialism, 2010, 21(2):79 -83. (in Chinese).

[4] ZHANG SG. Between the transfer of the use of land and agricultural modernization[J]. Management World, 2010(7): 66 -85. (in Chinese).

[5] GUO F, LEI M. An empirical research on status of land tenant transfer in China——A case study in Chongqing Municipality[J]. Journal of Southwest Forestry College, 2010, 30 (5): 77 -81. (in Chinese).