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Empirical Study on Factors Influencing Farmland Circulation in Economically Developed Areas

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Abstract Farmland circulation is the foundation of development of regional farmland market. With the aid of survey data of Jiangsu Province and using Heckman two-stage method, this paper analyzed factors influencing farmland circulation from supply and demand of land. Results showed that non-agricultural employment, social security level, and regional economic development level are key factors. In view of these factors, it is recommended to improve rural labor quality, establish perfect rural social security system, and constantly improve rural security level, which are fundamental ways to promoting farmland circulation and improve circulation market.

Key words Farmers, Land circulation, Economically developed areas, Land resource

A lot of researches have shown that farmland circulation is the result of many factors. (1) Non-agricultural industrial development and social security level are primary factors influencing farmland circulation. The development of rural non-agricultural industry and non-agricultural employment of rural labor are key factors determining development of land market in a certain region. At the present stage, since land undertakes the social security function to some extent, farmer households with higher family security level will have higher possibility to transfer out their land, and the area transferred will be larger^[1]; if non-agricultural income takes up a larger portion of family operating income, farmers will be more inclined to transfer out their land^[2]. (2) Completeness and stability of land property right are essential institutional factors influencing farmland circulation. Incomplete farmland property right reduces farmers' farmland operating income and transaction price, increases farmland transaction cost, and ultimately weakens farmers' farmland demand and supply^[3], while too frequent land adjustment reduces stability of farmers' land right and hinders development of farmland circulation market^[4]. (3) Land circulation of farmers is based on rational selection of their resource endowment. In general, it is more likely to transfer their farmland for those farmers who have lower agricultural production ability, larger per capita farmland, higher educational level, much non-agricultural employment experience, and larger proportion of non-agricultural assets^[5]; existing farmland area, number of family members, number of family agricultural labor, farmland characteristics, and farmland circulation rental are also important factors influencing farmland circulation^[6]. Different literature adopts different research methods to study farmland circulation. Many researches

adopt binary choice model, such as Probit and LOGIT, to analyze if there is transfer-in or transfer-out action of farmers at land circulation market^[7]; some researches firstly adopt Probit or LOGIT to analyze factors influencing land circulation, and then use Tobit model to analyze factors influencing scale of land circulation^[1, 6]; some researches adopt Tobit or multiple OLS regression to analyze factors influencing scale of farmland circulation^[8, 9].

Using field survey data of northern Jiangsu in 2008 and southern Jiangsu in 2010, by Heckman two-stage method, I divided land circulation action of farmers into land circulation and area of circulation from land supply and demand, and analyzed factors influencing farmers' land circulation action. As an eastern coastal developed area, Jiangsu Province has developed non-agricultural industry, which provides more job opportunities and sufficient condition for farmland circulation. Thus, its land circulation scale is larger, the range is wider, and the economic benefit is more significant.

1 Indicator selection and data source

1.1 Indicator selection As economic rational people, farmers will make overall judgment of their family status, social and economic situation, and make selection of whether participating in land circulation, transferring in or transferring out, and circulation scale, to realize optimal allocation of labor, capital and land resource, and finally maximize family utility. In this process, the fundamental principle is to minimize cost and maximize benefit. Therefore, factors influencing land circulation cost and income will affect farmers' land circulation action.

1.1.1 Non-agricultural employment of farmers. Only when there are non-agricultural employment opportunities and the wage level is not lower than income from operating agriculture, may farmers let out their farmland and become suppliers at the land circulation market. If most rural outgoing labor has no stable job and has no stable and high income anticipation, they will have higher dependence on land, and it is impossible to form stable land supply at

Received: September 12, 2013 Accepted: November 15, 2013
Supported by the Project of Jiangsu Social Science Foundation "Structural Characteristics of National Income Distribution in Jiangsu Province and Policies and Countermeasures for Narrowing Urban and Rural Income Gap" (12EYC013).

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land market. Thus, non-agricultural employment of labor and non-agricultural income of family are the most direct factors influencing farmland circulation. Farmer households with more non-agricultural labor, more non-agricultural working experience, and higher non-agricultural income, will have lower dependence on land. On the condition of lower agricultural income, farmers will tend to transfer out larger area of land due to increase of agricultural labor opportunity cost, to maximize family income. On the contrary, farmer households with more agricultural labor, more agricultural working experience, and lower non-agricultural income, will have higher dependence on land, and they will be more likely to transfer in land, and the area of land transferred in will be larger. Besides, employment distance of family members is also an important factor influencing farmland circulation. Generally, farmer households with shorter employment distance can take care of agricultural production at the same time. To maximize family utility, these farmer households will select part-time production, and they will prefer transferring in farmland to transferring out farmland. In this study, the proportion of employees in towns is taken as an indicator for measuring farmers' employment distance.

1.1.2 Social security level of farmer family. In China, apart from economic functions, farmland also assumes rural social security function and reemployment function. Social security level of families plays a decisive role in constant circulation of farmland. In view of limitation of survey data, the rate of joining the endowment insurance in family members was taken to assess social security level of farmer families. With improvement of rural social security, especially rural social endowment security, ultimate security function of land operation will be weakened. Therefore, farmers with higher family social security level will have lower dependence on land and will be more likely to transfer out their land and the area of land transferred will be larger.

1.1.3 Land resource endowment of farmer households. Per capita farmland area reflects situation of land assets possessed by farmer households. On the condition of comparatively low benefit of agriculture at present, a lot of rural labors flow to non-agricultural industry to maximize family income. Farmers do farm work mainly for purpose of grain ration. If the per capita farmland area is large, farmers will be more likely to transfer out their land due to increase in labor opportunity cost. On the contrary, farmers with less per capita farmland will be less likely to transfer out their land, but more likely to transfer in land for eking out a living. Separate land and fragmented management make farmers fail to realize scale effect, lead to rise of production cost for agricultural products, and reduce agricultural output level. In coastal developed areas like Jiangsu, basic living problem of farmers has been solved, non-agricultural industries develop rapidly and non-agricultural income constantly increases. Fragmented farmland leads to high opportunity cost of agricultural production and results in many farmers transferring out farmland. In this study, area of each land parcel is taken as an indicator for measuring farmland fragmentation.

1.1.4 Characteristics of head of household. Head of household is the major participant of family decisions and plays the important role in land circulation. In this study, educational level and age are used to measure characteristics of head of household. Farmers with higher educational level will have more non-agricultural employment opportunities and higher stability of employment, higher non-agricultural income, and generally they will adopt non-agricultural jobs. Besides, since these farmers have higher ability of accepting new knowledge and applying new technologies, they will be more likely to develop modern agriculture and expand operation scale, and their desire to transfer in land will be stronger. Nevertheless, these farmers are relatively few because the existing development level of modern agriculture is still limited and the situation of low agricultural income is not changed fundamentally. Older farmers have rich agricultural production experience but fewer non-agricultural employment opportunities and lower non-agricultural income, thus the possibility of their transferring in farmland is higher, but the possibility of their transferring out farmland is lower.

1.1.5 Location condition. In this study, the distance between families and towns is taken to measure location condition of farmers. According to the economic development level from low to high, value assignment in this study is as follows: northern Jiangsu area = 0, Changzhou = 1, Wuxi = 2, and Suzhou = 3. In less developed areas, farmers are weak in resisting against risks and social security and reemployment function of land are high, so farmers generally will not transfer out their land. In economically developed areas, farmers have more non-agricultural employment opportunities and higher non-agricultural income, thus they will be more likely to transfer out their land. Since small towns and modern agriculture develop rapidly, farmers near to towns will have higher demand for land and more non-agricultural employment opportunities, they will be more likely to transfer in or out their farmland.

1.2 Selection of models Farmland circulation can be divided into two interdependent but also interconnected stages: the first stage is whether to circulate, and the second stage is the ratio of circulation area. To avoid possible selection bias in land circulation, Heckman two-stage model was used in this study. Firstly, "whether to circulate" is taken as the explained variable at the first stage. All parameters were used to make Probit estimation of all samples, to determine decisive factor of farmland circulation. The specific equation is as follows: $Y = 1$ means land circulation appeared; if no land circulation appeared, *i. e.* $Y = 0$, the corresponding function will be:

$$\text{prob}(Y=0) = 1 - \text{prob}(Y=1) = 1 - \varphi(\beta'X) = 1 - \int \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt$$

where Y is dependent variable, *i. e.* whether land circulation appeared, including transfer-in and transfer-out; X stands for independent variable, including non-agricultural employment status, family social security level, land resource endowment, characteristics of head of household, and location condition; β' is the coef-

ficient to be estimated. Secondly, considering possible selection bias in OLS estimation, we need to obtain the conversion ratio λ from the Probit estimation equation. The conversion formula is as follows:

$$\lambda = \frac{\psi(z_i\gamma/\sigma_o)}{\varphi(z_i\gamma/\sigma_o)}$$

where $\psi(Z_i\gamma/\sigma_o)$ is density function of standard normal distribution, and $\varphi(Z_i\gamma/\sigma_o)$ is the corresponding cumulative distribution function. Finally, we used OLS method to make estimation of the equation, introduced as a variable of equation estimation into the model, to correct the selection bias. The model can be expressed by following equation:

$$Y_i = \beta_o + \beta_i Z_i + \alpha\lambda + \mu$$

where Y_i is the area ratio of land circulation (divided into area ratio of transfer-out land and area ratio of transfer-in land), Z_i is independent variable (including non-agricultural employment of farmers, and family security level), β_o is the constant term, and μ is random disturbance term. It should be noted that β_i is the regression coefficient of independent variable Z_i ; α is coefficient to be estimated for conversion ratio λ , if this coefficient is significant, it proves the selection bias exists, Heckman two-stage model is effective; otherwise, Heckman two-stage model is not tenable.

1.3 Data source The data in this study were selected from two field survey questionnaire issued by Institute of Rural Development of Jiangsu Provincial Academy of Social Sciences. (1) One survey was the program entrusted by Chinese Academy of Social Sciences in 2007: survey of national conditions in Lizhuang Village, a provincial-level poor village in northern Jiangsu. Major survey contents include basic family situation, production and consumption, and land circulation situation. In this survey, 167 valid samples

were obtained, involving 739 respondents. (2) The other survey was the program assigned by Institute of Rural Development of Jiangsu Provincial Academy of Social Sciences in 2010: research on moderate scale operation of agriculture at the background of integrated urban and rural areas. A total of 600 farmer households were surveyed in three cities of southern Jiangsu, including 300 in Suzhou, 150 in Wuxi and 150 in Changzhou. This program mainly surveyed basic family situation of farmer households, farmland circulation, and debt and credit of farmers. Excluding invalid samples, this study obtained 741 valid samples in total. The following analyses were based on these valid samples.

2 Empirical analysis on factors influencing farmland circulation

We adopted STATA9.0 and used Heckman two-stage method to make regression. Dependent variables in the second stage selected the ratio of land circulation area. For farmers with net transfer-in land, the ratio of transfer-in land area = transfer-in land area / existing land area $\times 100\%$; for farmers with net transfer-out farmers, the ratio of transfer-out land area = transfer-out land area / (existing land area + transfer-out land area) $\times 100\%$. In the selection of independent variables, Z in the second stage should be the subset of X , because although λ is a non-linear function of X , it may be well approximated using a linear function. If $Z = X$, λ may be highly correlated with Z_i , and such multicollinearity may bring about standard error with high $\beta_i^{[10]}$. Therefore, independent variables of the second stage OLS regression is the subset of selection model in the first stage. The regression results are listed in Table 1.

Table 1 Factors influencing farmland circulation in developed areas

Independent variables	Land transfer-out		Land transfer-in	
	Transfer-out or not	Area of transfer-out area	Transfer-out or not	Area of transfer-out area
Non-agricultural working experience	0.130 (2.85) **	—	—	—
Proportion of non-agricultural labor	0.003 (1.53) *	0.135 (3.35) ***	-0.002 (-0.44)	-0.023 (-1.58) *
Proportion of non-agricultural employees in towns	—	—	0.071 (1.48) *	0.013 (1.55) *
Proportion of non-agricultural income	0.010 (3.61) ***	0.128 (2.73) ***	-0.001 (-0.32)	—
Participation rate of endowment insurance	0.001 (1.43) *	0.070 (2.75) ***	-0.006 (-2.44) **	-0.005 (-0.38)
Farmland area per parcel of land	-0.117 (-1.71) *	-3.037 (-3.87) ***	0.107 (2.06) **	0.124 (0.33)
Farmland area per capita	0.017 (0.28)	4.156 (5.09) ***	-0.133 (-2.35) **	-3.797 (-10.45) ***
Age of head of household	-0.005 (-0.97)	-0.148 (-1.81) *	0.011 (1.54) *	0.019 (0.49)
Educational level of head of household	0.005 (0.09)	0.816 (0.95)	-0.212 (-2.64) ***	-1.019 (-2.45) **
Region	0.075 (1.57) *	0.470 (0.57)	0.132 (1.64) *	0.702 (1.79) *
Distance from towns	-0.006 (-1.63) *	-0.101 (-1.65) *	-0.011 (-1.57) *	-0.014 (-0.43)
Constant	-1.234 (-2.76) ***	33.752 (32.75) ***	-0.024 (-0.04)	-1.208 (-0.39)
λ	—	10.67 (1.62) *	—	8.99 (12.00) ***
Significance test of model	-434.50 (0.00) ***	123.78 (0.00) ***	-174.70 (0.00) ***	40.56 (0.00) ***

Note: *, **, and *** signify significance test at the level of 10%, 5% and 1% respectively; values within parentheses denote Z or T of variable estimation; for the model significance test, Probit model is Log likelihood value, and OLS regression test value is F value.

From Table 1, it can be known that the Log likelihood value (or F value) of all four land transfer-out, transfer-out area ratio, land transfer-in, and transfer-in area ratio equations pass the significance test, indicating the model holds. Besides, the OLS regression equation of transfer-out and transfer-in area ratio (inverse Mills ratio) passes the significance test at 10% and 1% level sep-

arately, indicating that farmland circulation has selection bias, and proving that Heckman two-stage method is most suitable method in this study.

Regression results indicate that non-agricultural employment has significant influence on farmland circulation. Farmers with longer non-agricultural working experience, more non-agricultural

labor, and higher non-agricultural income, will be more likely to transfer out farmland, and the area of transferred out land will be larger; farmers with fewer non-agricultural labor, less non-agricultural income, and higher proportion of employees in towns, will be more likely to transfer in farmland and the area transferred in land will be larger. Results of survey carried out in southern Jiangsu in 2010 show that complete non-agricultural employees account for 52.57%, part-time employees account for 32.87%, and complete agricultural producers account for 14.56%. The income structure shows that non-agricultural income has become major income source of farmers. Survey results indicate that non-agricultural income accounts for 75.5% of total family income, in southern Jiangsu areas, the value is up to 87.7%. Higher non-agricultural employment rate and non-agricultural income level lead to low dependence of farmers on farmland, and increase possibility of farmers to transfer out large area of farmland; at lower agricultural income level, the possibility of farmers to transfer in large area of farmland is lower. It indicates that farmer households with more non-agricultural employees in towns are more likely to transfer in farmland and the area transferred in will be larger. If employment distance is short, non-agricultural employees in towns can take care of agricultural production at the same time. When family labor is relatively sufficient, farmer households will transfer in larger area of farmland, to maximize family income.

Family security level of farmer households is positively correlated with land transfer-out ratio and transfer-in ratio, which passes significance test at 10% and 1% level respectively, indicating that farmer households with higher social security level are more likely to transfer out larger area of farmland; it is negatively correlated with land transfer-in ratio and transfer-in area ratio, which passes significance test at 5% level, indicating farmer households with higher social security level are less likely to transfer in farmland. As stated above, although non-agricultural income has become major source of farmers' income, due to instability and lower wage level of non-agricultural employment, in addition to higher house-purchase cost and living expenses, rural labor employment takes on the characteristic of "doing non-agricultural work when young, but do farming work when getting old". According to statistics, 60% migrant workers have monthly income of 500 – 1 000 yuan, and 20% migrant workers have monthly income of 1 000 – 2 000 yuan^[11]. This makes migrant work only becomes a channel for increasing farmers' income, and land becomes a guarantee for farmers evading non-agricultural work risks and living when getting old. In richer rural areas of southern Suzhou, 89.7% farmers still possess farmland. Among those farmer households, 68.7% think farmland has security function^[12]. To sum up, social security level determines value of farmland and dependence of farmers on farmland, so it is the decisive factor of farmland circulation.

Land resource endowment is an important factor influencing farmland circulation. In this study, we divide it into land area and the degree of land fragmentation. Regression results indicate that farmland area per parcel of land is negatively correlated with land

transfer-out and transfer-out area ratio, which passes the significance test at 10% and 1% level respectively; it is positively correlated with whether land is transferred in, which passes the significance test at 5% level. This indicates higher degree of land fragmentation brings about higher possibility of land transferring out. With rapid growth of rural population and increase of land demand for non-agricultural industries, the degree of land fragmentation in Jiangsu Province is constantly increasing. Survey data show that farmland area per parcel of land of farmers is 659 m²; farmers operating more than 5 parcels of land accounts for 51.55%; a farmer with the most parcels of land operates 2.046 hm² of farmland which is divided into 16 parcels. As a result, the irrigation efficiency, harvesting efficiency, and routine management efficiency are relatively low, and agricultural production cost is very high. When there is non-agricultural employment opportunity, these farmers will be more likely to transfer out their farmland, but less likely to transfer in farmland. The farmland per capita is positively correlated with land transfer-out and transfer-out area ratio, the transfer-out area ratio passes the significance test at 1% level; it is negatively correlated with land transfer-in and the transfer-in area ratio, which passes the significance test at the 5% and 1% level respectively. This indicates that for farmer households with richer land resources, they will transfer out land due to increase in opportunity cost for agricultural employment, and the possibility of their transferring in land is lower. These are basically consistent with our expectation.

Individual characteristic of head of household has certain influence on land circulation. Regression results indicate that age of head of household is negatively correlated with land transfer-out and the transfer-out area ratio, the land transfer-out area ratio passes the significance test at 10% level; it is positively correlated with land transfer-in and the transfer-in area ratio, and the land transfer-in area ratio passes the significance test at 10% level. If the head of household is old, the possibility of land transfer-in is higher; if the head of household is young and middle aged, the possibility of transfer-out is higher. Besides, the educational level of the head of household is negatively correlated with land transfer-in and the transfer-in area ratio, which passes the significance test at 1% and 5% level respectively. This indicates that farmer households with higher educational level are less likely to transfer in land and the land transferred in will be smaller. Survey shows that family structure of rural areas in Jiangsu Province takes on "three-member family" (young couple and child), and "two-member family" (old couple). Such situation is prominent in southern Jiangsu. Most three – member families have higher educational level, lower agricultural income and more non-agricultural employment opportunities. Thus, most young and middle aged people are engaged in non-agricultural industry. Only those few old people having lower educational level have to do farming work due to lack of non-agricultural employment opportunity. As a result, those old people have more demand for farmland and are more likely to transfer-in larger area of farmland.

Farmers from areas with different economic development level have different land circulation actions. Regression results indicate that regional economic development level is positively correlated with land transfer-out and the transfer-out area ratio, and the land transfer-out passes the significance test at 10% level; it is positively correlated with land transfer-in and the transfer-in area ratio, which passes the significance test at 10% level. Compared with northern Jiangsu areas, farmers in southern Jiangsu areas have more frequent land circulation, and the land circulation frequency increases with growth of regional non-agricultural economic development level. In addition, farmer households near to towns are more likely to have land circulation action, which is consistent with our expectation. Generally, regions with developed non-agricultural industries provide more employment opportunities in secondary and tertiary industries. In the existing situation of income from non-agricultural industries higher than income from agriculture, labor forces will migrate on a large scale, higher proportion of family income of farmer households will come from non-agricultural industries, opportunity cost of agricultural labor will be higher, and the possibility of farmers transferring their land will be higher. Furthermore, with improvement of agricultural mechanization, each labor can assume larger planting area. For the question "How much land is appropriate for your crop planting" in the survey carried out in northern Jiangsu in 2008, most male labors think it should exceed 1.33 hm², and some even think it should exceed 6.67 hm². This fully proves that labor employment is seriously insufficient for farmers who are unwilling to or can not go out to join in non-agricultural activities. Especially in current situation of low agricultural taxes and some subsidies, these farmers are enthusiastic to transfer in farmland. Therefore, no matter land transfer-in or transfer-out, the circulation action increases with development of non-agricultural industries.

3 Conclusions and discussions

Study has shown that regional economic development level, non-agricultural employment, and family social security level are key factors influencing farmland circulation, and farmers with different land resource endowment and individual characteristics of head of household have different land circulation actions. In southern Jiangsu where the development of non-agricultural industries is higher, secondary and tertiary industries provide more employment opportunities. Family income from non-agricultural industries takes up a larger portion. In addition to relatively developed modern agriculture, land circulation is more active. In underdeveloped northern Jiangsu, farmers' net income per capita is low, non-agricultural employment opportunities are few and not stable, and farmers' dependence on land is high, so land circulation is not active. Besides, although non-agricultural employment and non-agricultural income take up larger portion in rural areas of Jiangsu Province, due to limitation of farmers' quality, rural labor employment is not stable, and farmland is still an irreplaceable production factor, which hinders farmland circulation to some extent. Therefore, it fundamental way to promote farmland circulation is to improve rural labor quality, strengthen stability and persistence of non-agricultural employment, establish perfect rural social security system, and constantly improve the security level. For this, it is re-

quired to remove all regulations limiting transfer of farmers to towns and non-agricultural industries, strengthen training in migration employment of rural labor, enhance guiding training before migration of rural labor and vocational technical training, improve farmers' employment ability, promote broad and deep migration of rural labor to non-agricultural industries, and improve employment ability and stability of rural labor in non-agricultural industries. In addition, it is recommended to set up perfect rural social security system and constantly improve social security, to gradually weaken or even remove social security function of farmland. Furthermore, it is proposed to speed up developing modern agriculture, practically transform agricultural development mode, improve large-scale, industrialized and standardized agriculture, foster stable demanders of land circulation market, and promote healthy and sustainable development of land circulation. Finally, it is required to base on realities, accord with local situations, and actual conditions of farmers, and guide orderly circulation of farmland in different regions.

Acknowledgement

I would like to extend my deepest gratitude to researcher Bao Zongshun from Institute of Rural Development of Jiangsu Provincial Academy of Social Sciences. The data in this paper were selected from questionnaire carried out by Mr. Bao and all colleagues. Their hard work in field survey contributed a lot to this paper.

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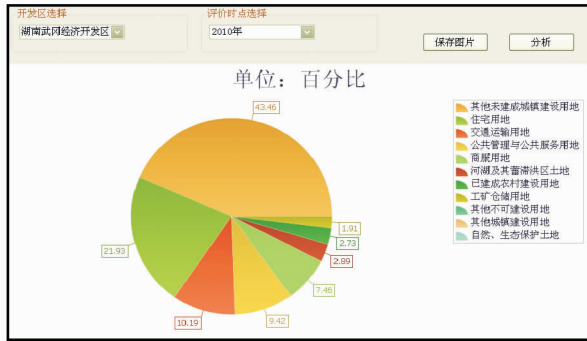


Fig. 7 Structural analysis



Fig. 8 Potential analysis

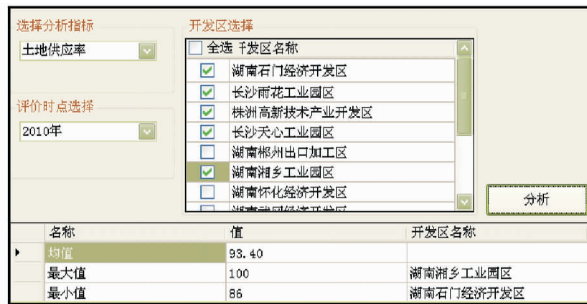


Fig. 9 Meta-analysis



Fig. 10 Cluster analysis

results of development areas are integrated and elevated into the database management system for intensive land use evaluation in

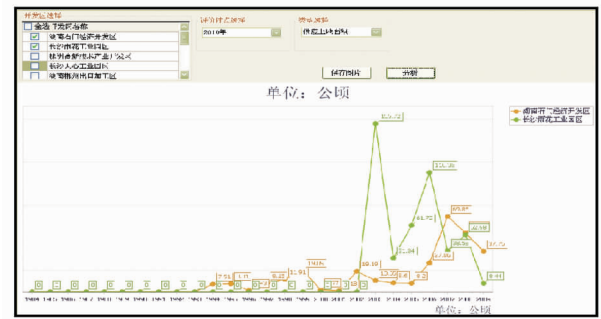


Fig. 11 Trend analysis



Fig. 12 Regional analysis

the development areas of Hunan Province, to provide strong technical basis for the scientific decision-making of land management.

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