Marginalization of Arable Land and its Correlation with Rural Labor Migration

——A Case of Tongcheng County, Hubei Province, China

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Abstract Based on the introduction of the connotation of marginalization, the index of diagnosing the marginalization degree is put forward. According to the 685 copies of questionnaires on peasant households in Tongcheng County of Hubei Province and the statistical data of local government, marginalization of arable land and its correlation with rural labor migration in Tongcheng County are studied by using aggregative indicator method, clustering analysis method and correlation analysis method. Result shows that marginalization of arable land has happened two times in Tongcheng County since 1985. Dry land has severer marginalization degree than paddy field. There is significant correlation between marginalization degree of arable land and rural labor migration; and the correlation between marginalization degree and rural labor migration in paddy field is greater than that in dry land. Marginalization of arable land will advance the rural labor migration, while in response to the poor current circulation of lands; the rural labor migration will further deepen the marginalization degree. Marginalization of arable land is one of the important factors affecting the labor migration in rural areas.

Key words Arable land using, Marginalization of arable land, Labor migration, Correlation, China

1 The theory of marginalization of arable land

1.1 The connotation of marginalization of arable land Marginalization of arable land is a process during which the land no longer has economic production capability driven by the comprehensive factors such as the society, economy, policies and environment and so on[1]. During the process of economic development, the period of rapid industrialization and urbanization is often accompanied by the phenomenon of marginalization of arable land. The marginalization of arable land began to spread in North America from the 1820s, and it began to spread in the west part of Europe from 1850s[2]; the using of arable land in China dates back to the late 1890s and gradually two to three times of marginalization occurred from the east to the west[3-4]. The most notable feature of marginalization of arable land is the continuously decreased net income of arable land, followed by the reduction of the intensive degree of land using and the corresponding decrease of crop acreage. When the marginalization appears and the proceeds from the land become too low, some farmers will transfer the operational rights of the land or abandon it to find other job opportunities. Numerous migrant workers arise from this background year by year in China.

1.2 The diagnosis of marginal arable land Arable land no longer has the "economic production capability" is the core connotation of marginalization. The marginalization of arable land is the gradual process of losing "economic production capability" and reducing to marginal land form normal land. From the concern of availability of data and operability of method, the net income, the intensive degree and the sown acreage of arable land are the three operational indexes to diagnose the marginalization of arable land. Generally speaking, the land use can be regarded as be marginalized, if the net income of some lands decrease year by year and the phenomenon of "the decrease of intensive degree", "the shrinkage of sown acreage" and even obvious "abandon of land" appear in the following process of land use[1].

1.3 The degree of marginalization of arable land From the normal arable land to marginal land, the land will experience the following processes: normal arable land-marginal land in the initial stage-marginal land in the intermediary stage-marginal land in the complete stage[4]. With the changes of natural conditions, cost factors, plant structure and so on, the developmental stages of the marginalization of arable land may copy the above stages or reverse them, for instance, the risen price of agricultural products and the cancellation of agricultural taxes and fees may turn the marginal land into normal arable land. The degree of marginalization of arable land or in which developmental stage of it can be judged by the net income, total income and agricultural output per unit area[4].

2 Data sources and processing

2.1 Data sources There are three data sources of this paper. Firstly, the author conducted three times of one to one questionnaires to households in 22 villages of 11 towns in June 2006, December 2006 and September 2007. 685 copies of questionnaires on the costs and earnings of the land ran by the

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farmers were obtained. The questionnaires include the total earnings and labor costs of various kinds of farmlands as well as the input costs of materials. According to the data, the net income, total income, the intensive degree and so on can be worked out. Secondly, the materials of the costs and incomes of the households provided by the agricultural investigation team in Tongcheng County are incomplete. They are mainly used to just the survey data in previous years. Thirdly, the data of acreage, agricultural yields, price index and rural labor migration comes from the *Comprehensive statistics on National Economy of Tongcheng County* of the Bureau of Statistics of Tongcheng County, Hubei Province.

2.2 Data processing and calculation

2.2.1 The calculation of the income and intensive degree of arable land using. The paddy field crops in Tongcheng County are mainly early season rice, middle season rice, late season rice, wheat, rapeseed, soybean, peanut, cotton and so on. The farming systems include the rice and rice; rice, rapeseed and rice; rapeseed, rice and rice; rice and rice; rice and cotton; rice and soybean. Among them, the most popular system is rice and rice, which accounts for over 70% of the total sown acreage. Taking the rice and rice farming system as an example, the author calculated the net income, total income and intensive degree of the paddy field used in Tongcheng County.

The dry land crops in Tongcheng County are mainly sweet potato, wheat, soybean, mash bean, peanut, sesame, *etc.* The farming systems include the wheat and sweet potato, wheat and beans, wheat and peanut, of which the farming system of wheat and sweet potato takes up a larger proportion. The sown acreage of summer crops (mainly of wheat) and sweet potato accounts for 79% of the total sown acreage of dry land. Taking the farming system of wheat and sweet potato as an example, the earnings of the dry land of Tongcheng County can be calculated. When calculating the income of land using, only the income of main products, for example, the income of rice in paddy field and the income of sweet potato and wheat can be used to calculated, while the income of byproducts is neglected, for it takes up only a small proportion of the total income and does not affect the analysis of the tendency. The income of paddy field from 2004 to 2006 includes the subsidies given by the country, such as, the subsidies of improved seeds, agricultural machine and fertilizers; the costs include the costs of labor, fertilizer, pesticide, animal and agricultural machine use, taxes and other expenses.

In order to eliminate the fluctuations of prices between years and establish the comparative basis of income, the total income and the net income are conversed according to the consumer price index of each year, for the income of households is mainly used for daily consumption. ① The calculation of the index of the total price (D_i). Based on the price index of 1985, the total price index of each year from 1986 to 2006 can be calculated compared to the overall index of 1985. ②The calculation of the comparative income of each year (M_i). By using the general price index, the income (N_i) can be converted to the comparative income (formula 1). The total incomes include the net income and the total income of the double-season rice per unit area of paddy field and the sweet potato per unit area of dry land.

$$M_i = N_i / D_i \times 100 \quad (1)$$

The computation of the intensive degree of land use applies the formula raised by German agricultural economists T. Brinkmann[5], who thinks that the basic concept of intensive or not is the money of capital, wage and capital interest consumed per unit area during the operation period. It can be presented by the following formula (2);

$$I = (A + K + Z) / F \quad (2)$$

In the formula, I is the intensive degree, A is labor wage, K is capital consumption, Z is operational capital interest, F is the operation area.

Since the time from planting to proceeding is short for rice, wheat and sweet potato, usually 4 to 5 months, so the operational capital interest is excluded.

2.2.2 The computation of the marginalization degree of arable land. After the calculating of the net income and total income of paddy field and dry land, the aggregative indicator method is applied to compute the marginalization value of arable land so as to comprehensively discuss the marginalization degree of arable land in Tongcheng County. The specific steps are as follows[6].

(1) The factors which have impact on the marginalization degree of arable land is standardized. The formula is as follows.

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij} / n} \quad (3)$$

In the formula, P_{ij} is the standardized value; X_{ij} is the reciprocal or the opposite number of impact factor; $i = 1, 2 \cdots, n$, is the number of the same factor; from 1985 to 2006, there are all together 22 factors; $j = 1, 2 \cdots, m$ is the number of factor; three factors of the net income, total income and crops yield per unit area exist here.

(2) Determining the weight of the impact factor, and then based on the determined result, multiple the each standard value of impact factor by its weight, then accumulate the results, such as formula (4)

$$F(w) = \sum_{i=1}^{n} [W_i \sum_{j=1}^{m} (W_j P_j)] \quad (4)$$

In the formula, $F(w)$ is the degree of marginalization; W_i is the weight of criterion layer; n is the umber of evaluating the criterion layer; W_j is the weight of each index in the index layer; m is the number of evaluating the index; P_j is the standardized value of each evaluation index.

Three factors determine the marginalization degree of arable land; the net income, the total income and the yields of per unit area, of which the impact of the net income on the marginalization degree is slightly bigger and the total income and the yields per unit area have the equal impact, so in computing the value of the marginalization degree of arable land, the weight of the three factors is 0.4, 0.3, 0.3 respectively; the criterion layer here means the impact of paddy filed and dry land on the marginalization degree. In Tongcheng County the area of the

paddy field and the dry land is in the ratio of 0.91 to 0.09, so the weight of the paddy field and the dry land is 0.91 and 0.09 respectively.

3 Results and analysis

3.1 The marginalization degree of different land types By using the method above, the net income, the total income and the output value per unit area of the land using in Tongcheng County can be worked out; by using the formulas (3) and (4) and the weight mentioned above, the marginalization value of agricultural land in Tongcheng County can be worked out.

Table 1 The marginalization value of agricultural land in Tongcheng County

Year	Marginalization value of paddy field	Marginalization value of dry land	Marginalization value of agricultural land	Year	Marginalization value of paddy field	Marginalization value of dry land	Marginalization value of agricultural land
1985	1.12	2.23	1.22	1996	1.21	0.69	1.17
1986	1.01	2.11	1.11	1997	1.19	0.90	1.16
1987	1.14	2.06	1.22	1998	0.87	1.15	0.90
1988	1.07	1.46	1.10	1999	0.57	1.43	0.64
1989	1.16	1.13	1.16	2000	0.64	0.59	0.64
1990	1.01	1.20	1.03	2001	0.60	0.22	0.57
1991	0.63	0.68	0.64	2002	0.62	0.35	0.60
1992	0.47	0.35	0.46	2003	0.77	0.50	0.74
1993	0.95	1.17	0.97	2004	1.28	0.63	1.22
1994	1.66	1.27	1.63	2005	1.37	0.49	1.29
1995	1.35	1.08	1.32	2006	1.31	0.32	1.22

The smaller the net income, the total income and the yield per unit area, the marginalization value will be small, which indicates that the marginalization degree will be deeper. By the use of SPSS statistical software and the clustering analysis, the marginalization value is analyzed. Combined with the changes of income of agricultural land using, the marginalization degree of Tongcheng County can be divided as follows. In 1992 the marginalization value of paddy field was smallest with the minimum of 0.47, which indicated that the paddy field was in the stage of complete marginalization in 1992 with the highest marginalization degree; the following years were 1999, 2000, 2001, 2002, 1991, which were in the stage of intermediate marginalization; in 1993 and 1998, the marginalization value was in the initial stage with the number less than 1. In the marginalization value of dry field, the value in 1992, 2001, 2002, 2003, 2005, 2006 were all less than 0.5, so the marginalization of dry land was in the stage of complete marginalization; the year of 1991, 1996, 2000, 2004 were in the stage of intermediate marginalization; the year of 1997 is in the initial stage of marginalization. The marginalization value of paddy field and dry land worked out by the application of aggregative indicator method is basically similar to the marginalization value obtained by the analysis of the changes of the net income, the total income and the yields. The results all show that dry land has severer marginalization degree than paddy field[4].

The marginalization value of Tongcheng County obtained by integrating the marginalization degree of the dry land and the paddy field indicates that the farmland of Tongcheng County experienced the process of from the initial stage of marginalization in 1990 to the intermediate stage of marginalization in 1991 to the complete stage of marginalization in 1992 and then came back to the initial stage of marginalization in 1993, then from the initial stage of marginalization in 1998 to the intermediate stage of marginalization from 1999 to 2003 and then returned to the normal arable land in 2004.

3.2 The correlation between the marginalization of arable land and rural labor migration

3.2.1 The net income, sown acreage and intensive degree of the agricultural land use and the rural labor migration. Since the foundation of family contract responsibility system in 1978, there was migration of labor forces in rural are. However, the statistics records of rural labor migration in Tongcheng County began in 1993. Combined with the above mentioned dry land, paddy field and the time of the marginalization of arable land, the correlation of the net income, sown acreage and intensive degree of agricultural with the rural labor migration can be analyzed by the application of SPSS statistical software. The data of 1993 and the data of the years from 1998 to 2002 can be used to investigate the relations between the marginalization of paddy field and the rural labor migration; the data of 1993, 1996, 1997 and the data of the years from 2000 to 2006 can be applied to study the relations between the marginalization of dry land and the rural labor migration; the data of 1993 and the data of the years from 1998 to 2003 can be adopted to research the relations between marginalization of arable land and the rural labor migration. The results are shown on Table 2.

Table 2 The correlation coefficients between arable land marginalization and country labour transfer

Paddy field			Dry land			Arable land		
Net income	Sown acreage	Intensive degree	Net income	Sown acreage	Intensive degree	Net income	Sown acreage	Intensive degree
−0.815 * *	−0.847 * *	0.785 *	−0.600 *	−0.950 * *	−0.793 * *	−0.832 * *	−0.843 * *	0.682 *

Note: the net income and the intensive degree is calculated based on the combination of the data of household investigation and the resources of costs and earnings surveyed by the agricultural investigation team, the sown acreage comes from the *Comprehensive statistics on National Economy of Tongcheng County*. * and * * mean significance at 0.10 and 0.05 levels respectively.

It can be seen from Table 2 that the rural labor migration is in negative correlation with the net income of paddy land and dry land on condition that the net income is 0.05 and 0.10 under the levels of the significance, which indicates that the smaller the net income of agricultural land, the larger the number of the rural migrate labors. Therefore, the reduction of the net income of the agricultural land is one of the reasons of the rural labor migration. With the relief of burden of taxes and fees, many migrate works have come back home and the shortage of employers have appeared in east region since 2005. The phenomenon which was caused by the increase of the net income of agricultural land clearly illustrated the above results; besides, the correlation between the net income of paddy field and the rural labor migration is greater than the correlation between the net income of dry land and the rural labor migration, which indicates that the migrate workers are mainly caused by the decrease of the net income of paddy field. There is a significant negative correlation between the sown acreage and rural labor migration, and the sown acreage of dry land owns greater correlation with the rural labor migration. The main reasons are as follows. In the first place, the dry land has severer marginalization degree than paddy field. The migrant workers often reduce the sown acreage of dry land at first. In the second place, the basic protective policies for agricultural land carried out by the nation also decrease the number of abandon of the paddy field. There are significant negative correlation between the intensive degree and the rural labor migration, which indicates that the more the number of rural labor force go out to work, the more extensive of the operation of dry land. Under the level of 0.01, there are significant positive correlation between paddy land and the rural labor migration. The main reason is that at the same time of reducing the input of labor force in paddy land per unit area, the rural labor increased the input of materials (such as pesticides, fertilizer).

3.2.2 The marginalization degree of arable land and the rural labor migration. Based on the value of the marginalization degree of paddy field, dry land and arable land in the same year and the number of migrant workers, the marginalization degree of arable land and the rural labor migration can be analyzed by using the SPSS statistical software, then the relative coefficient of marginalization degree of arable land and the rural labor migration can be obtained. The relative coefficient is -0.779, -0.703 and -0.768 respectively. Under the level of 0.05, there are significant negative correlation between the marginalization degree of arable land and the rural labor migration, which means the deeper the marginalization degree, the smaller the value of the marginalization degree and the larger the number of the rural labor migration. From the perspective of the relative coefficient, the correlation between marginalization degree and rural labor migration in paddy field is greater than that in dry land, the correlation coefficient of the marginalization degree and the rural labor migration is between the paddy land and dry land. The marginalization degree of arable land determined by the net income, total income and the yield per unit area of agricultural land use and the phenomenon of marginalization determined by the net income, sown acreage and the intensive degree all indicate that there is correlation between marginalization degree of arable land and rural labor migration and the correlation between marginalization degree and rural labor migration in paddy field is greater than that in dry land.

4 Conclusions and discussions

Taking the hilly regions of Tongcheng County, Hubei Province as an example, the results show that different types of agricultural lands have different marginalization degree. The dry land has severer marginalization degree than paddy field, while correlation between marginalization degree and rural labor migration in paddy field is greater than that in dry land. Marginalization of arable land will advance the rural labor migration, in response to the poor current circulation of lands; the rural labor migration will further deepen the marginalization degree. However, the marginalization of arable land has certain impact on the operation model of agricultural land and on the rural society, economy and ecosystem. The sources and degree of the impact is still unclear, so further study on them is needed.

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