

Analysis on the Land Use Behavior of Diversification Peasant Household Based on Allocation, Diversification and Investment Effects

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Abstract: In the process of traditional economy transforming into modern economy in china, farmer's diversification phenomena has arisen and developed and will continue a long time in the future. Accordingly, the general economic type of farmer diversification will effect on the rural source allocation. The land use behavior characteristics of diversification farmer are the aims of the study. Theoretic analyzing and empirical testing methods are used for the allocation, diversification and investment effects introduced by farmer diversification. It concluded that the allocation effect of land transfer and diversification effect of agricultural labor decreasing are mostly proved, but the investment effect of diversification income which will improve agricultural production capital is not significant.

Keywords: Diversification farmer, effect, land use

INTRODUCTION

Peasant household diversification is a universal phenomenon around the world, which is defined that as an independent production and operation unit, peasant household not only engage in agriculture production, but also undertake non-agricultural working. In the course of traditional economy transferring into modern economy, the phenomenon of peasant household diversification constant deepening was happened in many countries and regions, such as Germany, the United States, Norway, Austria, Switzerland, etc., which's diversification rate was more than 50% and that of Japan, South Korea and Taiwan was over 80% (Pei, 2007; Li *et al.*, 2009).

Since China implementing the household contract responsibility system in 1978, peasant household diversification began to sprout and eventually deepened in the middle of 1980s (Zhao, 2007). The Chinese peasant household rate of multiple operation was 53% in 1999 and is 70% recently (Li *et al.*, 2009). It is generally recognized that the reason of diversification lies in farmer possessing limited land resource, agricultural labour surplus and high comprehensive comparative benefit of agricultural operation, etc. Qian (2008) The essence of multiple operation is that farmer changes family's operation goal and investing structure of production factors, which would result in them realigning and optimizing their resource endowment of labour, land, capital and technique, etc. and then effect them on land operation scale, pattern and efficiency.

A few theoretical researches show that the rate of peasant non-agricultural employment increasing and free labour market have contributed to land transfer

(Yao, 1999, 2000; Kung, 2002) and free land transfer has revenue effect and marginal output smoothing effect which are conducive to increasing allocation efficiency of land resource (Yao, 1999, 2000, 1998). However, some researches conclusion is inverse. For example, according to rural land survey data of seventeen provinces organized by Renmin University of China and American Development Research Institute in 2005, Ye, Jiang and Feng drew a conclusion that although non-agricultural employment rate was 65.1% in 1999 and 83.2% in 2005 and the later is obviously higher than the former, the market of land use transfer developed slow and land transfer wasn't distinct increase. It was estimated that only one third farmers and one tenth arable land were in for transfer, in which almost half land transfer happened between relatives of fellow villagers by permissively verbal agreement that wouldn't take as normal market transaction (Ye *et al.*, 2006).

Most researches show that in the context of agricultural productivity development, land resource deficiency and man-land contradiction sticking out, non-agricultural employment is certain trend of rural labour employment pattern and structure changing (Shi and Zhang, 2000; Mei, 2003). Non-agricultural employment increases farmers' revenue source. Because of income enhanced, non-agricultural employment decreases the risk of farmers agricultural investing (Benjamin and Brandt, 1998) and makes for them capital accumulating (He, 2005) which results in their land investing level and land productivity raised (Hu and Wang, 2003). However, using six Chinese provinces farmer survey data in 2000, De Brauw and

Rozelle (2008) found out that non-agricultural income had no significant effect on productive investment that would raise household production capacity and farmers weren't apt to spending non-agricultural income on agricultural reproduction, in which the richer people tend to purchasing consumption goods or building house to improve current living level. By investigating Hebei Province and Liaoning Province, Rozelle *et al.* (1999) also found that while household labour turned to non-agricultural employment and absolutely gave up agricultural production, agricultural output fell rapidly. The investing effect of non-agricultural income couldn't completely offset the loss caused by labour input reducing and just partly counteract adverse impact. Putting it more specifically, decreasing per agricultural labour resulted in output falling 50.5 kg/mu, which accounted for 14% of average output (Rozelle *et al.*, 1999).

Taking point of view of allocation, diversification and investment effect, this study researches multiple operation farmer behavior of land use which is introduced by theoretically analyzing its micro-mechanism and adopts empiristic analysis method testing land transfer, input and output characteristics of diversification farmers. The following structure is that part two explains micro-mechanism of farmer diversification affecting on land use, part three introduces source of data and its descriptive statistics, part four shows the selection of models and variables, part five analyzes the estimated results and last part is main conclusion and policy proposal.

MICRO-MECHANISM OF FARMER DIVERSIFICATION AFFECTING ON LAND USE

Under the restraint of exiting resource endowment, rational peasant household is bound to carefully considering current market situation of land, labour, capital and technique and optimally combining them to maximize household utilization. In the context of China speeding up the tempo of industrialization and urbanization and economy drastically developing recently, the urban newly increase many employment opportunities which may undoubtedly raise the farming opportunity cost of rural labour, especially the well-educated young and middle-aged labour. Moreover, the arable land area of peasant household possessing decreases, but that the trend of population scale constantly increases is more and more obvious. Furthermore, agriculture is an underprivileged industry and its return rate is often lower than other industries generally. Comprehensive actions of many different factors make farmer have to decide household labour resource allocation and as a result the phenomenon of farmers multiple operation appears. It is thus clear that the change of labour resource allocation results in farmer diversification which would affect the change of land, capital and technique resource distribution, the later restructuring income conversely works upon labour relocating and thus moves in endless cycles. In

brief, production factors maintain relationships of mutual promoting and complementary dynamic equilibrium with each other. To simplify explanation, the decision-making of farmer land use behavior is roughly divided into two stages, namely land transfer decision-making stage and land investing decision-making stage.

Decision-making stage of land transfer. In the first stage, agricultural household have to choose between cultivation and not cultivation, namely weather continuing cultivation or abandoning cultivation. The cultivation abandoner more or less having some land may select abandoning land or transferring it to other peasant. After weighing both pure revenues, they maybe consider transferring land to continuing cultivator. Moreover, continuing cultivator maybe rent in land after they expect its cost and revenue. Thereupon, the land transfer occurs between cultivation abandoner and continuing cultivator that is called allocation effect. Cultivation abandoner would become non-agricultural household, while continuing cultivator would further evolve. Continuing cultivator maybe put part or the greater part of labour into agricultural production, the former is diversification farmer and the later is pure farmer. As diversification degree deepening, idle land belonged to diversification farmer possibly appears, which maybe be rented to pure farmer. Thereupon, the allocation effect of land occurs between diversification agricultural household and pure agricultural household.

Decision-making stage of land investing. The majority of pure agricultural household labour are engaged in agricultural production and administration from which the income is obtained accounts for 90% of household gross receipt. Diversification farmer simultaneously allocates labour into agriculture and non-agriculture. Because part labour that may be certain family members' all or part time put into non-agricultural working, correspondingly, farmer's agricultural income decreases, which process is called diversification effect. Diversification effect is a process of agricultural labour resource transferring into non-agricultural industries. Farmer obtain non-agricultural revenue from diversification which becomes the capital of farmer and they may select putting into agricultural production so as to increase agricultural income, which process is called investing effect. Investing effect is a process of non-agricultural revenue, namely non-agricultural industry resource transferring into agriculture. Thereby, in the stage of land investing decision-making, from farmer, the micro-level, we not only find agriculture supporting non-agricultural industry development, but also non-agricultural industry adversely fostering agriculture, i.e., resource bi-directional flowing phenomenon.

According to theoretic analysis above, three hypotheses which will be tested below are put forward:

Proposition 1: Farmer diversification makes for rural land transferring market development, promoting land

resource optimal distribution, namely occurring land allocation effect.

Proposition 2: Diversification effect leads that labour of farmer putting into agricultural production decreases, so that agricultural income, land productivity and capital input-output rate of land, etc. decrease.

Proposition 3: Investing effect conduces to diversification farmer putting more capital into agriculture than pure agricultural household.

SOURCE OF DATA

The farmer micro-data of research is from rural household random sampling of ten or more cities in Hubei Province, such as Wuhan, Huanggang, Xiaogan, Xianning, Jingmen, Jingzhou, etc., in September, 2010. The survey gave out altogether 305 questionnaires, taking back 288 valid questionnaires and effective rate being 94.4%. The collected survey information is individual characteristic data of householder including his age, degree of education and risk preference, household characteristic data including family scale, type, agricultural labour number, contracted land area, weather having a storeyed building and agricultural production characteristic data including land transferring, agricultural total income, various agricultural inputs and general input, land productivity, capital input-output rate, grain crop area, cash crop area, multiple cropping index, area of land uncultivated.

THE SELECTION OF MODEL AND VARIABLE

The model selection. While analyzing if farmer diversification significantly effects on land rented in or out and on building a storeyed house, dependent variable is dummy variable, hence adopting Logit binary selection model, which definition is Gujarati (2004):

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2 X_i + \mu_i \tag{1}$$

- P_i = Probability
- $P_i/(1-P_i)$ = Odds ratio
- X_i = Vector of explanatory variable
- μ_i = Residual

While analyzing if farmer diversification significantly effects on agricultural total revenue, land productivity and capital input-output rate, dependent variable is continuous variable, but some observations' value is zero, i.e., censored, hence adopting Tobit model, which definition is Yi (2008):

$$y_i = \begin{cases} 0 & y_i^* \leq 0 \\ y_i^* & y_i^* > 0 \end{cases} \tag{2}$$

- y_i^* = Index variable
- $y_i^* = \beta_0 + \beta_1 x_i' + \varepsilon_i$, x_i' = Vector of explanatory variable
- ε_i = Residual

Variable selection: Model variables and their description are shown in Table 1.

Dependent variables: Dependent variable concludes four types that are depicting allocation effect variables concluding land rented out (Y_1) and land rented in (Y_2), depicting diversification effect variables concluding agricultural total income (Y_3), land productivity (Y_4) and capital input-output rate (Y_5), depicting investing effect variables concluding fertilizer expenditure (Y_6), pesticide and seed expenditure (Y_7), hiring labour and machinery expenditure (Y_8) and total investment (Y_9). Accordingly ten models will be estimated below.

Table 1: Variable description, mean value and standard error

Variables	Description	Mean value	S.E.
Dependent variables			
Y_1	Taking a value of 1 for renting out land and 0 otherwise	0.142	0.350
Y_2	Taking a value of 1 for renting in land and 0 otherwise	0.285	0.452
Y_3	Agricultural total income, 100 yuan	87.736	115.903
Y_4	Land productivity, 100 yuan/hm ²	213.460	243.012
Y_5	Capital input-output rate	6.541	10.479
Y_6	Fertilizer expenditure, 100 yuan	9.221	14.258
Y_7	Pesticide and seed expenditure, 100 yuan	7.078	9.867
Y_8	Hiring labour and machinery expenditure, 100 yuan	2.854	5.267
Y_9	Total investment, 100 yuan	19.153	25.193
Explanatory variables			
X_1	Taking a value of 1 for pure farmer and 0 otherwise	0.188	0.391
X_2	Taking a value of 1 for diversification farmer I and 0 otherwise	0.319	0.467
X_3	Taking a value of 1 for diversification farmer II and 0 otherwise	0.330	0.471
X_4	Taking a value of 1 for non-agricultural household and 0 otherwise	0.163	0.370
X_5	Family scale, person	4.538	1.165
X_6	Agricultural labour, person	1.656	0.873
X_7	Householder age, year	47.347	7.930
X_8	Years of householder educated, year	7.097	2.685
X_9	Householder risk aversion index	0.858	0.594
X_{10}	Contracted land area, hm ²	0.382	0.331

Explanatory variables: Farmer type variables concluding pure farmer (X_1), diversification farmer I (X_2), diversification farmer II (X_3) and non-agricultural household (X_4) don't simultaneously appear in a model, but only three of them appear and the other is reference. Household characteristic variables conclude family scale (X_5), agricultural labour (X_6) and contracted land area (X_{10}). Householder individual characteristic variables conclude age (X_7), years of educated (X_8) and risk aversion index (X_9).

ANALYZING THE ESTIMATED RESULTS

Although Logit model is linear in the parameter, the dependent variable, the log of the odds ratio, is dummy variable. Hence estimated coefficients can't represent marginal effect, only deciding the effecting direction of explanatory variable on dependent variable according to the sign. Logit marginal effect could be calculated by expression, $f(\bar{X}'\hat{\beta}) \cdot \hat{\beta}$ (Greene, 2007). Tobit is nonlinear, too, i.e., estimated coefficients can't represent marginal effect, only deciding the effecting direction of explanatory variable on dependent variable according to the sign. If using OLS method substitutes Tobit, the estimated result exists problems of heteroscedasticity and inconsistency, but may roughly respond marginal effect (Greene, 2007; Du, 2001). Due to limited space, marginal effects of all models aren't offered here. The econometric software EVIEWS 6.0 is adopted. Mean value and standard error of variables are shown in Table 1 and the estimated result is in Table 2.

Allocation effect. In the model of land rented out, non-agricultural household and contracted land area are significant at the 1 percent level and the signs are positive, which show that the land rented out probability of non-agricultural household is significantly higher than that of base, pure farmer, but diversification farmer I, diversification farmer II, etc., aren't significant. In the model of land rented in, pure

farmer and diversification farmer I are respectively significant at the level of 1% and 5% and the signs are positive, which show that the land rented in probability of pure farmer and diversification farmer I is significantly higher than that of base, non-agricultural household. Family scale is significant at the 10% level and the sign is positive, which show that the probability of land rented in increases as family scale rises. Householder age is significant at the 5% level and the sign is negative, which show that the probability of land rented in decreases as the age rises. The action of householder age embodies two aspects: Firstly, technique level of agricultural production promotes as age increases which makes for land rented in. Secondly, agricultural work is high strength physical labour, hence as age rises physical strength decreases gradually which makes against land rented in. Obviously, above result indicates that the action of the later is bigger than that of the former.

In a word, the models of land rented in and out basically test allocation effect, i.e., non-agricultural household is land lessor, pure farmer and diversification farmer I are land leaseholders and only the allocation effect of diversification farmer I and diversification farmer II renting land to pure farmer is not significant.

Diversification effect. In the model of agricultural total income, diversification farmer I, diversification farmer II and non-agricultural household are respectively significant at the level of 5% and 1%, the signs are negative and as diversification degree deepens estimated value decreases, which show that agricultural income of diversification farmer I, diversification farmer II and non-agricultural household are obviously lower than that of base, pure farmer and this can be explained as farmer diversification or abandoning agriculture resulting in agricultural labour input decreasing, hence agricultural income decreasing.

Table 2: The estimated result

Variables	Allocation effect		Diversification effect			Investing effect			
	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	Y ₇	Y ₈	Y ₉
C	-5.084****	-1.513	41.826	220.603**	6.146	-0.164	3.782	5.965*	8.565
X ₁	—	2.211****	—	—	—	—	—	—	—
X ₂	0.764	1.321***	-36.180***	-8.262	-1.525	-5.813***	-2.955**	-2.369***	-10.343****
X ₃	0.539	0.722	-48.602****	-12.805	-1.735	-4.992***	-5.008****	-2.362***	-12.494****
X ₄	2.267****	—	-94.613****	-152.537****	-2.109	-13.252****	-9.259****	-5.424****	-24.199****
X ₅	0.222	0.250**	-6.735	-2.018	0.135	-0.729	0.078	0.221	-0.591
X ₆	-0.257	0.214	27.697****	64.979****	2.456****	2.996****	1.928****	0.280	4.415***
X ₇	0.018	-0.046***	-0.498	-1.193	-0.017	0.027	-0.061	-0.174****	-0.099
X ₈	0.079	-0.002	5.964***	2.994	-0.304	0.759***	0.263	0.074	1.122***
X ₉	-0.318	0.238	-10.552	-21.859	-0.665	-0.480	-0.490	-0.397	-1.447
X ₁₀	1.272****	-0.298	150.781****	-85.433**	0.020	16.042****	12.212****	9.648****	36.418****
Scale:C(11)	—	—	101.550****	246.312****	10.860****	13.128****	8.782****	6.162****	21.282****
Model	Logit	Logit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit
LR statistics	29.101****	34.220****	—	—	—	—	—	—	—
Pr (LR)	0.0006	0.0000	—	—	—	—	—	—	—
Log like.	-103.307	-154.929	-1635.411	-1876.359	-1028.356	-1068.350	-965.723	-628.797	-1211.777
Avg.log like.	-0.359	-0.538	-5.679	-6.515	-3.571	-3.710	-3.353	-2.183	-4.208
Obs.	288	288	288	288	288	288	288	288	288

*, **, *** and **** respectively represent being statistically significant at the level of 15%, 10%, 5% and 1%

Agricultural labour and contracted land area are significant at the 1% level and the signs are positive, which show that agricultural labour and contracted land area obviously promote agricultural income. Years of householder educated is significant at the 5% level and the sign is positive, which show that the higher the householder educated the higher his productivity which results in agricultural income increasing. In the model of land productivity, non-agricultural household is significant at the 1% level and the sign is positive, which show that land productivity of non-agricultural household is obviously lower than that of reference, pure farmer. Agricultural labour is significant at the 1% level, the sign is positive and contracted land area is significant at the 10% level, the sign is negative, which altogether show that the more labour putting into unit area land, namely labour increasing or land scale decreasing, the higher the degree of intensive cultivation that could promote land productivity. In the model of capital input-output rate, agricultural labour is significant at the 1% level and the sign is positive, which show that as agricultural labour increases capital input-output rate rises. Farmer type variables aren't significant.

In short, farmer diversification brings on agricultural income and land productivity decreasing and doesn't significantly effect on capital input-output rate, so it proves diversification effect going against agriculture to a considerable degree.

Investing effect. To Survey the models of fertilizer expenditure, pesticide and seed expenditure, hiring labour and machinery expenditure and total investment, the variables of diversification farmer I, diversification farmer II and non-agricultural household are respectively significant at the level of 10%, 5% and 1%, the signs are negative, which show that various agricultural production expenditures of diversification farmer and non-agricultural household are obviously lower than that of base, pure farmer. This result is inconsistent with proposition 3, i.e., proves investing effect of farmer diversification being false. The investing direction of the increasing income of farmer diversification will be researched below. In the models of Y_6 , Y_7 and Y_9 , agricultural labour is respectively significant at the level of 1% and 5%, the signs are positive, which show that as agricultural labour increases fertilizer, pesticide, seed and total investment increase. In the model of Y_8 , householder age is significant at the 1% level and the sign is negative, which show that as householder age increases hiring labour and machinery expenditure decrease. This result embodies above referred to that as age rises householder agricultural production technique level promoting is obviously more than physical strength decreasing. In the models of Y_6 and Y_9 , years of householder educated is significant at the 5% level and the sign is positive, which show the higher householder

educated the more fertilizer expenditure and agricultural total investment. In the models of $Y_6 \sim Y_9$, contracted land area is significant at the 1% level, which show the bigger the land area the more various agricultural inputs.

CONCLUSION

In summary, the main conclusions are shown as follows:

The land allocation effect of farmer diversification makes for land transfer market development. Non-agricultural household is land lessor, pure farmer and diversification farmer I are land leaseholders, but the allocation effect of diversification farmer renting land to pure farmer is not significant.

Farmer diversification brings on agricultural income and land productivity decreasing and doesn't significantly effect on capital input-output rate, so it proves diversification effect going against agriculture to a considerable degree.

Increased income of farmer diversification doesn't significantly promote production expenditure of fertilizer, pesticide, seed, labour and machinery, i.e., investing effect of farmer diversification is not significant.

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