Available online at www.sciencedirect.com

ScienceDirect

Agriculture and Agricultural Science Procedia 1 (2010) 372–375

Agriculture and Agricultural Science Procedia

International Conference on Agricultural Risk and Food Security 2010

Transferring Price of Rural Land Use Right with NPV and Game Analytical Method

Peng Han
School of Economics and Management, Henan Polytechnic University, Jiaozuo, P.R.China, 454000
E-mail: hanpeng11@163.com

Abstract: The present author first considers the risk of contractor's capability to fulfill contract as well as the risk of the state policy and market change during the turnover process of the rural land use right. It is found that the basic remising price of rural land use right is determined by the NPV method, and that the final transferring price is determined by the game analytical method. The price is set by the theory of perfect Bayesian Nash equilibrium after comprehensively considering the interest of supervisor, transferor, and transferee.

Key words: rural land use right; transferring price; NPV (net present value); game

1. Introduction

Rural land circulation refers to the land turnover between farmers, which can be realized by subcontracting, transferring, leasing, exchanging, pooling, etc. Subcontracting is the main way of spontaneous land circulation between farmers, who live on agricultural production [1]. The present paper measures transferring price of rural land use right set in the form of spontaneous circulation between farmers. Up to date, the transferring price of rural land use right has not come to an agreement in theory, and cannot refer to any measurement mode in practice[2]. Therefore, a study in transferring right of rural household contract land use right, which can be theoretical basis and effective in implementation, is significant for promoting rural land circulation and reducing disputes.

2. Estimate for land use right transfer income

2.1 Major risks in land circulation

Qing Haiqiong, et al (2009) believe that land circulation risks are mainly divided into risks in and after land circulation. The former includes enclosure movement risk, supervision and administration risk, economic dispute risk and risk of farmer getting small profit, and the latter includes risk of farmer losing land, social stability risk, food security risk, city pressure risk and agricultural risk[3].

If land circulation is considered as market behaviour, the client will encounter the following two risks.

The first is from the contractor's capacity to fulfill contract. The land circulation contract usually has a long fulfilling term. In the fulfilling process, if the contractor cannot well manage, it is difficult for the client to pay his contracting fees according to the agreement.

The second is from changes in government policy and market. As there are many possibilities in the future development, too long contract term of land circulation may lead to the interest loss of the farmer contractor or social contradictions. For example, the government has new policies that the farmer will not pay any tax, and will enjoy some subsidies for growing grains and financial subsidies. In this case, the former farmer believes that the

doi:10.1016/j.aaspro.2010.09.046

subsidies belong to be him, while the contractor believes that the subsidies belong to be him, so that disputes will emerge.

2.2 Estimate for transfer income based on NPV

At present, there are methods to value farm land price, such as soil potential valuation, income capitalization approach, market analytical approach, mathematical mode approach, cost approach, standard field approach, etc. However, the target of these researches is land property right, which is distinctly different from land use right[2].

The price of farmer circulation land use right should be made in an easy way other than in a difficult way. And the general method is to subtract production cost from land income. As it is very hard to predict the sale income of agricultural products and product cost, it is not suitable for farmers to adopt. The present author predicts the net income of next term by trend extrapolation, and then fixes the present value of land earning in the contract term by NPV. Let S1, S2, S3, S4, S5 be the net income of recent 5 years (maybe 3 or 4 years, etc). Farmers have a good knowledge of the information, and give a weight to each year (the nearer to the predicted term, the greater the weight is). R1 is the first year of the predicted term, and the rest can be done in the same manner. Due to the long contract term, there will be a discount for future income, $W = \sum_{i=1}^{n} \frac{R_i}{(1+r)^i}$, and r is discount factor. The determination of government bond interest rate tells that r value can be different as it is to predict the future, and $W = \frac{R_1}{1+r_1} + \frac{R_2}{(1+r_2)^2} + ... + \frac{R_n}{(1+r_n)^n}$. Since the transferor will not farm the land and transfers the use right, his income will a percentage of W, and W/ is the negotiation base price.

3. Transferring price game

3.1 Basic assumptions

(1) Although various factors are considered when W is determined, the two parties have asymmetric information. For example, the contractor only knows that the predicted income of the transferor is distributed among the interval [0, 1].

(2) It is supposed that the transferor and the contractor will bargain twice at most (It is certain that they can bargain for many times, but the more times they bargain, the higher the negotiation fee is. Reasonably determining W is one cause of reducing negotiation time). For the convenience of analysis, it is supposed that the transferor first offers the transaction price in the negotiation, and the contractor chooses whether to accept or not. The bid interval is (W_X, W_Y), $W \in (W_X, W_Y)$.

(3) If the contractor reaches an agreement with the transferor in the first round of negotiation, the game ends ahead of time, otherwise the second round begins. If the agreement is reached in the second round, both parties will lose some profits. δ is the conversion coefficient of the earning when both sides come to an agreement in the first round. It means that both sides will pay more for extra rounds, such as time value and actual expenditure, otherwise both sides will welcome more rounds (Especially in the negotiation of many rounds, the agreement will not be reached if there is no such discount.). If W_1 is the price proposed by the transferor in the first round, W_2 is the price in the second round, and both parties come to an agreement in the first round, the income of the transferor is W_2 and that of the contractor is $\delta(\pi - W_2)$. If they cannot work out the agreement in the second round, their income will both be 0.

3.2 Equilibrium price determination

According to the hypotheses above, an analysis can be made based on the negotiation model between trade union and manufacturer with incomplete information[4].

In the first round, the transferor proposes that the price should be W_1. If π, the income of the contractor, is more than π_1, the contractor will accept W_1, otherwise he will refuse to accept W_1.

If the price is refused in the first round, the judgment of the transferor on the income of the contractor will be revised and it will be uniformly distributed in the interval [0, π_1^*]. In the second round, the price is W_2 $(W_2 < W_1)$. If the income of the contractor π is more than W_2, the price will be accepted, otherwise it will be refused again.

We will begin to discuss sequentially rational strategy of both parties from the second round with the train of thought that is similar to backward induction, and then deduce its solution to Nash equilibrium.

We will first examine the contractor's choice in the second round (it is supposed that the he refuses in the first round). For the contractor, it is the last chance. If he refuses again, it means that both of their income is zero. Therefore, if $\pi \geq W_2$, he will choose to accept and will not care how much W_1 is in the next round. The income of the contractor is $\delta(\pi - W_2)$ at this moment.

Then we will look at the transferor's choice in the second round. At first, the transferor knows the choice way of the contractor at this stage. That is, the contractor considers $\pi \geq W_2$ as the evaluation standard. Secondly, the transferor believes that the income of the contractor is uniformly distributed in the interval [0, π_1] at this moment (Notice: π_1 is arbitrarily assumed and its constant value is discussed in the first round.). Therefore, the transferor chooses W_2 to maximize his income, namely,

$$\max_{w_2} (W_2 p_{2a} + 0 p_{2r})$$

p_{2a} and p_{2r} respectively represent the probabilities that the contractor accepts and refuses W_2. $p_{2a} = P[\pi \geq W_2]$ and $p_{2r} = P[\pi < W_2]$. According to the judgment of the transferor on the contractor, $p_{2a} = P[\pi \geq W_2] = (\pi_1 - W_2)/\pi_1$, but $p_{2r} = P[\pi < W_2] = W_2/\pi_1$. As a result, the above maximum problem turns out to be $\max_{w_2} \left[W_2 (\frac{\pi_1 - W_2}{\pi_1}) \right]$.

Therefore, the optimal choice of the transferor is $W_2 = \pi_1/2$. And if the contractor accepts the requirement in the second round, the income of the transferor is $\delta\pi_1/2$ and that of the contractor is $\delta(\pi - \pi_1)/2$.

Now we come back to the first round. The contractor has known that his maximum income $\delta(\pi - \pi_1)/2$ is in the second round. Consequently, the condition that he accepts W_1 in this round is his income $\pi - W_1 \geq \delta(\pi - \pi_1/2)$. By operation, we get

$\pi \geq \frac{W_1 - \delta\pi_1/2}{1-\delta}$ That is to say, when the contractor's income π meets the need of the inequality above, he will choose to accept. So the right of the inequality is π_1. Given

$\pi_1 = \frac{W_1 - \delta\pi_1/2}{1-\delta}$, and the solution is $\pi_1 = \frac{2W_1}{2-\delta}$.

The transferor knows the above decisions of the contractor in the first round and the result of the second round. Therefore, the price W_1, chosen by the transferor will make his expected profit maximum. That is, it will meet the requirements of

$$\max_{w_1} [W p_{1a} + \delta W_2(W_1) p_{ra}]$$

p_{1a} is the probability that the contractor accepts W_1 in the first round.

$p_{1a} = 1 - \pi_1 = 1 - 2W_1/(2-\delta) = (2 - \delta - 2W_1)/(2-\delta)$, p_{ra} is the probability that he refuses it in the first round but accepts it in the second round. $p_{ra} = p_{1r} . p_{2a} = [2W_1/(2-\delta)].[(\pi_1 - W_2)/\pi_1] = [2W_1/(2-\delta)].[(\pi_1 - \pi_1/2)/\pi_1] = W_1/(2-\delta)$ And after substitution, we get

$$\max_{w_1} (W_1 \frac{2-\delta-2W_1}{2-\delta} + \delta \frac{W_1}{2-\delta} \cdot \frac{W_1}{2-\delta}) = \max_{w_1} \frac{(2-\delta)^2 W_1 - 2(2-\delta)W_1^2 + \delta W^2{}_1}{(2-\delta)^2}$$

The solution is $W_1^* = (2-\delta)^2 / [2(4-3\delta)]$ 。

From W_1^*, we can deduce $\pi_1^* = \frac{2-\delta}{4-3\delta}$, $W_2^* = \frac{\pi_1^*}{2} = \frac{2-\delta}{2(4-3\delta)}$ $(W_2^* < W_1^*)$.

The above strategy profile and judgement is perfect Bayesian Nash equilibrium. In the equilibrium, the contractor with higher profit would choose to accept the price of the transferor, and contractor with lower profit will refuse it in every round. The judgement of the transferor in the second round indicates that the contractor will accept the price in the first round if he gains high profits.

4. Conclusion

(1) The farmers make basic judgement of the future of their fields and the judgement includes some risks. Based on forecasting the future net return, the discounting is made by considering the time value of money and the inflation factor. The determined total profits will be the base price of the negotiation between two parties. As the operating is not a complex mathematical model, it tallies with the negotiation between farmers, and it is easy to operate for the intermediary organizations of rural land use right transaction.

(2) The transferring price, finally determined by trade union with incomplete information and negotiation model of the companies, is an equilibrium price, which is accepted by both sides. And the price depends on the conversion factor of the profits.

References

1. Huang Xiaofeng and Shi Jiangang. Theory and Empirical Research of Rural Land Circulation after Tax Reform. Hunan Agricultural Sciences. No. 1(2008) 147-148.

2. Wu, Shushen, Deng Zhenhui and Zhang Mengfei. A Research on Measurement Model of Transferring Price of Rural Land Use Right. Economic Issue. No. 2(2002) 45-46.

3. Liu, Haiqiong, Huang Hongxiang, and Zhou Guanwen. On the Risk of Rural Land Circulation and its Circumvention. Commercial Times. No. 29(2009) 58-59.

4. Xie, Shiyu. Economy Game Theory. Shanghai: Fudan Press. (2002)387-390.