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The optimal boundary of political subsidies for agricultural insurance in welfare economic prospect

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Abstract

China is one of the most suffering countries in agriculture by Nature. The current statistics shows a growing lose by agriculture risk. Insurance, as a lack part in the agricultural risk management, is constraining the ability to defense the risk and the sustainable development for our modern agriculture. Either sufficient or deficient in political subsidies will cause welfare deadweight loss. The article analyzed the optimal boundary of the fiscal subsidies based on the welfare loss model in agricultural insurance. We're trying to reduce the benefit loss due to asymmetric information, optimize the efficiency of fiscal transfers and enhance the farmers' welfare. We also like to give several suggestions in how to promote our political subsidies in agricultural insurance.

Keywords: agricultural insurance; welfare loss; optimal subsidies' boundary

1. INTRODUCTION

Political subsidies for agricultural insurance have being gradually carried out in china for years. However, the academic community is still arguing about the optimal method in subsiding. Wu Zhongxing and Zhang Ya (2008) analyzed, through the establishment of the information-incentive model, the optimal scale of fiscal subsiding to the insurance company under different information environments, and the study pointed that government should bring in some other variables easy to observe as well as the performances of the insurance company as the basis of fiscal subsiding. Xing Huiru and Tao Jianping(2009) constructed the agricultural insurance Supply-Demand model which suit for the condition of maximizing the expectation by framers and insurance companies through M-V preference function. It demonstrated the fiscal subsidies can do well for the balance of agricultural insurance market, but the weight of these benefits is determined by the size of such subsidies. Sun Xiangyu and Zhong Funing(2008) obtained the willingness to pay for the insurance by the farmers using CVM, in order to measure the demand curve and calculate the value of welfare in different rates of subsidies. It turns out that the current trending for agriculture

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insurance is the "Lower insurance, Lower fee". Goodwin and Vandeveer (2000) indicted that, with the increase on the fiscal subsidies towards agricultural insurance, the burden of many governments is becoming heavy and heavy, which eventually will do harm to the development of the agricultural insurance. Ibarra and Skees(2007) believes that government should bring in the index insurance for decreasing the information asymmetry in the agricultural insurance. By using some of the factors that affect the behavior of market participants as the index, such as weather, technology, etc, we can build up index insurance contract, and enhance the transparence of information among government, farmer and insurance company. Therefore, we can finally decide the scale of the fiscal subsidies. In our country, we have experienced the political agricultural insurance and provided the subsidies to the insured farmers. The scale of the subsidies is closely related to the fiscal income. However, the higher subsidy means higher moral risk.

The article constructed the welfare economic analysis framework based on the former related studies, argued how government should do to give the insurance company the proper subsidies, and finally concluded the optimal boundary for insurance subsidies.

2. THE CONSTRUCTION OF THE OPTIMAL BOUNDARY FOR INSURANCE SUBSIDIES

2.1 Government Subsidies and Participation Constraints

Presume that insurance company try to run a specific insurance through one un-predictable effort e （$0 \le e \le 1$）, the initial cost is I . Once such insurance succeeded, it will bring the revenue R and the external effects E to the other insurance companies and farmers. The probability of the success is $p(e) = e$, and the effort cost is $\psi(e) = \frac{1}{2}ce^2$.

The index is the common knowledge between government and insurance company, so well as R and E . In order to simplifying the model, we take $(R+E)/c$ <1, therefore, p <1. Government has two ways to provide subsidies, they are S (after succeeded) and s (before operated).

2.1.1. Insurance company itself asks the expected income should weight over the investing cost: $p(e^*)R - \psi(e^*) \ge I - s$, and $e^* = \arg\max_e \{p(e) - \psi(e)\}$,which means the company would not run such insurance unless he can return his investing cost. We can get the effort level $e^* = R/c$ by replacing $p(e)$ and $\psi(e)$. Then we can get the individual ration constraints (IR) $p(e^*)R - \psi(e^*) = (R/c)R - \frac{1}{2}c(R/c)^2 = \frac{R^2}{2c} \ge I - s$

When s =0, the constraints are broken, but the external effects are so strong that government want it can keep running. In order to persuade the insurance company, government must provide certain subsidies s^* to at least satisfy the IR constraints of the insurance company, which is $s^* = I - \frac{R^2}{2c}$.

We take the shadow cost(the welfare loss in transfer payment to the insurance company) of public capital as λ , the social profit related to the program under the subsidies s^* is as follow:

Social profit = $p(e^*)(R+E) - \psi(e^*) - I - \lambda s^*$

$= (R/c)(R+E) - \frac{1}{2}c(R/c)^2 - I - \lambda(I - \frac{R^2}{2c})$

$$= \frac{RE}{c} + \frac{R^2}{2c}(1+\lambda) - I(1+\lambda)$$

Only if the equal is positive, the government will provide subsidies. That represents $E \geq (1+\lambda)(\frac{c}{R}I - \frac{1}{2}R)$.

2.1.2. We ignore the IR constraints of the insurance company at first, and presume that government can determine to provide subsidies after or before the operation, meanwhile, forbidden the government to impose from the insurance company.

The problem of government is $\max_{S,s}\left\{p(e^*)(E+R) - \psi(e^*) - I - \lambda[s + p(e)S]\right\}$

S.T.: $e^* = \arg\max_{e}\left\{p(e)(R+S) - \psi(e)\right\}$ (IC)

$p(e^*)(S+R) - \psi(e^*) - I + s \geq 0$ (IR)

We get the effort level is $e^* = (S+R)/c$. The problem of government can be simplified by ignoring the IR constraints: $\max_{S,s}\left\{\frac{S+R}{c}(E+R) - \frac{(S+R)^2}{2c} - I - \lambda[s + \frac{S+R}{c}S]\right\}$

By differentiating S, we get the optimal subsidies afterwards $S^* = \frac{E - \lambda R}{1+2\lambda}$. When the shadow cost of the public capital is 0, λ =0, then $S^* = E$. That means the total external effects are being paid to the insurance company.

By differentiating s, we take $s^* = 0$ for the negative item of s in the social welfare function.

2.1.3. By introducing the IR constraints of insurance company, and presuming it works, government must provide a size of s subsidies to make up the cost loss of insurance company.

Those who did not get the subsidies in advance bears IR as a tight constraint: $p(e^*)(S+R) - \psi(e^*) \geq I$. We can solve it out to get the optimal effort level: $\frac{(S+R)^2}{2c} \geq I$.

Then government must provide subsidies $s = I - \frac{(S+R)^2}{2c}$ in order to assure the insurance. We bring such constraint to the maximize problem of government and transforming it as follow:

$$\max_{S,s}\left\{\frac{S+R}{c}(E+R) - \frac{(S+R)^2}{2c} - I - \lambda[s + \frac{S+R}{c}S]\right\}$$

$$\max_{S}\left\{\frac{S+R}{c}(E+R) - \frac{(S+R)^2}{2c} - I - \lambda[I - \frac{(S+R)^2}{2c} + \frac{S+R}{c}S\right\}$$

By differentiating it we get the first-order condition: $S^* = \frac{E}{1+\lambda}$, and the relative subsidies in advance is

$$s^* = I - \frac{(\frac{E}{1+\lambda} + R)^2}{2c} > 0.$$

In the program, the social welfare is $-(1+\lambda)s^*$ by bring S and s. The welfare is negative for s^* is positive. Therefore, the government should not provide any kind of subsidies.

Above all, when post-subsidy can work, those expansive projects which cause higher external effects cannot provide argument to the use of post-subsidy. Differencing from the post-subsidy, prior-subsidy will not create the incentive to enhance the efforts. Therefore, post-subsidy is a worse political tool. Under certain circumstances, the use of post-subsidy is limited even it is taken as a compensating political tool.

2.2. Government Subsidies and Company Selection

The related indexes are as above. We presume there are two kinds of possible cost of insurance company, which is lower one and higher one $c \in [c_L, c_H]$. It is unknown by the government. Therefore, government tries to select the company by providing two kinds of contracts. We divided the insurance company into two types $\{(s_L, S_L), (s_H, S_H)\}$, the former pair suit for low-cost insurance company, and the later high-cost insurance company. Meanwhile, we granted the government giving subsidy in advance or imposing afterwards. The shadow value of public capital is $\lambda > 0$, the probability for the high-cost insurance company is α_H, and for the low one is $\alpha_L = 1 - \alpha_H$.

When the insurance company is choosing the contract the government wants it is. The problem for the i company {L, H} is $\max_e \left\{ e(R + S_i) - \frac{1}{2} c_i e^2 + s_i \right\}$. We get $e_i^* = \frac{R + S_i}{c_i}$ by the first-order condition.

The goal for the government is the max of the benefits depriving of effort cost and public capital cost:

$$\max_{s_L, S_L, s_H, S_H} \left\{ \begin{array}{l} \alpha_H [p(e_H^*)(R+E) - \psi_H(e_H^*) - I - \lambda[p(e_H^*)S_H + s_H]] \\ +\alpha_L [p(e_L^*)(R+E) - \psi_L(e_L^*) - I - \lambda[p(e_L^*)S_L + s_L]] \end{array} \right\}$$

Bring $e_i^* = \frac{R + S_i}{c_i}$ ($i = L, H$) into the above we can get:

$$\max_{s_L, S_L, s_H, S_H} \left\{ \begin{array}{l} \alpha_H [\frac{R+S_H}{c_H}(R+E) - \frac{(R+S_H)^2}{2c_H} - I - \lambda[\frac{R+S_H}{c_H} S_H + s_H]] \\ +\alpha_L [\frac{R+S_L}{c_L}(R+E) - \frac{(R+S_L)^2}{2c_L} - I - \lambda[\frac{R+S_L}{c_L} S_L + s_L]] \end{array} \right\}$$

The rent of the high-cost insurance company is:

$$\underbrace{\frac{R}{c_H}}_{\text{probability}} \cdot R - \underbrace{\frac{c_H}{2}(\frac{R}{c_H})^2}_{\text{cost}} - \underbrace{I}_{\text{invest cost}} = \frac{R^2}{2c_H} - I$$

If it refused to run it, then its benefit is zero. Therefore, the reserve value for such company is $\max\left\{0, \frac{R^2}{2c_H} - I\right\}$ in commonplace. Then the IR constraint of the high-cost company is $\frac{(R+S_H)^2}{2c_H} - I + s_H \geq \max\left\{0, \frac{R^2}{2c_H} - I\right\}$. Government shall take proper S_H and s_H in order to make equal for it. Then $s_H = I - \frac{(R+S_H)^2}{2c_H} + \max\left\{0, \frac{R^2}{2c_H} - I\right\}$. When the high-cost company is willing to run such insurance, the lower one can always duplicate its methods and get the expected return. If the high-cost company runs $\{s_H, S_H\}$ to make it such insurance regardless of the participation of the operation, government will find a pair of is no difference for participation the operation. In the moment, the lower one would definite prefer such operation, and its IR constraints is loosen. By the same time the incentive compatibility constraints is tight, because the $\{s_L, S_L\}$ has the sufficient reason to avoiding it from duplicating the high-cost company. IC constraint of the low-cost company is $\frac{(R+S_L)^2}{2c_L} + s_L \geq \frac{(R+S_H)^2}{2c_L} + s_H$. When the selection of $\{s_L, S_L\}$ made it is no difference in the selection of $\{s_L, S_L\}$ and $\{s_H, S_H\}$, the high-cost company would not have interest in following the lower one. To the any given selection, the low-cost company found it cans benefits only if it took a harder-working than the higher one. Due to such sufficiency to the society, government could provide a large sum of subsidies to the low-cost company to support it. When the low-cost company feel no difference about post-and-prior subsidies, the high-cost company will prefer the prior-subsidies due to the less efforts. Because of the tight IC constraints, the function of s_L can be like this: $s_L = \frac{(R+S_H)^2 - (R+S_L)^2}{2c_L} + s_H$

For the high-cost company, $\frac{R^2}{2c_H} - I$ >0, then

$$s_H = I - \frac{(R+S_H)^2}{2c_H} + \max\left\{0, \frac{R^2}{2c_H} - I\right\} = -\frac{S_H(S_H+2R)}{2c_H}$$

We bring s_L and s_H into the subject-maximum function of the government and get:

$$\max_{S_L, S_H}\left\{\begin{array}{l}\frac{\alpha_H}{c_H}[(R+S_H)\frac{R+2E-S_H}{2} - \lambda\frac{S_H}{2}] + \frac{\alpha_L}{c_L}[(R+S_L)\frac{R+2E-S_L}{2} \\ -\lambda[S_L(R+S_L) + \frac{(R+S_H)^2}{2} - \frac{(R+S_L)^2}{2} - \frac{c_L}{c_H}\frac{(2R+S_H)}{2}S_H]] - I\end{array}\right\}$$

By differentiating S_L, we got

$$\frac{\alpha_L}{c_L}[\frac{R+2E-S_L}{2} - \frac{R+S_L}{2} - \lambda(R+2S_L-R-S_L)] = 0 \Rightarrow S_L^* = \frac{E}{1+\lambda}$$

By maximizing S_H, we got

$S_H^* = \frac{E}{1+\lambda+\beta} - \beta\frac{R}{1+\lambda+\beta}$, and $\beta \equiv \lambda\frac{\alpha_L}{\alpha_H}\frac{(c_H - c_L)}{c_L} > 0.$

From the above, we know that $S_L^* > 0$, and $S_L^* > S_H^*$, so $S_H^* > 0$, s_L and s_H are possibly negative. Due to the cost of the public capital, government can give awards by imposing at advance.

When the return afterwards is less than the external effects E, both type of company will only make fewer efforts. Meanwhile, the transfer payment has cost, so it will twist the effort made by the low-cost company, and the high-cost company will do it worse.

3. CONCLUSION AND POLITICAL SUGGESTION

The article is based on the government subsidies and insurance company participation in the agricultural insurance. We analyzed that what the government should do to design the framework to enhance the participation of the insurance company, and eventually to increase the social welfare by promoting the sufficient supply of the agricultural insurance productions. When government could choose negative prior-subsidies freely, it would make effects to balance the incentive and rent-paying. To define those different company can do help for providing subsidies efficiently.

Upon the following conclusions in the article: when government and the insurance company share the mutual knowledge, post-subsidies can promote the social welfare better than the prior one. The prior-subsidies is a under-developed political tool due to its failure in encouraging. Otherwise, post-subsidies can give the corresponding subsidy to the insurance company according to its external effects; when there is difference in the cost of insurance company, the government should provide subsidies based on their effort level.

We make the corresponding political suggestions in the basis of the analysis. Firstly, the fiscal subsidies of the agricultural insurance should operated gradually at the experimental provinces, and by the step-by-step, it would grow mature and sophisticated. Then it will work efficient. Secondly, the government should look into the insurance company carefully, and get aware of its insurance type and productions. After that, government needs to get a firm and clear picture about the effort level of the insurance company, and provide the proper subsidies respectively. Finally, the premium subsidy and its type of agricultural insurance should be provided in the basis of the insurance productions operated in the different places. Subsidies should be beard by the central and the local finance.

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