

Analysis on the Behavioral Framework of Science and Technology Poverty Alleviation of Rural Technicians, Based on the Perspective of Information Asymmetry

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Abstract: Due to administrative resources constraints, the government has technical and artificial deviations in the assessment and supervision of rural technicians in the village. The agricultural technicians have the possibility of passive attitude toward poverty alleviation using technology. Based on this, this paper explores how the government influences the behavior of rural technicians through information disclosure, administrative penalties and rewards and restrictions. Studies have shown that information disclosure is introduced into social supervision resources, and negative behaviors of agricultural technicians are more likely to be discovered and will be punished accordingly, and the motivation for passive poverty alleviation will decrease. Administrative punishment can encourage agricultural technicians to actively carry out their work, but an excessively severe punishment system will dampen their enthusiasm for work. Rewarding limits can reduce the burden on the government, but it will lead to a decline in the income of agricultural technicians and hinder the development of science and technology poverty alleviation.

1. Introduction

The process of technical poverty alleviation involves the government, agricultural technicians, farmers and other stakeholders. Different subjects have different behavioral motives and make different behavior decisions. From the perspective of the law of technology diffusion, a technology must go through many links from the success of research and development to the achievement of results. The promotion of agricultural technicians as a core link plays a decisive role in the transformation of technology into actual productivity. Therefore, improving the enthusiasm and work efficiency of agricultural technicians has become the key to poverty alleviation through science and technology.

The government is the general organization that manages an administrative regional affair. In the process of technical poverty alleviation, it pursues the maximization of social public interests. However, in reality, it is limited by its own administrative resources and the feedback channels of the villagers, so the government is unable to conduct comprehensive and in-depth assessment and supervision of the selected agricultural technicians about all the scientific and technological services. In addition, the government's assessment and supervision system may be biased. Negative poverty alleviation agricultural technicians may pass the job assessment and evade administrative accountability by capturing government appraisers or scientific and technological service objects.

The resident agricultural technicians are the principal agents of the government. The behavior in the process of science and technology poverty alleviation is based on two major assumptions: First, the agricultural technicians are rationalists, pursuing maximum job performance to obtain material and spiritual rewards. Secondly, agricultural technicians are opportunists. When they have information advantages in information asymmetry transactions, they will consciously carry out

scientific and technological projects that are not suitable for local needs, focus on supporting local wealthy farmers or organizations, or capture government appraisers or technical services objects in order to manage the job assessment.

Therefore, based on the perspective of information asymmetry, this paper examines how the government influences the work enthusiasm and work efficiency of agricultural technicians through policy instruments such as information disclosure, administrative punishment and reward limits. This not only provides a theoretical basis for the analysis of the interaction relationship between different policy instruments from the perspective of information asymmetry, but also provides a reference for how to improve the enthusiasm and work efficiency of agricultural technicians in practice.

2. Model framework

Establish a game model between the government and the resident agricultural technician, and assume that the agricultural technicians can actively help the poor through work assessment and get work rewards, and vice versa.

2.1. Agricultural Technician

The agricultural technicians in the village choose the level of effort e , active poverty alleviation A or passive poverty alleviation N, and pass the test with a certain probability. $\sigma = 1$ means that the agricultural technicians get the job reward through work assessment, but $\sigma = 0$ means the opposite. $\Pr(\sigma = 1 / A)$ and $\Pr(\sigma = 0 / N)$ means the probability of passing the work assessment and the failing work assessment respectively, which records as θ_1 and θ_2 , and $\theta_1 = \theta_2 = \theta$, θ means the accuracy of the work assessment, $1 - \theta$ means the degree of deviation; due to the deviation of the agricultural technicians' work assessment and supervision, the technicians with active poverty alleviation may not pass the job assessment while the technicians with negative poverty alleviation may pass the job assessment, so $0 < \theta_1 < 1$, $0 < \theta_2 < 1$.

The agricultural technician determines the level of effort and can confirm the cost of the effort. The cost of hard work includes travel expenses to the countryside and training expenses for out-of-town training. Assume that the agricultural technicians effort-cost function is $c_i = f(e)(e = A, N)$, $f'(e_i) > 0$ means the greater the effort of the agricultural technicians, the higher the cost; $f''(e_i) < 0$ means when the agricultural technicians try to reach a certain level, the marginal cost decreases; the cost of active poverty alleviation is c_A and the cost of passive poverty alleviation is c_N , so $c_A > c_N$.

In addition to the basic salary W , the farm technicians also hope that their work can meet the government's expectations and receive the maximum reward S , which refers to $S = E(u)$. In reality, if the agricultural technicians perform well, they will receive material rewards and spirital rewards such as salary increase and so on. In order to simplify the analysis, this paper assumes that the agricultural technicians only receive economic rewards, and consider the accuracy of work assessment, salary and cost, and pursue the maximum profit $\max_{e=A,N} \pi_e = \max_{e=A,N} [W + S \Pr(\sigma = 1 / e) - c_e]$. If $W + S \cdot (1 - \theta_2) < c_N$, the agricultural technicians will choose to passively alleviate poverty; only when $W + S \cdot (1 - \theta_2) > c_N$ and $\pi_A - \pi_N = S[\theta_1 + \theta_1 - 1] - (c_A - c_N) > 0$, the agricultural technicians will actively alleviate poverty, and vice versa.

2.2. Government

The government cannot directly observe the efforts of agricultural technicians in the village. It can only form an expectation q for the probability $\Pr(e = A)$ that the agricultural technicians will actively support poverty alleviation A . Assume that the government has rational expectations, the expectation q is equal to the probability q^* that the agricultural technicians choose to actively support poverty alleviation A in equilibrium. In addition, the government does not know the cost of the efforts of the agricultural technicians, only knows the c_N distribution, assuming c_N complies $[0, c_A)$ uniform distribution. After the agricultural technicians who have passed the job assessment receive the award, the government will make a posterior estimate of the degree of effort, according to Bayes' rule:

$$\Pr(A/\sigma=1) = \frac{q \Pr(\sigma=1/A)}{q \Pr(\sigma=1/A) + (1-q) \Pr(\sigma=0/A)} \quad (1)$$

Let's plug θ_1 into the equation and calculate the derivative of this equation, and then work out as $\frac{\partial \Pr(A/\sigma=1)}{\partial \theta_1} = \frac{q(1-q)}{[q\theta_1 + (1-q)(1-\theta_1)]^2} > 0$, which means that with the increase in the accuracy of job evaluation, the government is more likely to reward the agricultural technicians who are actively support poverty alleviation.

The government gives certain incentives S to agricultural technicians. The utility of the agricultural technicians' active poverty alleviation A and negative poverty alleviation N is \bar{u} and \underline{u} respectively and $\bar{u} > \underline{u}$, so the government's total expected utility is $E(u) = \bar{u} \Pr(A/\sigma=1) + \underline{u} \Pr(N/\sigma=1)$. When the government finds that the work of the agricultural technician is worthy of reward $E(u) \geq S$, then the reward r is chosen. Otherwise, the choice is not rewarded n . The government objective function is $\max_{r,n} I_r [E(u) - S]$, where I is the indicative function and $I_r = 1, I_n = 0$.

2.3. Equilibrium Situation

Although the work appraisal system can't completely overcome the deviation, it has the basic screening evaluation function. Therefore, assume $\theta > \frac{1}{2}$, which means that the agricultural technicians A can actively pass the work assessment with relatively high probability. Order $\bar{u} = 1, \underline{u} = 0$, then the reward of the agricultural technician is $S = E(u) = \Pr(A/\sigma=1)$. After the derivation $\frac{\partial S}{\partial \theta} = \frac{q(1-q)}{[q\theta + (1-q)(1-\theta)]^2} > 0$, this refers that when the work assessment can more accurately reflect the efforts of the agricultural technicians and reduce the possibility of the agricultural technicians passively helping poverty alleviation, the government will be willing to give more rewards to the agricultural technicians; $\frac{\partial S}{\partial q} = \frac{\theta(1-\theta)}{[q\theta + (1-q)(1-\theta)]^2} > 0$ means that if governments are aware that there will be more efforts made, they will be willing to increase the rewards of agricultural technicians, and agricultural technicians will receive corresponding returns.

Given θ , there is no difference $\pi_A^* = \pi_N^*$ in the equilibrium state c_N^* whether the agricultural technicians choose positive poverty alleviation A or negative poverty alleviation N . Because the

probability of the agricultural technicians actively helping the poor A is $q^* = 1 - \Pr(c_N^*) = \frac{c_A - c_N^*}{c_A}$,

then figure out: $q^* = \frac{\theta}{c_A} - \frac{1-\theta}{2\theta-1}$

It can be seen that when $c_A \leq 2\theta - 1$, $q^* = 1$ means that the agricultural technicians will definitely help the poor, because the government will provide sufficient subsidies for the countryside, which will greatly reduce the work cost of the agricultural technicians and increase the income of their work. When $c_A \geq \frac{\theta(2\theta-1)}{1-\theta}$, $q^* = 0$ means the agricultural technicians will passively support poverty alleviation. When $\frac{\theta(2\theta-1)}{1-\theta} < c_A < 2\theta - 1$, it is available that $\frac{\partial q^*}{\partial \theta} = \frac{1}{c_A} + \frac{1}{(2\theta-1)^2} > 0$, the higher the accuracy of the work assessment, the greater the possibility that the agricultural technicians are identified as negative poverty alleviation, and then the agricultural technicians would work more actively; $\frac{\partial q^*}{\partial c_A} = \frac{-\theta}{c_A^2} < 0$ indicates that the agricultural technicians actively promote poverty and lead to an increase in work costs. Increase the burden of agricultural technicians and curb their enthusiasm for work.

The accuracy of work assessment and the cost of work are the key factors that determine whether the resident agricultural technicians can actively help the poor. When the accuracy of job evaluation is reduced, government incentives will be reduced. The active work of agricultural technicians will increase the cost and may not pass the job assessment, and there is a greater possibility of choosing negative poverty alleviation. Therefore, the government should improve the assessment, supervision mechanisms and methods to accurately reflect the differences in the performance of agricultural technicians.

3. Behavior analysis

In the case of deviations in assessment techniques and regulatory mechanisms, how the government influences the motivation and work income of agricultural technicians through different policy tools is analyzed.

3.1. Information disclosure

The villagers and other members of the society have higher supervision enthusiasm and supervision ability. Under the conditions of limited assessment and supervision, the introduction of social supervision resources and information disclosure can effectively improve the level of science and technology poverty alleviation. This section mainly discusses how the government can encourage the agricultural technicians to actively carry out their work when the work assessment and supervision are biased.

3.2. Administrative penalties

This section focuses on the fact that when the problems of assessment and supervision are missing and deviations cannot be effectively overcome, the more stringent administrative penalties are more conducive to the rural agricultural technicians to carry out poverty alleviation work.

3.2.1. The Influence of Administrative Punishment on the Work Enthusiasm

Assume that resident agricultural technicians need to pay a certain fine p for failing to pass the job assessment. The risk of active poverty alleviation is $p(1-\theta)$, and the risk of negative poverty reduction is $p\theta$. The target function of agricultural technicians is:

$$\max_{e=A,N} \pi_e = \max_{e=A,N} [W + S \Pr(\sigma = 1/e) - c_e - p^* \Pr(\sigma = 0/e)] \quad (2)$$

Indicates the degree of balanced effort of agricultural technicians under administrative penalties q_p^*

$$\pi_A^* - \pi_N^* = (S + p)(2\theta - 1) - c_A q_p^* = 0 \quad (3)$$

When $0 \leq p < \frac{c_A}{2\theta - 1} - 1$, $\frac{\partial q_p^*}{\partial p} = \frac{1 - 2\theta}{2\theta - 1 - c_A} > 0$, it shows that for every 1 unit of fines raised by

the government, the risk of responsibility for the active poverty alleviation of agricultural technicians increases $1 - \theta$, and the risk of negative poverty alleviation increases θ , the agricultural technicians will put more energy into the work to reduce the risk of responsibility.

3.2.2. The impact of administrative punishment on the effectiveness of poverty alleviation work

Using modest administrative penalties plays an irreplaceable role in motivating agricultural technicians to actively help the poor. When opening administrative penalties, the government should consider the potential bias of the monitoring mechanism and the working cost of the agricultural technicians. If the blindly imposed excessive administrative penalties will dampen the enthusiasm of the agricultural technicians and limit the growth of their income, it is not conducive to Sustainable development of science and technology poverty alleviation.

3.2.3. Reward limit

In order to alleviate the heavy burden of high-value bonuses, the government may impose a cap on the bonus of resident agricultural technicians. This section focuses on the impact of incentive limits on the enthusiasm of agricultural technicians and their poverty alleviation benefits.

Suppose the government stipulates that the upper limit of the bonus is \bar{S} and $\bar{S} < S^*$, q_S^* is the bonus for the government to perform only the work assessment, and Z is the equilibrium effort of the agricultural technician under the incentive limit. Existing c_N^* makes $\pi_A^* = \pi_N^*$, so:

$$q_S^* = \frac{\theta}{c_A} - \frac{1 - \theta}{2\theta - 1} \quad \pi_{SA}^* = w + S\theta - c_A(S \leq \bar{S}) \quad (4)$$

The government set an upper limit on bonuses, which reduces the remuneration of agricultural technicians and negatively affects the enthusiasm of agricultural technicians. In reality, if the travel expenses and training tuition fees in the countryside increase, the original active poverty alleviation will face greater cost pressures, and the bonus limit policy limits these agricultural technicians to balance the income and expenditure through rewards, so that the agricultural technicians can Tend to negative poverty alleviation.

4. Summary and recommendations

Based on the development status of science and technology poverty alleviation work of rural technicians in China, this paper discusses the agricultural technicians' poverty alleviation behaviors and different policy tools from the perspective of information asymmetry.

The accuracy of job evaluation determines the enthusiasm of agricultural technicians. When job evaluation and supervision mechanisms are limited, information disclosure becomes an important tool to encourage agricultural technicians to work. Although information disclosure will increase the cost of agricultural technicians, reasonable information volume, key information and high information disclosure effectiveness can inhibit the possibility of agricultural technicians' passive poverty alleviation, enable the active poverty alleviation to obtain higher income, and promote better science and technology poverty alleviation.

Administrative punishment can encourage agricultural technicians to actively help the poor. However, if the agricultural technicians have higher work costs, or the regulatory capture causes the responsibility to be biased, excessive administrative punishment will dampen their enthusiasm for work, and information disclosure will become an effective supplement to administrative punishment. Therefore, the government can establish an open platform for information disclosure, determine a set of “core reference systems”, conduct centralized information management, and expand the positive effects of information disclosure.

Reward limits can reduce the government's economic burden, but it is easy to cause agricultural technicians to passively help the poor. Therefore, when the government sets an upper limit on the bonuses of agricultural technicians, it should take relevant supporting measures such as improving the promotion space for agricultural technicians and establishing a rotation system, etc., focusing on preventing potential agricultural technicians from passively helping the poor.

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