Aspiration and poverty in an asymmetric information game: a case study of Southern Xinjiang

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Abstract

Purpose – The purpose of this paper is to reveal the internal mechanism of the deviation of targeted poverty alleviation under the condition of asymmetric information.

Design/methodology/approach – Introducing a traditional signaling game theory model with dynamic asymmetric information, this study uses a dataset covering 813 poor households from Southern Xinjiang, China, to theoretically and empirically study the effect of aspiration of the poor households on poverty alleviation.

Findings – First, there exists asymmetric information between the poor households and village leaders. Second, the "short, arbitrary and fast" poverty alleviation approach may quickly pull people out of poverty, but it may also nurture a dependency culture where poor households lose their aspiration and ability to escape poverty through their own efforts. Third, due to long lasting universal state support, poor households in the national designated poor counties are less able and ambitious to escape poverty by themselves than their counterparts living in the national nondesignated areas.

Originality/value – The research results show that pro-poor development policies should be upheld to improve the residual utility that can benefit all households as a result of the poverty alleviation campaign. Relevant policy recommendations are made for China's continuous effort to fight relative poverty beyond 2020.

Keywords Asymmetry information, Poverty alleviation, Wisdom and aspiration, Signaling game, Post-2020 anti-poverty campaign

Paper type Research paper

1. Introduction

Poverty alleviation is an unavoidable challenge in the development of human society (Liu and Guo, 2018). It is also a political issue closely related with social stability. In an increasingly globalized world, fighting against poverty is not only a moral obligation but also a strategy to counter global insecurity cross national borders. Over the 70 years since the founding of the People's Republic of China, especially in the past 40 years of economic reform and opening up, China has transformed itself from a poor and backward agrarian country to the world's second largest economy, creating the greatest miracle of economic development and poverty alleviation in the world modern history. China also achieved spectacular poverty alleviation results in the last four decades, contributing to more than half of the global poverty reduction. The rural poor population and poverty incidence dropped from 770m and 97.5% in 1978 to 16.6m and 1.7%, respectively, in 2018 (NBS, 2019). In addition, China aims to eradicate abject

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poverty by the end of 2020, making sure that all the people will no longer worry about food and clothing with guaranteed access to nine years compulsory education, basic healthcare and housing.

According to the World Bank's absolute poverty line of $1.9 a day per person (2011 PPP-adjusted), at the beginning of reform and opening-up, China's rural poverty incidence at 97.5% was substantially higher than Africa's and the world average [1]. Since then more than 800 million people have been pulled out of abject poverty due to agricultural reform and urban economic development. The "household production responsibility system" greatly stimulated farmers' production incentives, leading to rapid growth in agricultural production and household incomes as well as providing a solid foundation for the following urban and industrial development (Chen, 2019; Liu and Guo, 2018). Over the period 1978–85, real per capita net income in rural China on average increased by 15% per annum, lifting more than 300m people out of absolute poverty across the country (Yao, 2000). Through constantly improving the poverty management system and capacity, China's poverty incidence dropped below Africa's in 1993, below the world average in 2005 and continued to outperform the rest of the world thereafter (Figure 1). The so-called "targeted poverty alleviation" was first introduced in 2012 at the 18th Chinese Communist Party (CCP) National Congress, aiming to win the poverty eradication battle as part of the national integrated effort to build an all-round well-off society by 2020 before the CCP's 100th anniversary. During 2013–18, about 82.4m people were lifted out of poverty in six years, and the rural poverty rate dropped from 10.2% to 1.7% (NBS, 2018).

The last mileage of poverty eradication before the end of 2020 and the continuing effort to contain relative poverty beyond 2020 are two most important challenges faced by the government. Improving the mentality of the poor is important in changing the behavior of poor individuals to enhance the effectiveness of anti-poverty policies. Promoting the aspiration of the poor will become a key issue for the continuing anti-relative poverty campaign beyond 2020, as Xi Jinping points out "poverty alleviation in the New Era should combine government support with encouragement of the poor to escape poverty by themselves through improving their ability and aspiration to do so". In other words, helping the poor to lift themselves out of poverty is an important strategy to improve the quality of

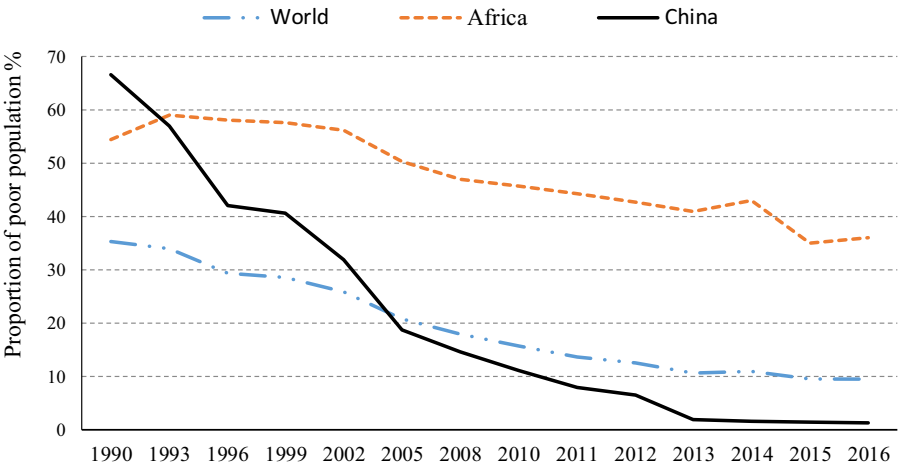

Figure 1.
Poverty alleviation of the world, Africa and China, 1990–2016

Source(s): https://data.worldbank.org.cn/; https://www.huanqiu.com/

poverty alleviation effort in China today [2]. This paper develops an asymmetric information game model to study the exact mechanism of government support policy at the village level and its effectiveness when the poor does not correctly inform the village leaders who control resources and have the decision-making power to distribute them.

The rest of this paper is organized as follows. Section 2 provides a brief literature review. Section 3 elaborates a signaling game framework for our theoretical analysis. Section 4 develops an empirical model to identify the main determinants of poverty reduction using the empirical data of 813 poor households collected from six counties in southern Xinjiang. Section 5 concludes with some policy recommendations.

2. Literature review

Poverty is usually associated with powerlessness, vulnerability and above all failure of aspiration (Ibrahim, 2011). There is no denying that, poverty stifles dreams, or at least the process of attaining dreams, which is reciprocally linked with the failure of aspiration. Ray (2003) developed the idea of an aspiration window, which is formed from an individual's cognitive word, her zone of "similar", "attainable" individuals. This is consistent with Dalton's cognitive window (2016). Thus, if economic betterment is an important goal, the aspiration window of the poor must be opened to achieve self-betterment.

Education not only improves people's ability to participate in social and economic development but also inspires people's aspiration. Previous studies on poverty causing factors have focused more on education (Liu and Hannum, 2017; Huisman and Smits, 2009), health (Wang *et al.*, 2019), social capital (Hamano *et al.*, 2010; Lin, 2012), etc. By the late 1970s, the World Bank emphasized economic growth based on human-capital accumulation to reduce poverty (Birdsall and Londono, 1997). Using longitudinal data from China, Liu and Hannum (2017) found that children experiencing spells in poverty were more likely to drop out of schools than others. However, Wang (2018) found that although China's TWOS policy (Two Waivers, One Subsidy) was quite successful in helping children from poor households to receive compulsory education the quality of education there was still significantly lower than in the cities.

Many scholars have begun to study the relationship between people's aspiration and poverty (Ravallion *et al.*, 2013; Deaton, 2016). For instance, Ravallion *et al.* (2013) proposed that different people may have different ideas about what it means to be "rich" or "poor" or "satisfied" with one's life. Deaton (2016) put forward the estimation of behavior to elucidate mechanisms and causes, to predict policy effect and to guide poverty reduction. Thus, subjective poverty is important to poverty alleviation. Based on a generalized ordered logit model, Guagnano *et al.* (2016) revealed that self-perceived poverty is strongly associated not only with household socioeconomic characteristics but also with the social capital endowment. Adullah *et al.* (2016) studied the determinants of subjective well-being in China and put forward that further decline in poverty would enhance well-being. Obviously many scholars have extended the living status research to individual subjective perspective and "bounded rationality" must be considered when studying the behavior of micro individuals. Simon (1972) proposed the "bounded rationality theory", suggesting that the rationality of individuals is "bounded", and it denotes a style of behavior that is appropriate to the achievement of given goals, within the limit imposed by given conditions and constraints. In recent years, more and more economists are interested in bounded rationality modeling in game theory (Sent, 2001). Don (2014) suggested that bounds on rationality are typically generated by institution and information properties. Therefore, due to limited cognition and aspiration, poor households are bounded rational, resulting in lower efficiency of the poverty alleviation mechanism than we expected.

3. Theoretical analysis

Spence (1973) proposed the dynamic model in signaling markets where the buyers revise prices based on experiences and the sellers, with private information about their types, choose utility-maximizing signals given the prices (Spence, 1973; Noldeke and Samuelson, 1997). More and more information economists focus on situations where one player (hereinafter referred to player A) has private information embedded in a signal game. On this basis, player A sends a signal to player B, who thereupon takes an action (Cho and Kreps, 1987).

Following the above-mentioned literature, this paper develops the canonical signal game in a dynamic asymmetric information model to study the opportunistic behavior of the poor households in the "generalized system of preference (GSP)" poverty alleviation mechanism. It analyzes the impact of endogenous development aspiration of the poor on the efficiency of anti-poverty fund utilization and sustainable development of the regional economy.

Our theoretical model is based on two basic assumptions. First, it assumes that the poor household is a signal sender and the village leader is the signal receiver in the dynamic game. Second, it assumes that the poor household can either work or receive government financial support to escape poverty.

Currently, China has a nationwide campaign to eliminate absolute poverty based on the current poverty line (2300 Yuan per person per year at 2010 prices) and the "Two No Worries and Three Guarantees" discussed earlier. Every village throughout the country has a village leader and a working group to identify the poor and provide various financial supports to the households who are identified as poor. In practice, vulnerable households are encouraged to apply for the "poverty status". The village leader normally asks the working group to check whether the households are really qualified for being identified as poor. It is a tedious but rather transparent process. Vulnerable households have the incentive to apply for the poverty status because the related benefits are comprehensive and important for the families to escape poverty. To make sure that all the real poor are identified and the nonpoor are not, the village leader has an important but difficult obligation, particularly in the process of identification.

If the vulnerable household provides correct information, it will be straight forward for the village leader to make a correct decision. However, if the household provides incorrect information, it will be difficult for the village leader to make a correct decision. The following theoretical model presents a dynamic game based on the asymmetric information between the household and the village leader.

The first player is the household who is applying for government support, called θ, which is either an objective or a subjective poor household. We defined the two types of poverty as $\theta = \theta_o$ and $\theta = \theta_s$ correspondingly. That is to say, θ represents the poverty causes concerned by the village leader in the process of identification. Besides easily observable factors, such as cultivated land area, per capita annual income, health and employment, another important factor is the endogenous aspiration of the household. An industrious poor household is considered to have endogenous aspiration, but a poor household with a dependency desire is considered to have little endogenous aspiration. Whether the poor is diligent or lazy is normally unobservable. Objective poverty ($\theta = \theta_o$) is caused by irresistible objective factors such as poor health and/or inability to work. Subjective poverty ($\theta = \theta_s$) is caused by subjective factors due to lack of aspiration and/or wisdom.

For simplicity, it is assumed that there are also two types of village leaders, defined as γ. If the village leader is more concerned about the number of households to be lifted out of poverty, we define $\gamma = \gamma_n$, and if the village leader is more concerned about the quality and sustainability of poverty alleviation, we define $\gamma = \gamma_q$. The probability of any village leader falling to any of the two types is assumed to be 0.5 for simplicity of discussion.

Poor households and village leaders all benefit from targeted poverty alleviation support. For example, poor households will get subsidies and village leaders may get promoted if they

do their jobs well. U_θ and U_γ, respectively, demote the utilities of the poor household and the village leader. In addition, whether the village leader is concerned about the quantity or the quality of poverty alleviation, public investments using poverty alleviation funds can lead to the development of the poor household to escape poverty. China's poverty alleviation funds can be invested in infrastructure, public health, medical care, education and other undertakings, bringing about the so-called pro-poor development effects. In other words, targeted poverty alleviation is always a good thing as far as the village in general and the poor household in particular are concerned. The reservation utility of the poor household and the village leader is a constant A, which is nonnegative and defined as the utility that is left over to the general public of the village brought about by the poverty alleviation investment. Then the total utility of targeted poverty alleviation is $\mathrm{TU} = U_\theta + U_\gamma + 2A$.

Due to poor health, old age and other related problems, θ_o is generally unemployed. Therefore, the signaling payoff is $C_o = 0$. In contrast, θ_s is due to the lack of aspiration and/or unwillingness to work. Supposing that labor remuneration not only depends on unit labor price p and working hours t but is also related to the reservation utility A. Let $\varphi(p, t, A)$ denotes labor remuneration and $\partial\varphi(p, t, A)/\partial A > 0$. It needs to be stressed that the more the pro-poor or inclusive economic development, the greater will be the reservation utility of poverty alleviation. In other words, given a certain amount of poverty alleviation fund, if a higher proportion is used for public investment and a lower proportion is used for direct payout to the poor, then the village will build a better capacity to help all the households irrespective of whether they are poor on not. This is because the village leader will be able to extend the labor service support, improving labor skills through training and establishing factories and/or cooperatives to increase employment opportunities, all of which will have a positive effect on local employment and income. On the other hand, leisure brings happiness l, so the signal payoff of the subjective poor is $C_s = \varphi(p, t, A) - l$. The village leader can respond to information sent from the poor household with N_1(giving more subsidy) or N_2 (giving less/no subsidy). No matter what type of poor households, they are eager to obtain government support. The average expectation of the poor from the village leader is $E(\gamma) = (N_1 + N_2)/2$.

In the process of targeted poverty alleviation in China, only the households identified as poor can receive government subsidies. For the purpose of identifying the poor household accurately, the village leader needs to investigate the various basic characteristics of the applying households for support, including the means of production, household demographic structure, income, education, etc. Participation in work can be remunerated. If there is no work, or there is work but it earns less income than the government poverty line, it implies that the family is poor and can be granted the poverty status for state support. However, some households whose members are able to work but they do not wish to work or they work but do not provide accurate information in the hope that they are granted the poverty status to secure government support. This is the most difficult challenge faced by the village leader in making his/her decision during the process of identification. It is also the focus of the following game.

The type of poverty-stricken household $\theta \in \{\theta_o, \theta_s\}$ is private information that the village leader does not know for certain. Suppose the prior probabilities of the village leader's awareness of the type of poor household are $\mathcal{P}(\theta_o) = \mu, \mathcal{P}(\theta_s) = 1 - \mu, (0 < \mu < 1)$, respectively, when the village leader decides whether to give subsidies, he/she does so knowing whether or not the poor is employed, but not knowing for sure what is the poverty type. The village leader needs to infer his type or modify the prior belief about the type by observing the information sent by the household, and then decides his/her own optimal action. According to the Bayesian rule, the village leader from the information sent out by the poor household, can get the posterior probability $\mathcal{P}(\theta|M)$ and can increase the accuracy of poverty identification and assistance. Hence the equilibrium outcome is greatly affected by the interpretation that would be given by γ to the information that θ might have sent.

At the beginning of the game, the poor of either type can only send one of two signals: $M_1 =$ be in employment or $M_2 =$ be out of employment. Because of the objective constraints, the only choice of the objective poor (θ_o) is $M = M_2$ as $M = M_1$ is irrelevant in this case. The utility obtained through targeted poverty alleviation support is $U(\theta_o) = A + (N_1 + N_2)/2$. It's important to point out that, if the village leader does not implement assistance, it means dereliction of duty and will be held accountable, so the effect is $A - U_\gamma$ (see Figure 2).

$$U(\theta_o) = \begin{cases} A + (N_1 + N_2)/2 & (N = N_1) \\ A & (N = N_2) \end{cases}$$

For the subjective poor (θ_s), there are two possibilities (options), i.e. $M = M_1$ and $M = M_2$. However θ_s predicts that its information will be used by the village leader, so it sends M_2 to the village leader expecting that the latter will respond with N_1 even though the household is actually in employment. For the village leader, the utility level $U_\gamma + A$ is always better than U_γ (see Figure 2). So the utility level for θ_s is as follows:

$$U(\theta_s) = \begin{cases} A + \varphi(p, t, A) - l & (M = M_1) \\ (N_1 + N_2)/2 + A - [\varphi(p, t, A) - l] & (M = M_2) \end{cases}$$

There are two possible equilibria, separating equilibrium and pooling equilibrium (Spence, 1973; Vickers, 1986; Brandts, 1993). In general, if the reservation utility A increases, so does $\varphi(p, t, A)$, *ceteris paribus*. By the comparing utilities, the subjective poor (θ_s) choose $M = M_1$, i.e. it tells the truth, the utility obtained is $A + \varphi(p, t, A) - l$. The game realizes the following separating equilibrium.

$$\text{SE}: \begin{cases} M(\theta = \theta_o) = M_2, & M(\theta = \theta_s) = M_1 \\ P(\theta = \theta_o | M = M_2) = \mu, & P(\theta = \theta_s | M = M_1) = 1 - \mu, \ (0 < \mu < 1) \end{cases}$$

If $\text{E}(\gamma) = (N_1 + N_2)/2 > \textit{work pay}$, the subjective poor will choose $M = M_2$, i.e. it does not tell the truth, to maximize his/her utility $(N_1 + N_2)/2 + A - [\varphi(p, t, A) - l]$. In this case, the subjective poor tries to secure government support through providing false information relating to employment. The village leader modifies the prior probability in combination with the signal released by the poor household to obtain the best possible assessment results. Therefore, no matter what type of the village leader may be, his/her choice on the information

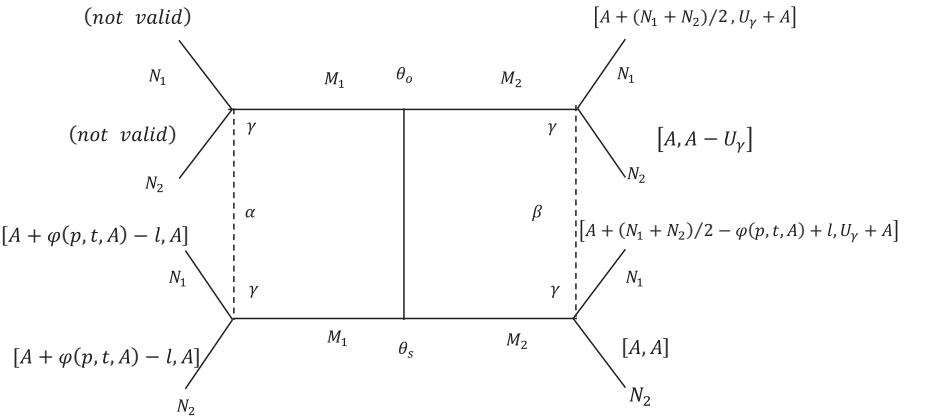

Figure 2.
Asymmetric information dynamic game between village leader and poor household

set β is to give subsidy ($\beta \rightarrow N_1$). The game realizes the following pooling equilibrium.

$$\text{PE}: \begin{cases} M(\theta = \theta_o) = M_2 & M(\theta = \theta_s) = M_2 \\ P(\theta = \theta_o | M = M_2) = 1, & P(\theta = \theta_s | M = M_1) = 0 \end{cases}$$

The actual effect of cash transfer on labor supply depends largely on the cause of unemployment. Indeed, cash transfer assistance can raise income, but biased choice toward leisure instead of work may nurture a dependency attitude, discouraging job seeking effort. Because the incentive for an individual to search work (and lose cash transfer assistance) is less than the incentive to remain as a transfer recipient (Ellwood, 2000). How does transfer payment affect the labor supply can be illustrated by three sets of simplified curves.

The following assumptions need to be made before elaboration. First, because China's labor market is huge, the wage level is assumed to be fixed at W_m. If the household is identified as poor, the corresponding government assistance is given as G_a. Second, for a person, the time of day is fixed at 24 h, so the budget line does not move in parallel. Third, leisure is assumed to be a normal good.

If $W_m > G_a$ and the poor household has internal aspiration, then the utility difference between the two is greater than the utility of leisure (U_L), or $U(W_m - G_a) > U_L$. As shown in the right-hand panel of Figure 3a, point A is where the poor household can maximize its utility, implying that the household has internal aspiration to escape poverty through its own effort.

For the poor household without aspiration, $W_m > G_a$ still holds, but the utility difference between the two is smaller than the utility of leisure, or $U(W_m - G_a) < UL$. It implies that the poor household does not wish to work and feels happier to receive a lesser amount of government assistance than earning a higher amount of wage income through work. As shown in the right-hand panel of Figure 3b, the corner point is an optimal solution for the household.

The above two scenarios do not exhort all the possibilities in practice. There is another possible scenario where the household has some capacity to work but is unable to earn enough income to escape poverty. In this case, it will be identified as poor and the village will provide support to make up the short fall between the actual wage income and the government poverty line. This case is illustrated in Figure 3c.

From the discussion presented above, we can make the following proposition and inferences.

Proposition. In the process of targeted poverty alleviation with asymmetric information, the poor with different aspiration raises their utility by sending out different signals.

Inference 1: When China's targeted poverty alleviation mechanism brings greater reservation utility, it indicates that the government pays more attention to public health, education, transportation construction, labor skill training, etc., resulting in a "pro-poor" development effect. The objective poor will be pulled out of poverty through government subsidies. The subjective poor will work within their capacity to achieve sustainable income. The poverty alleviation mechanism plays the role of "supporting the wisdom" and "promoting the aspiration", and a separating equilibrium is formed.

Inference 2: On the contrary,if the poverty alleviation mechanism brings smaller reservation utility, it would make the poor household pay more attention to the type of village leader, then compare the size of government subsidies and work pay. If the subsidy is greater than work pay, the opportunistic behavior will occur. The subjective poor tends not to work or attempts to hide their work pay to secure government support. In this case, a pooling equilibrium is formed.

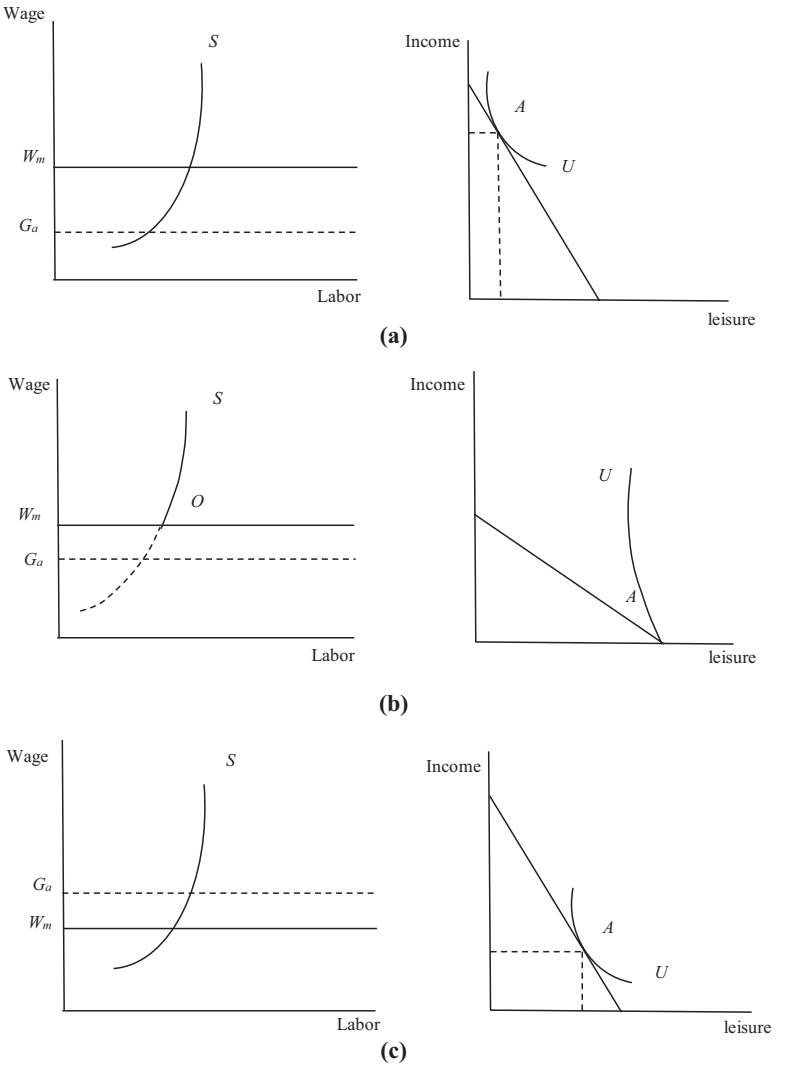

Figure 3.
(a), (b), (c)

4. Poverty characteristics and sample selection

4.1 Current poverty characteristics of China

There is a skewed distribution of poverty spatially in China. The western region has the highest poverty incidence, accounting for 55.1% of the country's total poor population (Table 1). The policy of reform and opening-up encouraged some people and regions to become rich first and expected that other people and regions would be able to catch up. However, investment, human-capital resource and advanced technology were highly concentrated in the coastal open areas, leading to significant interregional inequality and difference in poverty distribution (Yao and Zhang, 2001).

Region	Rural poverty population (million)		Poverty incidence (%)		National shares (%)	
	2012	2018	2012	2018	2012	2018
East	13.7	1.5	3.9	0.4	13.8	8.9
Central	34.5	5.9	10.5	1.8	34.8	36.0
West	50.7	9.2	17.6	3.2	51.4	55.1
Nation	98.9	16.6	10.7	1.8	100.0	100.0

Source(s): CNBS, *Poverty Monitoring Report of Rural China 2018*

Table 1.
Poverty and distribution in rural China in 2012 and 2018

Over the last 40 years, a rapid Lewis type shift involving industrialization and urbanization has led to a substantial change in China's urban and rural economies (Sutherland and Yao, 2011). Economic development has been accompanied with some serious distributional and social problems, especially in the rural areas. Relatively low growth of rural incomes compared to urban incomes has induced a larger urban-rural income gap. In 2018, the urban average per capita disposable income was 39,250 yuan per year, while the rural per capita net income was only 14,617 yuan per year. However, what deserves affirmation is that people's living standards have been greatly improved in both the urban and rural areas according to the trends of the Engel's coefficients measuring the shares of food expenditures as proportions of the total household expenditures (Figure 4).

4.2 Variables selection

This paper selects poor households in southern Xinjiang as the sample for the following three reasons. First, as part of the country's 14 poverty-stricken areas, southern Xinjiang is an important battlefield for the government to fulfill its objective of poverty elimination by 2020 based on the current poverty line. Second, even though poverty incidence in Xinjiang fell from 19.8% in 2013 to 5.7% in 2018, it is still well above the national average. Third, ethnic minorities account for a high proportion in Xinjiang, especially in the poor villages of the southern regions, where ethnic minorities account for nearly 95%. After eliminating incomplete and outlier values, our final dataset contains 813 poor households, 3,860 family members, from six villages selected from southern Xinjiang in 2016.

Data used in this study are sourced from the poverty archives [3] based on the household survey by the resident task force organized under China's targeted poverty alleviation program. Table 2 presents the basic features of the dataset. In particular, 55.4% of the sample households have a household head older than 50. Most of the household heads have little education, with 72.1% of them receiving primary education or less. Many household heads cannot read, write or communicate with people of any other ethnic group, especially the Hans. This reflects the seriousness of the traditional and backward mentality in China's frontier minority areas. The health conditions and labor skills of the household heads are also poor. The share of chronic illness and disabled people as a proportion of the sample household members is over 11%. If the number of people who do not have any labor skills are taken into account, the proportion of household members who are sick or without labor skills is as high

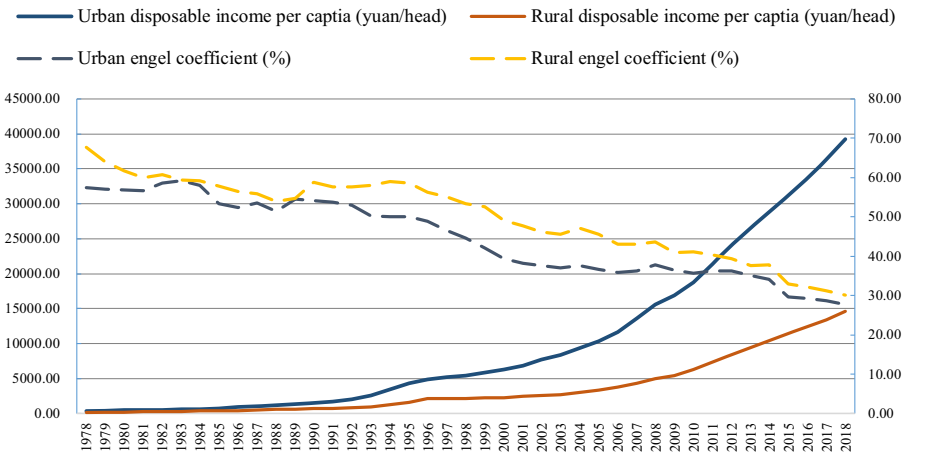

Figure 4.
China's urban-rural income gap and Engel's coefficients (1978–2018)

Variable	Group	Quantity	Share %	Total
Age	<30	45	5.5	813
	31–49	318	39.1	
	50–69	325	40.0	
	70+	125	15.4	
Health	Healthy	695	85.5	813
	Chronic ailment	49	6.0	
	Disabled	43	5.3	
	Serious sickness	26	3.2	
Education	Illiteracy and semiliterate	14	1.7	813
	Primary	576	70.9	
	Junior high	195	24.0	
	Senior high	28	3.4	
Skill	High	20	2.5	813
	General	586	72.1	
	No skills	207	25.4	

Table 2. Characteristics of sample householders

as 25.4%. Due to the lack of labor skills, traditional agricultural production is still the main source of income for the vast majority of households in our sample, which represents the general situation in southern Xinjiang and other parts of China's poverty-stricken areas.

4.3 Variables description

The possible determinants of poverty at the household level considered in this paper are summarized in Table 3. In addition to the four key explanatory variables, i.e. education, labor skills, working-time off-farm and motivation of work, 15 other variables describing the characteristics of individuals, households and production conditions are used as control

Categories	Variable	Description	Mean	Std.dev
DV	*Y*	Poor = 0, nonpoor = 1	–	–
Key explanatory variables	Education	Primary = 0, junior high = 1, senior high = 2	0.31	0.53
	Skill	Scarce = 0, general = 1, good = 2	0.77	0.48
	Work	Working days off-farm per month	1.19	3.32
	Motivation	Lack of motivation. Yes = 0, No = 1	0.64	0.48
Control variables	Age	Age of householder	53.06	14.99
	gender	Female = 0, Male = 1	0.81	0.39
	health	Serious illness = 0, chronic sickness = 1, healthy = 2	1.82	0.46
	insurance	Medicare status, No = 0, Yes = 1	0.89	0.31
	student	Proportion of students (%)	0.19	0.20
	patient	Proportion of sick persons (%)	0.07	0.19
	Labor	Laborers of household	4.73	2.46
	cultivated area	Size of cultivated area (ha)	3.81	4.03
	distance	Distance from dwelling to main road (km)	1.74	1.54
	housing	House is dilapidated, Yes = 0, No = 1	0.69	0.46
	water	Drinking water is safe, No = 0, Yes = 1	0.95	0.21
	income	Per capita income in logarism in 2016	7.67	0.67
	poverty status	Low-security poverty household = 0, Low-security household = 1 General poverty = 2, General household = 3	1.17	1.10

Table 3. Variable selection and description

variables. What needs to be clarified is that the key explanatory variable *motivation* is judged by village leader based on the actual situation of poor households. If poor households are young, healthy and able to participate in labor, but they choose not to work, then the village leaders believe that their poverty is caused by lack of aspiration.

5. Empirical analysis

5.1 Methodology

The probit and logit models are widely used in poverty research. For example, Guagnano *et al.* (2016) used the generalized ordered logit model to study the effect of social capital on subjective poverty.

As the dependent variable is a binary variable, let $y_i = 0$ denote a poor household and $y_i = 1$ a nonpoor one. The empirical model can be expressed as

$$y_i = \beta_0 + \beta_1 \text{education}_i + \beta_2 \text{skill}_i + \beta_3 \text{work}_i + \beta_4 \text{motivation}_i + \beta_5 \text{control}_i + \mu_i \quad (1)$$

The admissible range of dichotomous dependent variable is $\{0, 1\}$ If the household is poor, $y_i = 0$, otherwise, $y_i = 1$. We use "*education*" and "*skill*" as proxy variables to describe the "*wisdom*" of the poor households. We also use "*work*" and "*motivation*" to represent the aspiration of households to escape poverty through their own efforts. The control variables will include all the other variables in the empirical model such as *age*, *gender* and the health conditions of the household heads or other household members as well as the production conditions of the household.

5.2 Empirical analysis

In order to assess how and to what extent subjective factors of poverty affect rural households' ability to escape poverty, three different logit models will be estimated as specified below. Model 1 (M1) includes all the sample households. Model 2 (M2) adds a squared term of the age of the household head. Model 3 (M3) uses "*whether work*" to replace "*work*" in M2 to test the robustness of the model. Table 4 reports the regression results of the three models.

Based on the results of M2, the education level of household heads is found to be an important determinant of poverty. The estimated coefficient of *education* is significantly positive, implying that the higher the education level, the more likely that the household will be able to escape poverty. Education can break the traditional production path dependency. It can also block the intergenerational transmission of poverty. The estimated coefficient of *skill* is insignificant, suggesting that it has little effect on poverty reduction in the sample households. One possible and reasonable explanation is that the vast majority of the sample households depend on basic agricultural production for their living, and labor skills play an insignificant role in the production process.

As defined previously, the variable *work* measures the number of days per month the household members working off-farm as migrant workers in the towns and cities outside the village. It measures the ability of the household to earn nonfarm income, which is increasingly important in rural China to raise household income and hence escape poverty. As expected, the estimated coefficient of *work* is significantly positive, implying that working off-farm enables households to pull themselves out of poverty effectively.

The variable *motivation* reflects the willingness of the poor household members to work, on-farm and/or off-farm, so that they can reduce their dependence on government support to escape poverty. This variable is used to measure the aspiration of endogenous efforts of the poor households in fighting against poverty. The data on *motivation* are collected from asking the household members who have ability to work, but are not prepared to work or do

	DV (poverty = 0, non-poverty = 1)					
	M1		M2		M3	
Variables	Coefficient	t	Coefficient	t	Coefficient	t
Education	0.68***	3.27	0.75***	3.48	0.80***	3.66
Skill	−0.05	−0.16	−0.35	−0.99	−0.09	−0.28
Work	0.13***	3.90	0.14***	4.06	–	–
Whether work	–	–	–	–	0.65**	2.10
Motivation	−1.03***	−3.7	−1.05***	−3.72	−1.07***	−3.89
Age	0.02*	1.80	0.13**	2.29	0.12**	2.02
Age^2	–	–	−0.001**	−2.02	−0.0009	−1.71
Gender	−0.29	−0.97	−0.34	−1.11	−0.34	−1.13
Health	0.65*	1.76	0.67*	1.82	0.64*	1.66
Insurance	3.40**	2.40	3.32**	2.57	3.25**	2.48
Student	−1.81***	−2.85	−1.77***	−2.72	−1.67***	−2.60
Patient	−0.09	−0.11	0.09	0.11	0.32	0.34
Labor	0.15***	2.60	0.15***	2.80	0.15***	2.74
Cultivated area	0.09**	2.10	0.09**	2.04	0.09**	1.98
Distance	0.02	0.13	0.03	0.23	0.03	0.26
Housing	2.02***	5.58	2.04***	5.48	1.93***	5.29
Water	3.27***	5.41	3.29***	5.62	3.24***	5.45
Poverty status	1.13***	9.03	1.14***	9.17	1.15***	9.37
Pseudo R^2	0.4275		0.4330		0.4192	
Prob > χ^2	0.0000		0.0000		0.0000	

Note(s): "*", "**" and "***" represent the significance level of 10%, 5% and 1% respectively

Table 4. Regression results using all the sample households

not know how to find a desirable job. This is a key concern of this paper as over 36% of the households indicate that they lack the motivation of work. The estimated coefficient of *motivation* is significantly negative, implying that households without motivation to work is more likely to be trapped in poverty. This could have been a result of the long lasting government support provided to the poor households so that a dependency culture has been nurtured. This dependency culture has encouraged some of the poor to maintain their poverty status with government support, although they have the potential ability to pull themselves out of poverty through their own efforts. This result corresponds to the scenario presented in Figure 3b in the previous section.

The age of the household head is an important variable in explaining the poverty status of the household. In general, age is related to work experience and more experience means that the household head is more able to work and support the family. In this regard, it is expected that the variable *age* will have a positive effect on poverty reduction. However, when people get older, their physical/mental strength may decline although they are more experienced. We add the squared term of the age variable to reflect the change of age on poverty reduction and expect the effect of the squared term to be negative. The estimated coefficients of age and its squared term are significantly positive and negative as expected, implying an inverse U-shape nonlinear relationship between the age of household heads and poverty reduction.

The control variable, *cultivated area*, is significantly positive for poverty reduction. This implies that households are more likely to escape poverty if they have more cultivated areas. However, in our sample, most households do not have enough cultivated areas to make a decent living through farming alone. Using cotton production as an example, the valuable return is about 2835 yuan/mu with government subsidies. The cost of production is nearly 2,335 yuan/mu. The net income is only 535 yuan/mu. This suggests that it is extremely difficult for most poor households to rely on agriculture to escape poverty. In other words, in rural China in general and the poverty-stricken areas such as southern Xinjiang in particular,

most rural households have to secure off-farm jobs through migration and/or establish their own non-farm businesses to pull themselves out of poverty. In our sample, self-run businesses are rare, so that the poor households have to rely on government support to escape poverty if they cannot find or lack the motivation to find off-farm employment.

5.3 Elasticity calculation and analysis

In order to understand the impact of the explanatory variables on poverty reduction, we further calculate the odds-ratio of poverty. In Table 5, the estimated coefficients of the explanatory variables $\beta_i s$ in the logit model are not the elasticities, and hence they cannot be used to measure the marginal effects of the variables on the dependent variable. However, the "odds-ratio" can explain appropriately the probability of poverty occurrence with respect to the changes in the explanatory variables.

Based on the theory of "odds-ratio", this paper calculates the elasticity of the key dependent variable with respect to the independent variables based on the results in model 1 of Table 5. The summary results and explanations are reported in Table 5.

We also calculate the average elasticity of the key explanatory variables. The results and corresponding explanations are shown in Table 6.

It is obvious, the level of education, off-farm employment and self-motivation for poverty alleviation all play a critical role in reducing poverty. In particular, self-aspired households are 2.86 times more likely to escape poverty than those without any aspiration. If household members are able to work one more extra day off-farm, the poverty odds-ratio will decline by 15%. Based on the average-elasticities calculated using the sample households and the regression results, it proves that poverty reduction is highly sensitive to the changes in the level of education, the working time off-farm and the self-motivation of the households. In particular, self-motivation and off-farm employment are closely related with the subjective efforts of the poor households themselves, which is the focus of this study. However, providing public services through the public support system, with different governmental organizations taking responsibilities of the relevant areas, such as education, medical care, health insurance, better housing and clean drinking water are also important for poverty reduction.

Table 5.
Elasticity and their explanations

SIV	$\widehat{\beta}_i$	O-R	Corresponding explanations
Education	0.7544	2.12	Education up 1 level, poverty odds-ratio down 2.12 times
Work	0.1389	1.15	Working up 1 day, poverty odds-ratio down 15%
Motivation	1.0514	2.86	With self-motivation, poverty odds-ratio down 2.86 times

Note(s): SIV = significant independent variable, "O-R" = poverty odds-ratio

Table 6.
Average-elasticity and their explanations

SIV	$\widehat{\beta}_i$	Av-elasticity	Corresponding explanations
Education	0.7544	0.589	Education up 1%, the probability of getting out of poverty increases 0.589%
Work	0.1389	0.109	Work up 1%, the probability of getting out of poverty increases 0.109%
Motivation	1.0514	0.821	Aspiration up 1%, the probability of getting out of poverty increases 0.821%

5.4 Sensitivity analysis

To further testify the importance of the motivation and ability to work and how these may have been affected by the dependency culture, we separate the sample into two sub-samples. The first sub-sample consists of the households located in the national designated poor counties and the second sub-sample consists of the national non-designated poor counties. It is assumed that poor households of the first sub-sample are more likely to have developed a dependency culture, leading to a lower aspiration and ability to work off-farm as the more important means to escape poverty compared to those located in the national nondesignated counties.

The first sub-sample contains 485 households and the second sub-sample 328 households. The regression results using the logit model are reported in Table 7. It is striking to note that the effects of different explanatory variables on the dependent variable are different in different sub-samples. Education is found to have a positive and significant effect on poverty reduction in the second sub-sample but not in the first one. It implies that in the national poor counties, the level of education in reducing poverty is irrelevant, as the poor may just rely on state support to escape poverty. It may also imply that the level of education is generally low in the first sub-sample so that education does not appear to have a significant effect on poverty reduction. This explanation is re-affirmed by the estimated coefficients of *work-time* and *motivation*. In both sub-samples, *work-time* is found to have a significant and positive effect on poverty reduction, implying that off-farm employment can lead to higher incomes and higher probability to escape poverty irrespective of whether the households are located in the national designated poor counties or not. However, motivation is found not to have any significant effect in the second sub-sample, although it has a significant and negative effect in the first one. It indicates that due to the absence of a dependency culture in the national non-designated poor counties, households' lack of aspiration to work is irrelevant as an influential factor in determining their poverty status, and hence the proportion of households without an aspiration to escape poverty in the second group is also significantly lower than that in the

	DV (poverty = 0, non-poverty = 1)			
	National poor counties		Non-national poor counties	
Variables	Coefficient	*t*	Coefficient	*t*
Education	0.24	0.60	1.32**	4.00
Skill	−1.04	−1.41	0.42	0.89
Work	0.46***	5.96	0.09**	1.44
Motivation	−1.52***	−2.97	0.07	0.14
Age	0.23**	2.47	0.18**	2.07
Age^2	−0.0023***	−2.79	−0.0013	−1.60
Gender	−0.92	−1.61	−0.72	−1.60
Health	−1.01	−0.99	−0.18	−0.40
Insurance	2.59	1.23	3.12**	2.64
Student	−0.03	−0.03	−2.52**	−2.48
Patient	1.40	0.77	0.69	0.54
Labor	0.25*	2.35	0.24**	1.99
Cultivated area	−0.12	−1.42	0.23***	2.79
Distance	−3.59***	−4.05	0.01	0.11
Housing	3.35***	4.35	2.89***	2.85
Water	5.62***	6.38	1.79***	2.80
Poverty status	0.93***	4.02	1.33***	7.42
Pseudo R^2	0.6327	0.6469	0.4590	0.4652
Prob>χ^2	0.0000	0.0000	0.0000	0.0000

Note(s): "*", "**" and "***" represent the significance level of 10%, 5% and 1%, respectively

Table 7. Sensitivity analysis based on national designated poor counties and nondesignated counties

first sub-sample. Through further statistical analysis, we found that in the first and second sub-samples, the proportions of poor households without poverty alleviation motivation are 46.8% and 21.1%, respectively, suggesting that the proportion of households without aspiration to escape poverty through their own efforts in the national designated poor counties is more than double the level in the national nondesignated poor regions.

Comparing the estimated coefficients of the control variables, it can also affirm that the dependency culture exists in the first sub-sample but not in the second one. For example, medical insurance, the proportions of students and patients as a percentage of the total household members are not found to have any significant effect on the poverty status of the households in the first sub-sample but they are important determinants in the second one. It implies that due to universal and generous government support, the problems of healthcare and schooling are mainly resolved through the generous poverty alleviation funds provided by the state in the national designated poor counties. However, this is not the case for the nondesignated poor counties where health insurance, children's education and sickness of household members can significantly prevent households from escaping poverty, as they are less likely to receive generous state support.

6. Conclusions and policy implication

Due to asymmetric information in the process of targeted poverty alleviation, we construct a theoretical framework to analyze the opportunistic behavior of poor households based on the signaling game theory model. We also employ the logit model to analyze the impact of "wisdom" and "aspiration" of the poor households on the effectiveness of poverty alleviation and reveal the causes of "poverty trap" in the poverty-stricken areas. Our empirical results show that traditional "give people fish" poverty alleviation policy causes some adverse behavioral consequences of the poor, making them seriously depend on direct transfer payments and lose the aspiration to escape poverty through their own efforts. The phenomenon of "poverty trap" is particularly serious in the national designated poor counties where it is found to have developed a serious dependency culture among the poor.

The most important contribution of this study is to the construction of the theoretical framework based on the game theory. In addition, the concept of reservation utility is introduced in the context of the anti-poverty campaign in China. Our results show that only when China's targeted poverty alleviation mechanism has a greater reservation utility can the "pro-poor" development policy play a better role in "supporting the wisdom" and "promoting the aspiration". On the contrary,if the poverty alleviation mechanism brings about little reservation utility, it would make the poor households pay more attention to direct financial support and nurture a motivation-hindering dependency culture. This seriously undermines the effectiveness of the poverty alleviation policy, as direct financial support could not be withdrawn without forcing the people who have been lifted out poverty to be trapped in poverty again.

In the post-2020 era of targeted poverty alleviation, we must promote the integration of comprehensive poverty alleviation and rural revitalization. On the one hand, poverty-stricken villages with certain resource endowment advantages should promote the consolidation of agricultural land, realize large-scale operations and increase the contribution of technological progress to agricultural development. On the other hand, the government should carry out labor skill training, promote the employment of the poverty-stricken people in the village and stimulate the endogenous development momentum of the local communities.

Notes

1. http://www.chinadaily.com.cn/global/2019-02/28/content_37442050.htm

2. http://www.xinhuanet.com/politics/leaders/2017-12/08/c_1122082017.htm
3. Poverty Archives: In order to dynamically manage the poor population and achieve targeted poverty alleviation, China's government establish relevant files of each poor households to record poverty status and characteristics.

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